Five Essays on Entrepreneurial Finance: Exploring New Ventures' Financing Sources

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Dedicated to my family.

Acknowledgements

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List of abbreviations

2SLS	Two-stage least squares
BMWi	Federal Ministry for Economic Affairs and Energy
e.g.	for example
et al.	and others
etc.	et cetera
FAME	Financial Analysis Made Easy
i.e.	that is
IV	Instrument variable
KfW	Reconstruction Credit Institute
Max	Maximum
Min	Minimum
N	Number
NACE	Nomenclature statistique des activités économiques dans la Communauté européenne
NTBF	New technology-based firms
Obs.	Observations
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary least squares
RBV	Resource-based view
R&D	Research and development
S.D.	Standard deviation
SBIR	Small Business Innovation Research
SME	Small and medium-sized enterprise
UK	United Kingdom
US	United States
ZEW	Centre for European Economic Research

1   Introduction

1.1   Entrepreneurial finance research

Entrepreneurs face many challenges when creating a new venture, one of which is access to financial sources. It is widely understood that access to financial sources is a challenging and time consuming task for entrepreneurs (King and Levine, 1993; Klonowski, 2014). On one hand, entrepreneurs are usually not able or willing to provide all necessary funds from their private wealth. On the other hand, outside capital is difficult to receive, given the lack of collateral, insufficient cash flows and the presence of significant information asymmetry with external capital providers (Cosh et al., 2009). Those financial constraints are especially prevalent in the early stages of new ventures' life cycle, characterized by a focus on business survival and migrating to a higher level of organizational development (Almeida and Kogut, 1997; Cumming, 2012). Therefore, entrepreneurs must understand what types of financing they can access in certain stages of the new ventures' life cycle.

Until the 1980s, entrepreneurship and entrepreneurial finance were mainly considered applied trade as opposed to an academic field of research (Landström, 2005). A major reason was that entrepreneurship has been considered as a throughout practical field of interest, e.g., for those who could not attend college and simply found a new business (Kuratko, 2016). History shows that with each downturn or stagnation of an economy new and innovative business concepts arise that entail prosperity and sustainable growth (Kirzner, 1979). Therefore, research acknowledged the overall importance of entrepreneurship in the 1980s and began to extensively examine new ventures. The increased interest can be attributed, first, to the intensification of global competition, the resulting increase of uncertainty, and to greater market fragmentation, and second, the technological progress giving smaller firms an advantage (Carlsson, 1992).

A fundamental question in entrepreneurship research is what financial resources new ventures use and why certain ventures are more likely to access funding (e.g., Cassar, 2004; Denis, 2004). Financial resources are necessary to develop and maintain business operations. The financing decisions of new ventures have conclusively important implications for the economy, given the role entrepreneurs play in innovation and economic growth (King and Levine, 1993). Financing decisions with regarding whether

to use debt and/or equity during the early stages of a new venture have been shown to affect firm survival and performance and on business operations (Shane and Venkataraman, 2000). While research on entrepreneurial finance has been increasing, we still have a limited understanding in this field of research (Cassar, 2004).

Entrepreneurial finance covers many sources of capital, and most of the academic literature in this field is conclusively segmented by the source of capital (Cosh et al., 2009). In line with that, entrepreneurial finance comprises many subtopics, such as financial contracting, financial gaps, capital availability, public policy, and international differences stemming from discrepancies from institutions and cultures (Cumming, 2012). As these topics are diverse and complex, most studies on entrepreneurial finance usually focus on, at most, one of these topics at one time (Cumming, 2012).

Table 1.1 New venture financing

Life cylce stages	Financing stages	Major financing sources
Development stage	Pre-seed financing	Entrepreneur's assets
		Family and friends
		Financial bootstrapping
Start-up stage	Seed financing	Entrepreneur's assets
		Family and friends
		Business angels
		Venture capitalists
		Crowdfunding
		Government assistance programs
Survival stage	First-round financing	Business operations
		Venture capitalists
		Suppliers and customers
		Government assistance programs
		Commercial banks
Rapid-growth stage	Second-round financing	Business operations
		Suppliers and customers
		Commercial banks
		Investment banks
		Venture loans

Source: Following Leach and Melicher, 2011.

Academic research has reached the overall consensus that new ventures usually lack financial resources. This condition makes it important that the entrepreneur understands and attempts to access sources of financial capital (Leach and Melicher, 2011). Table 1.1 shows major types of financing stages and sources for new ventures. Usually, new ventures follow a maturation process, which comprises the development, start-up,

survival and rapid-growth stage. Those stages can be associated to certain financing stages. Main stages of financing include seed financing, start-up financing, first-round financing, and second-round and liquidity-stage financing, during which certain financing sources become available.

By referring to Table 1.1, the following Chapter 1.2 will explain the new ventures' life cycle stages, financing stages, and major financing sources. This brief introduction into the entrepreneurial financing environment is necessary to understand and pigeonhole the focus of this dissertation on the start-up and survival stages' external funding sources, which are business angels, venture capitalists, crowdfunding, government assistance programs, and banks. The overreaching motivation that guides this dissertation is the provision of a comprehensive picture of those external funding sources by examining current issues and uncovering cross-connections.

1.2 Financing through the life cycle of new ventures

1.2.1 Pre-seed financing for new ventures

Pre-seed financing is the primary source of funds during the development stage of a new venture, in which the venture progresses and forms an idea to a business opportunity. The most likely source of financing is the assets of the entrepreneur(s) to put the feasibility of an idea on trial. An underlying assumption of previous studies on this topic is the new venture's "funding gap" cannot be filled, usually, by the entrepreneurs themselves (e.g., Freear et al. 1995; Carter and van Auken, 2005). To mitigate this issue, financial bootstrapping is an important supplementary source of capital during that stage. Financial bootstrapping can be defined as using methods not to rely on long-term external capital from debt providers while simultaneously securing access to resources (Winborg and Landstrom, 2001). To be more precise, Harrison et al. (2004) divide financial bootstrapping in two forms. First, new ventures develop creative ways of gaining access to financial sources, without using banks' debt capital or equity finance from other traditional financiers. Second, new ventures aim to minimize the need for financing by securing access and availability of necessary resources to develop and maintain business operations. It is common for entrepreneurs to sell valuable private assets to increase the liquidity of the new venture (Leach and Melicher, 2011). The entrepreneur's willingness

to reduce the living standard by reducing private expenditures is likely to affect the lack of financial capital positively. Other capital providers during the development stage of a new venture are family and friends, which are the secondary main source for seed financing (Leach and Melicher, 2011).

Previous studies find that family and friends may have more detailed information about the entrepreneur and the new venture compared to outsiders (e.g., Casson, 2003; Lam, 2010). Under these circumstances, financing suffers fewer contracting problems and is cheaper than finance from external capital providers (Lee and Persson, 2016). Family and friends may also be willing to provide capital for little or no interest. The reason for this behavior stems from the norms of the behavior in groups with family or narrow ties, in which support or the concrete provision of resources is more evenly distributed (Kotha and George, 2012).

1.2.2 Types of seed financing sources

The development stage of a new venture is followed by the start-up stage, which coincides with *seed financing* and during which the new venture is organized and a revenue model is developed (Leach and Melicher, 2011). Thus, during that stage the new venture enters the relevant market. In line with this, seed financing is targeted at new ventures beginning to generate revenues under the regime of a skilled management team. The entrepreneur's assets and capital of family and friends remain relevant but minor sources of seed financing. Both sources depend mainly on the availability of private capital and assets of the entrepreneur(s). The new ventures usually shift to trying to attract outside capital and particularly external equity investors (Baum and Silverman, 2004).

External equity is primarily provided by two sources: Business angels and venture capitalists. Business angels are the most prevalent form of external equity investors (Lindsay, 2004), which is, for instance, in line with the results of Ripsas and Tröger (2015) showing that 29.7% of German start-ups have received business angel funding in 2015. Business angels can be described as private individuals, who provide risk capital to new ventures, in which they have no prior formal or family connections (Sørheim, 2005). They offer small amounts of external equity (usually up to approx. €250.000) and can simultaneously add value beyond providing financing (Mason and Harrison, 2000).

They mostly have gained previous work experience and developed extensive networks, which they will use for the benefit of the new venture (Sørheim, 2005). Without business angel funding, many new ventures would not survive and reach subsequent stages in the new venture life cycle (Lindsay, 2004). Another prominent source of external equity is financing by venture capitalists (Börner, 2005). Venture capitalists are professional financial intermediaries investing in private, young companies expected to have a high growth potential. They typically invest the capital they raise in different new ventures to reduce the overall risk of total loss of the invested capital (Black and Gilson, 1998). Considering that aim, they not only provide money to their portfolio companies, but also contribute managerial input, monitoring, network, and reputation (Lerner, 1995; Gorman and Sahlman, 1989; Lee and Wahal, 2004). Figure 1 shows venture capitalists' investment volumes in Germany between 2011 and 2015. Annual investments are moving between approx. €5,055m in 2013 and €7,133m in 2014. When considering 20% of German start-ups receive funding from venture capitalists (Ripsas and Tröger, 2015), we get a glimpse of the importance of this financing source.

Figure 1 Venture capitalists' investment volumes in Germany (in €m)
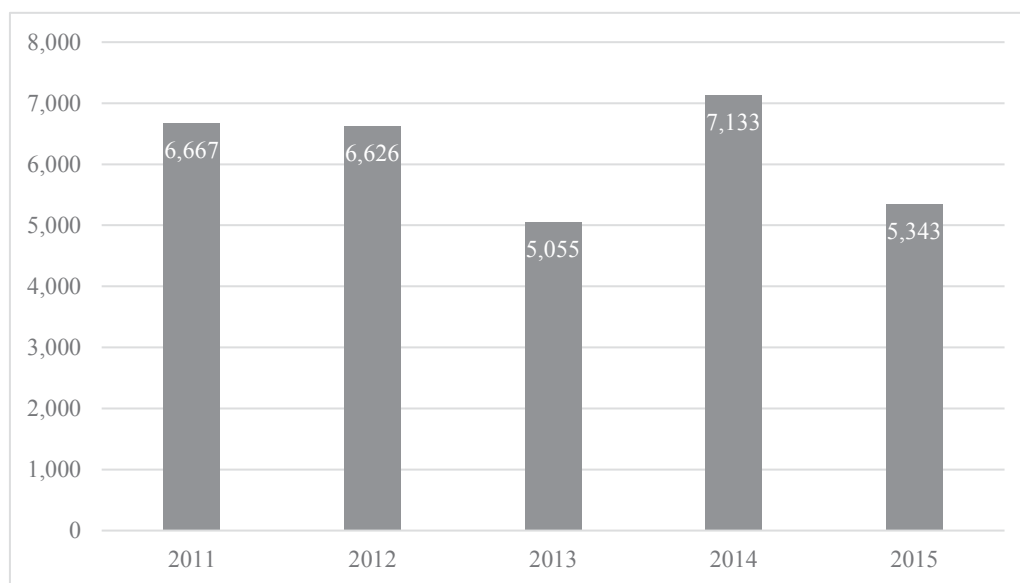
Source: Following BVK, 2016.

Equity-based crowdfunding is another source of equity capital for start-up financing that has recently emerged. It can be described as an increasingly widespread form of fundraising, typically via online platforms, on which individuals are on the one hand able to pool money to support a particular entrepreneurial project (Ahlers et al., 2015). The

entrepreneurs on the other hand have to make an open call to sell a certain shares of equity on the Internet, hoping to attract many individuals to invest in their venture (Ahlers et al., 2015). Equity-based crowdfunding is influenced by the legislative environment of its home country (Ahlers et al., 2015). In line with this, it is subjected to regulatory issues, e.g., demand for disclosure (Cumming and Johann, 2013), since it comprises the sale of a security, which is why equity-based crowdfunding is restricted in many countries (Ahlers et al., 2015; Bradford, 2012).

Last, government assistance programs to support start-up financing can provide funding. Since gaining access to financial resources might be crucial for new ventures to foster innovation, prosperity and growth, governments try to find appropriate solutions to support them (Bergström, 2000; Cumming, 2007; Koski and Pajarinen, 2013). Government initiatives to support new ventures aim at providing them with funding to close the funding gap in the private capital markets, which constitutes relevant funding sources of public subsidies for new venture financing. The two primary sources for equity capital are non-repayable subsidy grants and government venture capital. However, major differences appear (e.g., funding volumes, selection procedures, etc.) when comparing government support programs from a cross-country perspective and, moreover, vary even on different levels of governance. Furthermore, governments use not only equity capital to support new ventures, but also subsidy loans, taxes and incubators to name the most prominent ones. This dissertation focuses solely on non-refundable subsidy grants.

1.2.3   First-round financing for successful new ventures

A new venture enters the survival stage after the start-up stage, during which revenues grow, but cannot cover all expenses. Therefore, entrepreneurs must lend capital or allow others to own a part of their firm by receiving funding in return (Leach and Melicher, 2011). During that stage, *first-round financing* occurs, which is usually external equity capital being provided by involved venture capitalists of the start-up stage. New ventures usually focus on increasing their market share during the survival stage, which results in a cash deficit (Min and Wolfinbarger, 2005). This implies the need for additional financing to cover operating costs and strategically relevant future investments to support a successful market penetration.

Not only do business angels and venture capitalist provide funding during that stage, but also some other capital providers, such as government initiatives through public subsidies or government venture capital. Other sources are suppliers granting trade credits. A trade credit takes place, when a supplier provides goods or services to the new venture, which does not pay immediately, but promises to pay later (Wu et al., 2014). This promise can be characterized as an implicit financing contract, where suppliers take the risk that the financed new ventures will not pay in the future (Wu et al., 2014). According to theory, suppliers also face advantages when grating a trade credit, which are advantages in information acquisition, in controlling the new venture, and in salvaging value from existing assets (Petersen and Rajan, 1997).

Another external source for new ventures in the survival stage are bank loans, which are particularly important in the financing of young firms in bank-based capital markets, e.g., Western Europe (Achleitner et al., 2011). Despite information asymmetries between the new venture and debt provides, banks can select promising firms that fit their lending strategy. The large number of studies that have examined the availability of bank loans to new ventures (e.g., Wendt, 1946; Stiglitz and Weiss, 1981; Berger and Udell, 1998) can also be an indicator for the relevance of bank loans for new ventures.

1.2.4 Financing during the rapid-growth-stage of successful new ventures

If new ventures were able to secure financial resources during the survival stage, they enter the rapid-growth stage. Cash flows and revenues grow rapidly during that stage (Leach and Melicher, 2011). A basic condition for an increase in revenue streams is a simultaneous increase of inventories and accounts receivable, which requires the presence and use of significant capital resources. New ventures usually must commit sizable amounts of financial resources to investing in working capital (Baum and Silverman, 2004). In line with this, *second-round financing* can be described as additional venture capital, which is necessary to cover increasing working capital expenditures.

Investment banks are important for new ventures during the rapid-growth stage. They can be characterized as firms that advise and support firms in their financing decisions. Those banks are also interested in helping successful new ventures to undertake an initial public

offering. New ventures' equity will be offered the first time publicly and venture investors have the opportunity to cash in (Venkataraman et al., 2008).

Another source of capital during the rapid-growth stage are venture loans, which are explicitly developed for innovative young ventures. Venture loans are structured differently, compared to traditional debt capital, since interest rates are higher, and this type of financing includes an equity kicker in the form of warrant coverage (Hesse et al., 2016). Venture loans extend the new venture's liquidity runway and increase chances of subsequent financing to reach further milestones and release additional growth potential (Hesse et al., 2016).

1.3   Motivation and research gaps

Entrepreneurial finance covers many sources of capital as we have seen in the last chapters. As these topics are diverse and complex, most studies focus on, at most, one of these topics at one time (Cumming, 2012). The overreaching motivation that guides this dissertation is the provision of a comprehensive picture of the most relevant external funding sources by examining current issues on entrepreneurial finance and uncovering cross-connections. This dissertation focuses on external financing during the start-up and survival stage, since financial constraints for new ventures are especially prevalent in these early stages (Cumming, 2012; Leach and Melicher, 2011). Table 1.1 has highlighted major external funding sources during the start-up stage, which are business angels, venture capitalists, crowdfunding, and public subsidies, and during the survival stage, which are venture capitalists, public subsidies, and commercial banks.

Figure 2 shows survey results for the chosen financing sources of German start-ups in 2014 and 2015, and highlights their importance for entrepreneurs. We can see the results are stable, indicating that approx. 10% of 542 start-ups in 2014 and 11% of 650 questioned start-ups in 2015 have used debt capital. Furthermore, this figure emphasizes the importance of public subsidies, since almost one-third of all start-ups have received financial government support. The results for venture capital comprises the aggregated numbers of both business angels and venture capitalists, and shows that every second start-up has received venture capital. Last, only 4% of German start-ups use crowdfunding as a financing source, which is not surprising, since crowdfunding is a

recent phenomenon. I have identified research gaps on the financing sources mentioned before, which will be briefly presented in the following paragraphs.

Figure 2 Financing sources of German start-ups in 2014 and 2015
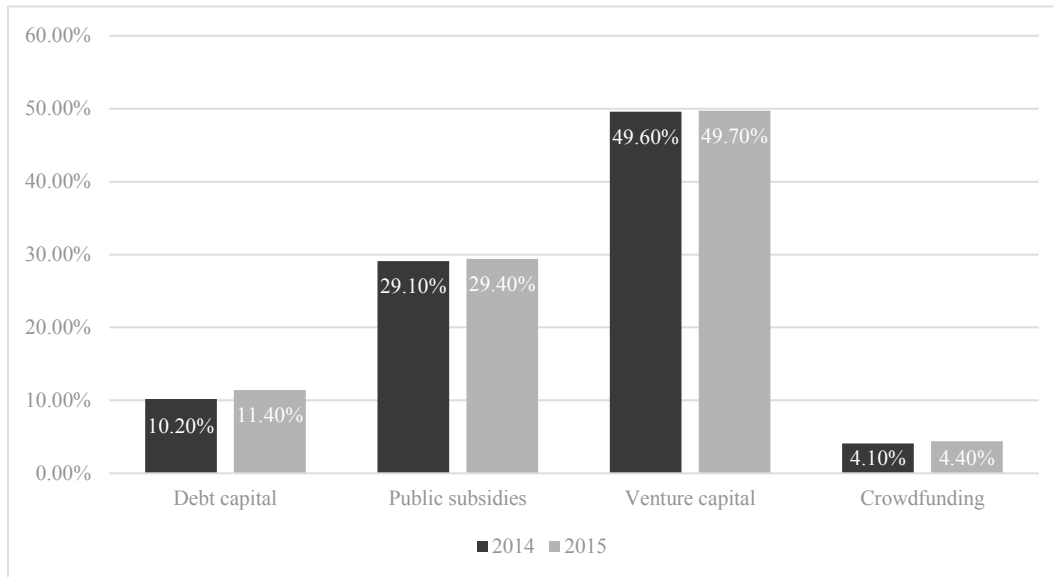
Source: Following Ripsas and Tröger, 2015.

First, new ventures usually must rely on debt capital for survival (Berger and Udell, 1998), particularly in bank-based capital markets, as access to outside equity from venture capitalists is even more restricted (Brouwer and Hendrix, 1998; Huyghebaert et al., 2007). Debt capital offers the opportunity for new ventures to overcome their financial problems during early years. However, it is unclear how bank loans should be allocated to benefit future entrepreneurial prospects from an intra-firm perspective. In line with that, the linkage between how debt capital resources influence the process of accessing other resources and developing business operations has not yet been investigated. This linkage may be of particular interest, since allocation of scarce financial resources might directly affect development of a competitive advantage and entrepreneurial survival. This dissertation aims to close this gap and examines how bank loans must be allocated from an intra-firm perspective to benefit entrepreneurial survival.

Second, debt providers can select new ventures that fit their lending strategy (Hanley and Girma, 2006; Huyghebaert et al., 2007), even if information asymmetries are prevalent (Blumberg and Letterie, 2008). Entrepreneurs are usually better informed than outsiders due to the difficulty of assessing the value of new ventures and the abilities of the

entrepreneurs. The required information is usually uneconomic to obtain and difficult to interpret (Mason and Stark, 2004) or may not even exist.

Entrepreneurial finance literature has reached consensus about some relevant criteria for banks' assessment of new ventures, including the entrepreneur's experience, business characteristics, and gender (e.g., Smallbone et al., 2003; Marlow and Patton, 2005). Other determinants are the entrepreneur's personal wealth and willingness to use it as collateral. More recently, the spread of *public subsidy programs* has drawn attention to their role as an information factor in lending decisions (Meuleman and DeMaeseneire, 2012; Cumming and Johann, 2013). Previous studies have indeed pointed out that public subsidies could serve as quality certificates, because they provide outsiders with additional information and can reduce information asymmetries (Lerner, 1999; Feldman and Kelley, 2006; Kleer, 2010). However, governments are committed to support and develop selective industries (Wydra et al., 2010), but industry differences in the role of subsidies as certification for subsequent debt capital providers have not yet been examined in the literature. This is surprising since industry heterogeneity enables classifications of certain business characteristics, which might be relevant for banks' lending decisions. This dissertation aims to close this research gap by explicitly accounting for industry heterogeneity, regarding demand for debt and the selection of new ventures into subsidy schemes. Furthermore, this dissertation applies econometric techniques that account for non-observable determinants of subsidy receipt.

Third, not only might subsidies be a relevant determinant for banks' lending decisions, but also for *venture capitalists'* investment decisions. Lerner (1999) finds empirical evidence that awardees of the United States government Small Business Innovation Research (SBIR) program have better access to venture capital. He suggests government grants provide certification that new ventures can use as leverage to further finance. However, a crucial aspect in this research context is that most studies about subsidy certification do not distinguish between different subsidy types, regarding their origin, which makes it difficult to draw valid conclusions about the functionality of these funding instruments. This dissertation aims to close this gap by conducting an examination of cross-national, national, and sub-national grants to draw out key insights that selectively awarded grants from certain government levels might differently reduce information asymmetries between new ventures and venture capitalists.

When considering investment determinants of venture capitalists, four general criteria can be identified: The entrepreneur, business characteristics, market structure, and financial considerations (MacMillan et al., 1986). A part of this dissertation aims to focus on the entrepreneur's characteristics, or to be more precise, the founder's gender and educational background. Previous studies point 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), and less external equity financing, such as private equity or venture capital (Verheul and Thurik, 2001). However, it is still little known about gender differences in accessing venture capital funding, regarding human capital and firm characteristics. This is surprising because gender differences in business environments are a current problem (Bloomberg, 2015). A deeper understanding of discrepancies between men and women might help to close the gender gap in business environments and release untapped growth potential (Carter et al., 2003). By applying socialization theory and the discrimination hypothesis, this research gap is tackled by examining gendered effects of entrepreneurs' educational backgrounds and the innovativeness of new ventures.

And finally, crowdfunding has recently emerged as a new funding source for new ventures and serves as an alternative financing channel besides traditional financial instruments (Mollick, 2014). Crowdfunding allows individuals to provide new ventures with funding, even with small amounts, often in return for equity stakes, interest, and/or a non-monetary reward (Belleflamme et al., 2014) via online platforms. The information embedded in the new ventures' descriptions on crowdfunding platforms is a main driver in transmitting the relevant aspects of a business idea to the crowd (Cumming et al., 2015). While hard facts on the new venture are relevant to the crowd in making their investment decision, less explicit information could also be an important investment determinant. In particular, tactics such as self-promotion, through e.g., positive language, could impact the impression made on potential crowdfunders, hence, crowdfunding success. This is in line with the suggestion of Allison et al. (2015) who emphasized the need for an investigation on impression management in reward-based crowdfunding environments. Therefore, this dissertation aims to shed light on the role of impression management tactics in crowdfunding by analyzing the reward-based crowdfunding platform Kickstarter, where individuals pledge money in exchange for one of various rewards offered by the entrepreneur (Kuppuswamy and Bayus, 2014), and, moreover,

compare the results with those of Parhankangas and Ehrlich (2014) about business angels' perceptions toward impression management tactics. The primary goal is to answer the question on how the linguistic behaviors of entrepreneurs manifested in their business descriptions affect the likelihood of raising capital.

Table 1.2 Identified research gaps on external finance channels

Debt capital	*Public subsidies*	*Venture capital*	*Crowdfunding*
Allocation of debt capital from an intra-firm perspective to benefit survival	Certification function regarding industry heterogeneity	Reduction of information asymmetries due to subsidy receipt regarding subsidy origin	Impression management tactics in reward-based crowdfunding environments
Reduction of information asymmetries due to subsidy receipt regarding industry heterogeneity	Certification function regarding subsidy origin	Gendered investment behavior regarding the entrepreneur's educational background	

Source: Own presentation.

Based on the above mentioned research gaps, this dissertation examines research issues summarized in Table 1.2. This cumulative dissertation aims to provide an overview and examination of recent research issues dealing with different capital sources of financing new ventures.

1.4 Contributions

This dissertation contributes to the academic literature in five main ways. Bank loans, as an important source of financing for new ventures, have received only limited attention in previous studies. First, my dissertation shows that debt capital resources does not necessarily increase the probability of entrepreneurial survival, as this rather depends on the debt's investment allocation to specific assets. Debt capital that has been used to increase the specific human capital resources of a new venture supports the development of a unique competitive advantage. Thus, this dissertation also adds to previous literature by examining entrepreneurial finance theories on investing financial debt regarding the resource-based perspective of competitive advantage.

Second, the allocation of resources and developing a competitive advantage are major determinants of new ventures' survival prospects and growth. In this line, I shed light in the relevance to public finance for entrepreneurial survival. The results not only confirm

a relation between public subsidies and subsequent access to other financial sources, but also show that quality certification through the receipt of a subsidy is particularly valuable for information-opaque industries, which are the high-tech manufacturing sector and knowledge-based service new ventures. Although bank loans are an important source of financing for new ventures (Berger and Udell, 1998; Colombo and Grilli, 2007; Meuleman and DeMaeseneire, 2012), financial debt has received little attention so far. This dissertation contributes new insights on new ventures' access to bank financing by revealing that banks can use the information of a subsidy receipt as value-added data, particularly, for information-opaque new ventures.

Third, this dissertation extends previous literature on subsidy certification and subsidy financing by showing that not all subsidy grants necessarily serve as certificates for outsiders. The certification effect varies for different government levels and is particularly strong for highly competitive cross-border grants. The effect is weaker, but still prevalent for sub-national subsidies.

Fourth, I can add to previous academic research on entrepreneurial finance literature by focusing on venture capital as a major source of financing for new firms, which received rather little attention in this research context. This dissertation sheds new light on new ventures' access to venture capital funding, by revealing that venture capitalists, particularly, use cross-national and sub-national grants to assess new ventures.

When considering determinants of venture capital financing, I contribute to current literature through an examination of gender differences in accessing venture capital funding regarding human capital and firm characteristics. By applying socialization theory and the discrimination hypothesis, gendered effects of entrepreneurs' educational background and the innovativeness of new ventures are examined, while controlling for structural differences. A key contribution is that the gender gap is particularly high for entrepreneurs with a university degree. This result highlights the interdependencies of gendered effects and sheds light on reasons for the gap in accessing venture capital funds.

Last, this dissertation contributes to the literature on impression management theory by examining how entrepreneurs can effectively communicate and show their confidence while providing relevant information about the crowdfunding project and personal characteristics. I operationalize impression management tactics and focus on the role of

positive language, the promotion of innovativeness, and supplication behavior as relevant determinants on crowdfunding success. Furthermore, I clarify whether and how crowdfunders react to certain language patterns and compare the results to business angels. The previous academic literature emphasizes that business angels have developed conceptual abilities and extensive experience in evaluating uncertain entrepreneurial business models (Gompers and Lerner, 2001; Macht and Weatherston, 2014), whereas crowdfunders usually have less detailed financial and market-related experience (Ahlers et al., 2015; Freear et al., 1994). Nonetheless, the crowd can select promising projects and provide them with funding (Kim and Viswanathan, 2014). A comparison of our results with those of Parhankangas and Ehrlich (2014) about business angels' perceptions toward impression management tactics helps to gain a deeper understanding of the investor's decision making process.

Table 1.3 Contributions of this dissertation

Debt capital	*Public subsidies*	*Venture capital*	*Crowdfunding*
Insights of how the presence of financial debt resources does not necessarily increase the probability of survival, as this rather depends on the debt's investment allocation.	Insights of how quality certification through the receipt of a subsidy is particularly valuable for information-opaque new ventures.	Insights of how venture capitalists perceive the reduction of information asymmetries through a new venture's receipt of a subsidy.	Insights of how entrepreneurs can effectively communicate and demonstrate their confidence while providing relevant information about the crowdfunding project.
Insights of how banks perceive the reduction of information asymmetries through a new venture's receipt of a subsidy.	Insights of how the certification effect varies for different government levels and is particularly strong for highly competitive cross-border grants.	Insights of how venture capitalists perceive female entrepreneurs, and the genders' link to education and innovativeness.	Insights of how crowdfunders react to certain language patterns and compare the results to traditional financiers.

Source: Own presentation.

Table 1.3 sums ups the contributions of this dissertation. The contributions will be explained in more detail in the chapters 2 to 6.

1.5 Synopsis

Figure 3 provides an outline of the structure of this dissertation. This dissertation comprises five studies to investigate the research gaps highlighted previously to examine recent research issues dealing with different capital sources of financing new ventures. The first study "The Investment Challenge of Financial Debt: Survival Dynamics of New

Technology-Based Firms" (Chapter 2) is located in the field of debt capital. This study analyzes the role of debt capital in the survival of new technology-based firms (NTBF) by shedding light on how financial debt must be invested to increase entrepreneurial survival prospects. It refers to resource-based theory and how this approach explains the processes through which a firm can access resources. Studying 3,556 German new ventures, this study proposes a two-stage regression model, first, to take into account the unique investment behavior of NTBFs and, second, to examine which debt investments positively influence survival prospects.

Figure 3 Structural overview of the dissertation

Debt capital	*Public subsidies*	*Venture capital*	*Crowdfunding*
Chapter 2: The Investment Challenge of Financial Debt: Survival Dynamics of New Technology-Based Firms			
	Chapter 3: The Effect of Subsidies on New Ventures' Access to Bank Loans		
		Chapter 4: How Do Public Subsidies Influence Venture Capital Access? An Examination of Cross-National and National Grants	
		Chapter 5: Bridging the Gender Funding Gap: Do Female Entrepreneurs Have Equal Access to Venture Capital?	
			Chapter 6: Effects of Impression Management Tactics on Crowdfunding Success

Source: Own presentation.

Similarly, the second study "The Effect of Subsidies on New Ventures' Access to Bank Loans" (Chapter 3) refers to the research field of debt capital as well, but, moreover, is also linked to the capital source of public subsidies. 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 young firms to develop, governments have increasingly initiated selective support programs to foster the innovation performance and growth of new ventures. For such support to become effective, however, it is important for firms to

be able to augment these publicly provided resources with additional means. Studying 10,814 new ventures founded between 2005 and 2013 in Germany, this study tests whether the subsidy itself could facilitate access to bank loans, while applying econometric techniques that account for the endogenous nature of a subsidy receipt.

The third study "How Do Public Subsidies Influence Venture Capital Access? An Examination of Cross-National and National Grants" (Chapter 4) builds on the results of the second study by contextually and methodologically adjusting the capital source, from debt capital to venture capital. This study addresses the key question of how grant-based subsidies might serve differently as quality certificates for NTBFs when trying to raise venture capital. Therefore, I distinguish between cross-national, national, and sub-national subsidies. Based on data of 405 German NTBFs, I apply a non-parametric matching procedure to control for the endogenous nature of subsidy reception.

The fourth study of this dissertation "Bridging the Gender Funding Gap: Do Female Entrepreneurs Have Equal Access to Venture Capital?" (Chapter 5) puts a focus entirely on the venture capital funding channel for new ventures. This study examines whether access to venture capital for female entrepreneurs is more constrained than for their male counterparts, considering their educational background and innovativeness. I use an econometric approach to analyze gender differences in gaining access to external equity capital, based on data of 3,137 German new ventures, founded between 2005 and 2009. Our results emphasize a gender gap regarding external equity funding.

Last, the aim of the fifth study "Effects of Impression Management Tactics on Crowdfunding Success" (Chapter 6) is to shed light on determinants that convince the crowd to fund a project on a crowdfunding platform. Therefore, I compare business angels and crowdfunders to gain a better understanding of their investment behaviors. In particular, I examine whether self-promotion through positive language as well as emphasizing innovativeness and supplication as impression management tactics drive crowdfunding success. Based on a sample of 221 Kickstarter campaigns and a total of 195,217 words embedded in their project descriptions, I develop and test hypotheses concerning linguistic behaviors affecting the likelihood of fundraising, the number of project backers and the amount raised.

The studies are published or under review in peer-reviewed and leading scientific journals in the field of entrepreneurship and entrepreneurial finance. In the following, I highlight the original source of publication or the current state of the five papers.

Study 1: Lins, Elmar and Lutz, Eva, "The Investment Challenge of Financial Debt: Survival Dynamics of New Technology-Based Firms", unpublished working paper (first round of revisions in Journal of Banking and Finance, submission date: 18.08.2016).

Conference presentations:
- Global Conference on Business and Finance, San Jose, Costa Rica, 28.05.2016
- Accepted at the 76th Annual Meeting, Academy of Management Conference 2016, 09.08.2016, Anaheim, USA

Study 2: Hottenrott, Hanna; Lins, Elmar and Lutz, Eva, "The Effect of Subsidies on New Ventures' Access to Bank Loans", unpublished working paper (first round of revisions in Small Business Economics, submission date: 12.05.2016).

Conference presentations:
- ZEW/MaCCI Conference, Mannheim, Germany, 02.07.2015
- DRUID15 Conference, Rome, Italy, 16.06.2015
- Fachkonferenz Economics of Entrepreneurship and Innovation, Trier, Germany, 02.06.2015
- G-Forum, Oldenburg, Germany, 14.10.2014

Study 3: Lins, Elmar, "How Do Public Subsidies Influence Venture Capital Access? An Examination of Cross-National and National Grants", unpublished working paper (first round of revisions in International Journal of Entrepreneurship and Innovation Management, submission date: 27.04.2016).

Study 4: Lins, Elmar and Lutz, Eva (2016), "Bridging the Gender Funding Gap: Do Female Entrepreneurs Have Equal Access to Venture Capital?", International Journal Entrepreneurship and Small Business, Vol. 27 No. 2/3, pp. 347-364.

Study 5: Lins, Elmar; Fietkiewicz, Kaja and Lutz, Eva (2016), "Effects of impression management tactics on crowdfunding success", International Journal Entrepreneurial Venturing, forthcoming.

Conference presentations:

- HICSS 2016, Kauai, Hawaii, 08.01.2016 (presented under the title "How to convince the crowd: An impression management approach")
- 3rd Crowdinvesting Symposium, Academic Workshop, Munich, 23.10.2015 (presented under the title "How to convince the crowd: An impression management approach")

2 The investment challenge of financial debt: Survival dynamics of new technology-based firms

2.1 Introduction

NTBFs usually have to rely on external financing for survival (Berger and Udell, 1998). In this context, financial debt continues to play a major role, particularly in bank-based capital markets, whereas access to outside equity from venture capitalists is highly restricted, especially in Continental Europe (Brouwer and Hendrix, 1998; Huyghebaert et al., 2007). Debt financing offers the opportunity for new ventures to fill their financing gaps. However, debt instruments require ongoing liquidity to pay interest and redemption and may therefore dampen entrepreneurial success, since high-risk investments might be more difficult to implement (Diamond and Rajan, 2000). It is unclear how exactly bank loans should be allocated to benefit future entrepreneurial prospects. We investigate the role of debt capital from an intra-firm perspective and examine how debt must be invested to increase business survival prospects. We propose a two-stage model, first, to take into account the unique investment behavior of NTBFs and to examine how scarce debt resources are allocated. Second, we employ duration analysis methods to investigate which investments positively influence the development process of a competitive advantage, thereby increasing entrepreneurial survival prospects.

Development of competitive advantage can be explained by the resource-based view of the firm (RBV), which is used to examine the relation between causes (e.g., resources) and effects (e.g., entrepreneurial survival). Therefore, we adopt the RBV approach, since RBV takes a dominant perspective in business strategy development that links economic value to business strategy through the firm's resources and capabilities (Barney et al., 2011). The literature defines these resources and capabilities as bundles of tangible and intangible assets (e.g., Alvarez and Busenitz, 2001; Wright et al., 2001). Recently, the question of where resources come from has begun to attract attention (Barney et al., 2011). For instance, Wernerfelt (2011) examines the processes through which a firm can access resources, and shows that a firm's current stock of resources creates asymmetries for competitors when trying to gain new resources. However, the linkage between how financial capital resources can influence this process of accessing other resources and what effects follow has not yet been investigated. This linkage may be of particular interest, since allocation of scarce financial resources might directly affect development

of a competitive advantage and entrepreneurial survival. Our study aims to close this gap and examines how bank loans must be allocated from an intra-firm perspective to benefit entrepreneurial survival. Recent studies based on RBV theory highlight that heterogeneity can influence the nature of these processes and be a source of bias in empirical studies (Combs et al., 2011). We focus on NTBFs to ensure examination of a homogeneous industry.

NTBFs make a great contribution to modern economies (Chemmanur and Fulghieri, 2014) by generating innovation, efficiency, and economic growth (Colombo et al., 2013a). To perform this role, NTBFs need adequate resources, particularly financing, (Grilli and Murtinu, 2012). Due to the technology-intensive nature of their business operations, NTBFs are likely to face severe adverse selection and moral hazard problems when trying to access funding sources (Berger and Udell, 1998; Carpenter and Petersen, 2002; Denis, 2004). Therefore, access to scarce financial resources is a major obstacle to overcome followed by the question of how to correctly allocate received capital.

We use the KfW/ZEW Start-up panel database, which contains data for newly founded, legally independent firms in Germany aged 1 to 7 years. We find statistically significant results that NTBFs are not likely to use financial debt to fund research and development (R&D) projects, possibly due to the rigidity of bank debt contracts. We also show that the amount of tangible assets positively affects entrepreneurial survival, since more tangible assets reduce information asymmetry and financial risk for capital providers, business clients, and customers. However, we show no significant results for NTBFs using debt resources to accumulate tangible assets, while controlling for various factors that could influence survival prospects. Additionally, our results indicate that debt-financed R&D decreases the probability of entrepreneurial survival, mainly due to the slowness of NTBFs' first product launch. Consequently, no early revenue streams can be developed to fulfill bank repayment obligations. Finally, we find that debt-financed recruiting initiatives increase the probability of entrepreneurial survival, since specific human capital can be accumulated to develop and maintain a competitive advantage.

Our study contributes to the literature in two ways. First, we add to the literature on entrepreneurial finance and debt relevance to firm survival and growth. Bank loans, as an important source of financing for new ventures, have received only limited attention in previous studies. Our study shows that the presence of financial debt resources does not

necessarily increase the probability of entrepreneurial survival, as this rather depends on the debt's investment allocation to specific assets and business projects. Second, we contribute to the literature on the resource-based perspective of entrepreneurial survival. This study examines entrepreneurial finance theories on investing financial debt with regard to the RBV of competitive advantage. Debt capital increases the specific human capital resources of a new venture, which might consequently support the development of a unique competitive advantage.

The next section explains our conceptual framework and reviews the recent literature on entrepreneurial firm survival and investment of financial debt from an intra-firm perspective. In Section 2.3, we develop our research hypotheses. Section 2.4 presents our data set, relevant descriptive statistics, the variables that we use for our analytic approach, and the methodology. Section 2.5 interprets our empirical results. In Section 2.6, we draw conclusions regarding the allocation of debt capital in important resources that affect the probability of entrepreneurial survival.

2.2 NTBF survival and the investment challenge of financial debt

The factors determining survival of new ventures have been extensively analyzed in the entrepreneurship literature, including human capital of the founders (Gimeno et al., 1997), profitability (Carter and Auken, 2006), and access to external equity financing (Boyer and Blazy, 2014). As first argued by Stinchcombe (1965), new ventures have to deal with the problem of the liability of newness, which can be described as greater risk of failure in comparison with established firms. During their infancy, firms have to overcome the obstacles of achieving both a functional organizational structure and an adequate efficiency level, with regard to product supply processes, to keep pace with competitors (Hyytinen et al., 2015). This might include establishing business relations with suppliers, winning customers for firm products, and especially acquiring suitable capital and allocating the available capital stock (Hyytinen et al., 2015).

New ventures face investment challenges at the very beginning of their life cycle (e.g., product development, market entry, or employee compensation). They must allocate scarce financial resources that facilitate entrepreneurial survival and growth (Robb and Robinson, 2012; Tanrısever et al., 2012). A growth-oriented new venture might initially

differentiate itself based on either developing and financing a unique product, and/or internal processes that stimulate the new ventures' efficiency and cost reductions in the long-run (Tanrısever et al., 2012). In particular, NTBFs are growth-oriented (e.g., semiconductor and biotech firms). Their business model often relies on increase in efficiency and/or cost reduction, which leads to unique product features (Hatch and Dyer, 2004). Furthermore, since process-related investments must secure business development in the long-run, many of these new ventures prefer to turn to debt as a means of financing (Tanrısever et al., 2012).

The literature on entrepreneurial finance indicates that financial capital in new ventures' early lifecycle stages is critical to future success (e.g., Cooper et al., 1994; Fotopoulos and Louri, 2000; Tveterås and Eide, 2000). Cooper et al. (1994) find that the amount of raised capital is positively associated with new-firm survival. The scarcity of early capital is linked to business strategy, which determines the development of processes and products. Further, more capital buys time, while the entrepreneur overcomes unexpected problems (e.g., production delays), which are common in more complex NTBF business models (Cooper et al., 1994). In line with this, Tveterås and Eide (2000) find for young Norwegian manufacturing firms, that the probability of survival can be increased through better access to external capital. However, when taking into account different types of financial capital, we should refrain from adopting the generalized findings mentioned above, since the importance and characteristics of bank debt differ substantially from external equity capital, particularly in bank-based capital markets, such as Western Europe (Achleitner et al., 2011).

The degree of financial debt in the early stages of an NTBF may increase the risk of failure (Fotopoulos and Louri, 2000). Banks do not benefit from the high returns of growth-oriented new ventures in case of successful outcomes (Schröder, 2013); thus, they demand higher interest payments to maximize profits than in situations of debt financing for less information-constrained, fully grown companies. This is the major obstacle NTBFs must overcome, particularly if allocation of early and scarce financial resources will not generate immediate cash flows to fulfill repayment obligations.

We aim to shed light on the role of debt capital in the survival of NTBFs by examining how received bank loans must be invested to decrease the risk of failure. It is recognized that the amount of initial financial resources is crucial to new ventures' survival, but it

remains unclear how exactly financial debt must be allocated from an intra-firm perspective to indeed benefit future business prospects.

2.3 Hypothesis development

2.3.1 Debt investments in tangible assets

NTBFs usually suffer from capital market imperfections such that financial constraints hamper their creation and growth (Colombo and Grilli, 2007). They are reliant on debt capital to develop and maintain business operations, which can be accessed only if the debt provider believes in the solvency of the entrepreneurial firm (Hutchinson, 1995). This can be achieved by fostering conditions of minimizing underinvestment problems, such as avoidance of major growth opportunities, maintenance of an investment strategy, and resource allocation that exposes the NTBF to only moderate or low levels of risk (Hutchinson, 1995). A firm then needs to actively demonstrate that low-risk projects are being undertaken. If an NTBF aims to demonstrate such conditions, the mix of tangible and intangible assets, as well as the speed with which intangible assets can be transformed into tangible assets are partly linked to an intended demonstration effect for debt providers (Hutchinson, 1995). Monitoring difficulties are prevalent when firms use intangible assets, since their values become problematic in the event of financial distress (Myers, 1984). Tangible assets are less uncertain due to reasonably active secondary markets (Hutchinson, 1995). In line with this, debt covenants are written in terms of tangible assets and often explicitly exclude intangibles (Long and Malitz, 1985). We see that such conditions of minimizing underinvestment problems not only directly affect the entrepreneur's decision of how to allocate scarce financial resources to tangible or intangible assets, but also the business strategy, entrepreneurial success, and growth.

RBV studies address a fundamental question at the heart of NTBF survival: How can growth potential through competitive advantage be released and sustained? Conversion of tangible assets into products or solutions for customers through internal processes, which might foster or even lead to development of a competitive advantage, appears to be a valid answer to this question (Davenport, 2013). Assets must be absorbed and transformed as part of an organizational process to transform input factors into desired products or services, thereby creating an economic return for NTBFs (Srivastava et al.,

1999). This conversion process can be started and maintained only with financial resources. As mentioned in Section 2.2 above, financing of process-related business developments must be secured over a long period of time, which is why many NTBFs turn to financial debt (Tanrısever et al., 2012). Consequently, most of the financial resources may primarily be invested in tangible assets (e.g., machinery), to create the basis for systematically generating products or services, and continual absorption of customers' buying power. The returns from this value-adding process can then not only be used to fulfill banks' repayment obligations, but also to further improve and maintain business operations to secure entrepreneurial survival. Foss (1997) shows that tangible resources improve firms' sustainable competitive advantage and contribute significantly to business survival. Further, the level of tangible resources is also accepted among practitioners as an important measure of firm success (Kaplan and Norton, 2001).

We therefore hypothesize the following:

H1a: There is a positive relationship between debt capital and subsequent accumulation of tangible asset stock.

H1b: There is a negative relationship between tangible asset stock and NTBF failure.

2.3.2   Debt investment in R&D projects

R&D investments play a major role in building capabilities that enhance competitive advantage (David et al., 2008; Yeoh and Roth, 1999). Commitment to R&D investments is necessary for product innovation, since such investments are a prerequisite to executing predevelopment, market-related, and technological activities (Capon et al., 1992; Hambrick and Macmillan, 1985; Zirger and Maidique, 1990). However, this is accompanied by high uncertainty with respect to financing R&D (Hall and Lerner, 2010; Shen and Zhang, 2013). Entrepreneurs are usually better informed than outsiders, which is why this partially one-sided distribution of information further hampers banks' lending probability (Blumberg and Letterie, 2008; Van Osnabrugge, 2000). Thus, banks are reluctant to finance R&D projects, since uncertainties cannot easily be reduced due to complex project assessments. Additionally, R&D investments generate intangible assets that serve as poor collateral, which is why debt providers are reluctant to fund R&D

(Kochhar, 1996; Williamson, 1988). Finally, the rigidity of debt contracts limits NTBF flexibility to pursue a sustained program of R&D investment (O'Brien, 2003). In line with this, previous empirical studies show that debt capital and R&D are negatively associated (Balakrishnan and Fox, 1993; Vicente-Lorente, 2001).

A possible explanation for these results is the fact that banks have substantially more bargaining power compared to borrowers when they negotiate the terms of a loan (Bolton and Scharfstein, 1990). First, evaluating NTBF R&D investments is difficult due to the time lag between investment and payoff (Berk et al., 2004; Laverty, 1996) and the many external factors that might influence ultimate payoffs (Hill and Snell, 1988). Furthermore, evaluation criteria of R&D investments must be based on high quality judgment with regard to the probability of success (David et al., 2008), the strategic relevance of an R&D project for an NTBF, and spillover benefits (Oral et al., 1991). Second, the returns from investments in R&D projects are subject to weak appropriability (David et al., 2008), since competitors might somehow gain access to information about an NTBF's R&D program (Teece, 1986). Providing assurance to debt providers that the firm is making appropriate investments in R&D would require public disclosure of data on important business projects. This would necessarily weaken entrepreneurs' appropriability when negotiating the terms of a loan and erode their motivation to use debt capital for R&D projects (Bhattacharya and Chiesa, 1995; David et al., 2008).

R&D, regardless of whether it is debt-backed, remains an important determinant of NTBF survival (Heirman and Clarysse, 2007). R&D is positively associated with development of a competitive advantage of a new venture and so with its survival prospects (David et al., 2008; Heirman and Clarysse, 2007). RBV theory suggests that probability of survival increases when a firm develops specific capabilities (Barney, 1991), which might be improved by R&D investments. Ericson and Pakes (1995) show that R&D investments stimulate the active learning process and improve firms' ability to survive. This result is in line with Audretsch (1995) who finds that R&D-active firms exhibit a higher probability of survival. Similarly, Kimura and Fujii (2003) show that R&D activities increase firm survival rates. We therefore hypothesize the following:

H2a: There is a negative relationship between debt capital and subsequent R&D activity.

H2b: There is a negative relationship between R&D activity and NTBF failure.

2.3.3 Debt investments in human capital

Human capital is a crucial factor for debt providers when evaluating the risk associated with lending money to an NTBF (Åstebro and Bernhardt, 2003). Banks will provide funding at lower required returns to new ventures where the perceived value of human capital is or will be higher (Scherr et al., 1993). Consequently, proxies for future human capital, such as employee growth, reveal the value of a new ventures' human capital stock, which indicates more debt within the capital structure and a greater potential for entrepreneurial survival (Myers, 1984; Scherr et al., 1993).

The entrepreneurial literature provides a number of arguments about human capital as a determinant for entrepreneurial survival, which can be specified in several ways. First, human capital increases the capabilities to perform entrepreneurial tasks of exploiting business opportunities (Shane and Venkataraman, 2000; Unger et al., 2011). Second, human capital is positively related to managerial acumen and venture strategy, which has a positive effect on entrepreneurial survival (Baum et al., 2001). Third, knowledge and capability are helpful in acquiring other important resources, such as financial and physical capital, to improve the development of organizational structures, products, and services (Brush et al., 2001). Finally, human capital is necessary for further learning and supports accumulation of knowledge and capabilities (Hunter, 1986; Unger et al., 2011). In sum, new ventures with higher accumulations of employee knowledge and capabilities should be more effective and efficient in business operations than ones with lower accumulations of employee knowledge and capabilities (Unger et al., 2011). We therefore hypothesize the following:

H3a: There is a positive relationship between debt capital and subsequent employee growth.

H3b: There is a negative relationship between employee growth and NTBF failure.

2.4 Methodology

2.4.1 Data and variables

We use the KfW/ZEW Start-up panel, which was established in 2008 by the Centre for European Economic Research (ZEW), KfW Bankengruppe and Creditreform to examine newly founded, legally independent firms in Germany. See Fryges et al. (2009) for a detailed description. The initial data set used for the following analysis comprises information on approximately 6,000 start-ups from the cohorts 2007 through 2011, which were interviewed via a telephone survey on a yearly basis. The data set contains quantitative and qualitative information about the founders. Further, firm-specific data, as well as information about the financial resources of the new venture (financing sources and finance structure) are included.

Figure 4 Kaplan-Meier survival estimates
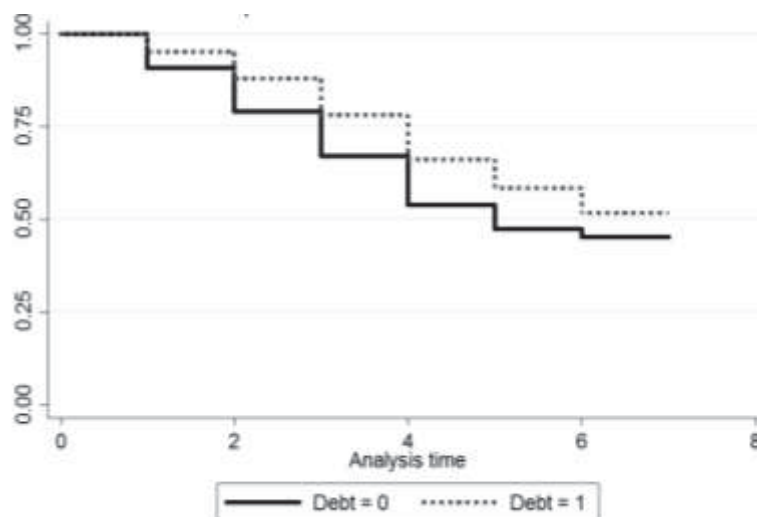
We examine the variable *Debt*, which indicates whether a new venture uses long-term bank loans in a particular year. It should be noted that long-term bank loans explicitly exclude short-term debt in terms of overdraft facilities. Firms using long-term bank loans are coded 1, 0 otherwise; 27% of all firms in our sample use financial debt. Figure 4 exhibits Kaplan Meier survival estimates, which show that debt-financed NTBFs in our sample are indeed more likely to survive than their non-debt-financed counterparts. We are particularly interested in how bank loans must be invested to decrease the risk of failure, which is why we use *Debt*, first, to determine whether NTBFs use debt capital for accumulating the tangible asset stock, increasing R&D activity, and/or hiring personnel.

Then, we implicitly evaluate the effect of these debt investments on the NTBF's survival prospects.

One of our main variables of interest is the value of tangible assets and its effect on new venture survival prospects. Cassar (2004) shows the importance of tangibility of assets in considering the role of asset structure on NTBF survival. Tangible assets serve as liquidation value, which leads to a reduction in financial risk for financiers and business clients (Harris and Raviv, 1991). We add the variable *TangibleAssets* as the natural logarithm of the total value of tangible assets that a NTBF is able to use. The natural logarithm reduces or even eliminates skew (and therefore statistical bias), since our measure of tangible assets is right-skewed before logarithmization. Another main variable of interest is R&D expenses. We add the variable *R&D* to our econometric model, which indicates the natural logarithm of R&D expenses for the observed German NTBFs. Similarly to the last variable, the R&D expenses of our observations are right-skewed, which is why we use the natural logarithm of this variable to reduce skew and statistical bias. Our third main variable is *Employ*, which indicates the number of employees in a particular year and serves as a proxy for accumulation of external human capital. On average, the observed NTBFs have approximately four employees.

We include a set of control variables to account for the survival of NTBFs. When arguing from the RBV perspective, we suggest that in the case of NTBFs, organizations have few resources. In the earliest stages, NTBFs rely almost exclusively on the human and social capital embedded in the entrepreneurial team (Aspelund et al., 2005). Consequently, previous entrepreneurship research has paid increasing attention to entrepreneurial teams. These studies find that new ventures founded by entrepreneurial teams are more likely to survive, to obtain sufficient resources, and to release more growth potential compared to new ventures started by single entrepreneurs (Cooper and Bruno, 1977; Eisenhardt and Schoonhoven, 1990; Harper, 2008). We include the variable *Team*, which takes the value 1 for entrepreneurial teams, 0 otherwise. On average, 39% of German NTBFs in our sample are founded by teams.

One of the most analyzed 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). Further, human capital theory suggests that the higher the educational level of the entrepreneur,

the more successful the venture will be (Becker, 1962). In line with this notion, the theory of absorptive capacity (Cohen and Levinthal, 1990) suggests that the greater the ability to recognize the value of external information in developing a business idea, the more successful the entrepreneur will be (Block and Wagner, 2010). We include the dummy variable *Uni*, which takes the value 1 for entrepreneurs with a university degree, 0 otherwise. On average, 60% of the founders in our sample graduated from a university.

Another major factor for entrepreneurial survival is a new venture's profit. A profitable NTBF is able to generate cash-flow streams, which are essential for the new venture's survival (Carter and Auken, 2006). Further, profitability indicates the ability of new ventures to enter the market and attract customers, which could imply a reduction in perceived uncertainty by business partners and financiers (Chen et al., 2010). In addition, profitability ensures that a NTBF is able to meet debt obligations. The dummy variable *Profit* takes the value 1 for profitable firms, which are 49% of our sample.

Table 2.1 Variables of the econometric model

Variable	Description	N	Mean	S.D.	Min	Max
Debt	1 for bank loans in use	3,556	0.27	0.44	0	1
TangibleAssets	Natural logarithm of value of tangible assets	3,556	8.26	2.90	0	12.21
R&D	Natural logarithm of R&D expenditures	3,556	4.02	5.20	0	13.82
Employ	Number of employees	3,556	4.03	8.54	0	321
Team	1 for founding by a team	3,556	0.38	0.48	0	1
Uni	1 for founders with a university degree	3,556	0.59	0.49	0	1
Profit	1 for new ventures with profit	3,556	0.53	0.50	0	1
VC	1 for new ventures using external equity financing	3,556	0.08	0.28	0	1
Exp	Founders' industry experience in years	3,556	3.55	1.33	1	6

The literature points out that external equity financing, such as venture capital investments, have a positive certification effect on attracting further external capital (Megginson and Weiss, 1991). This certification effect might enable NTBFs to access follow-up funding from different sources, such as government venture capital and financial debt. Financial resources increase the survival prospects of entrepreneurial firms (Boyer and Blazy, 2014). Therefore, we include the variable *VC*, which takes the value 1

for external equity financing. Table 2.1 provides an overview of all the main variables of our econometric models. In our sample, 187 NTBFs receive external equity capital.

Further, we control for the industry experience (*Exp*) of an entrepreneur, because previous studies show that relevant work experience may increase the probability of receiving external financing and, moreover, increase the survival prospects of entrepreneurial firms (Nofsinger and Wang, 2011; Wright et al., 1997). Therefore, we use years of industry experience of a founder to control for this specific type of human capital. This is a valid approach assuming that there is a relationship between human capital investment and the results of human capital investment (Unger et al., 2011). Current research indeed agrees with this assumption (Unger et al., 2011). In our sample, the average founder has relevant work experience of 15 years.

2.4.2   Econometric model

We perform two-step hierarchical regression models to examine the effect of resource gain and allocation through bank loan receipt on NTBF survival. In the first step, we use random effects regression models to clarify whether the use of financial debt affects the average value of tangible assets, R&D intensity, and number of employees in the following year. In the second step, we use the fitted values of the first stage to conduct a duration analysis (Lancaster, 1992) that allows us to estimate the length of time until NTBF failure.

Our observations consist of a cross section of durations $t_1, t_2, \ldots, t_n \in T$, where T is a random variable. For our sample, we use duration analysis to examine the probability of whether a specified event occurs. The dependent variable is the timespan of survival, which is calculated as the difference between t and the new venture's specified event, in our case the new venture's death (Agarwal and Audretsch, 2001). NTBFs might have been created at different points in time, which is why T is unavoidably censored (Giovannetti et al., 2011).

We model the hazard rate as the product of an arbitrary and unspecified hazard rate $h_0(t)$ and a suitable function of covariates (see vector x_i' below), to measure the effect of

different regressors, that is, the fitted value of tangible assets, R&D intensity, and the number of employees.

$$h(t|x_i) = h_0(t) \times \exp(x_i'\beta) \tag{1}$$

We calculate our estimates via Maximum Likelihood by semiparametric Cox proportional hazards regression, which has the advantage of not requiring distributional assumptions about the hazard rate. However, our sample consists of annual observed NTBFs and only observes NTBF deaths from year to year without being able to distinctly order their deaths within each period (Cox and Oakes, 1984). Hence, we apply the econometric approach of Breslow (1974) for our Cox proportional hazards regressions to correct the partial likelihood function and to receive unbiased and consistent estimates.

When considering the non-random nature of bank loan access, the allocation of scarce financial resources, and entrepreneurial survival, endogeneity appears to be an issue that we have to account for as a robustness check. We implement instrument variable (IV) regressions that allow correcting for selection bias and endogeneity in the first stage of our two-step hierarchical approach. IV estimators can avoid the bias that Ordinary Least Squares (OLS) suffer from when explanatory variables are correlated with the error term in the regression model of interest. Therefore, we undertake the following steps.

Step 1:

$$Debt_{it} = \gamma_0 + \gamma_{li}IV_{it}' + \alpha_i x_{it}' + \vartheta \tag{2}$$

Step 2:

$$F.TangibleAssets = \delta_0 + \delta_1 \widehat{Debt}_{it}' + \beta_i x_{it}' + \epsilon \tag{3}$$

$$F.R\&D = \delta_0 + \delta_1 \widehat{Debt}_{it}' + \beta_i x_{it}' + \epsilon \tag{4}$$

$$F.Employ = \delta_0 + \delta_1 \widehat{Debt}_{it}' + \beta_i x_{it}' + \epsilon \tag{5}$$

While this approach is appealing in general, identifying valid instruments for debt receipt is likely to be difficult (Coles et al., 2012). To verify the exogeneity of the instrument to the endogenous components, we conduct statistical tests, that is, the under-identification test (Kleinbergen-Paap) and an F-test of excluded instruments.

2.5 Results

In the first step of our econometric approach, we want to examine for which types of resources debt capital is used. Table 2.2 exhibits the estimates from regression models with random effects and forward-lagged dependent variables. Model 1 shows that there is no significant effect from financial debt and the accumulation of NTBFs' tangible asset stock in the following year. A possible explanation for this result is that tangible assets must be accumulated before gaining access to financial debt, as new ventures have to reduce adverse selection and moral hazard costs by pledging their assets as collateral or contracting for fixed charges to be placed on particular tangible assets (Cassar, 2004). Further, due to preferred contracting mechanisms of debt providers, previous studies show that bank financing in particular will depend upon whether debt capital can be secured by tangible assets (Berger and Udell, 1998). Thus, tangible assets might be sufficient and already available within a debt-backed new venture, so that the entrepreneurs can use capital stock for other investments.

In Model 2, we examine whether debt capital is used for subsequent R&D financing. Our results show that the estimate for the debt variable is negative and significant at the 5% level, which is in line with results from previous studies (Balakrishnan and Fox, 1993; Vicente-Lorente, 2001). This is due mainly to the rigidity of debt contracts, which limits NTBF flexibility to pursue R&D investments (O'Brien, 2003). Further, R&D investments usually generate intangible assets that serve poorly as collateral, which may also explain the reluctance of debt providers to fund R&D (David et al., 2008; Kochhar, 1996; Williamson, 1988). When considering the control variables in Model 2, we can, for instance, see that entrepreneurs with a university degree are more likely to be more R&D-active. A possible explanation for this is that R&D is a complex process, which makes specific human capital necessary, and that universities are a major source for R&D (Soh and Subramanian, 2014). Further, venture capital-backed NTBFs exhibit significantly higher R&D expenditures in the following year, which serves as evidence for H2a. Venture capital has become the form of financial intermediation most closely associated with dynamic and innovative entrepreneurial new ventures, particularly for NTBFs (Bottazzi and Da Rin, 2002). They invest in R&D-active new ventures to spur innovation and release growth potential (Kortum and Lerner, 2000; Sapienza, 1992).

In Model 3, we examine whether debt capital is used to finance employee growth in the following year. Our results show that NTBFs with financial debt increase the number of employees in the following year. As expected, new ventures use bank loans to overcome the liabilities of newness and smallness by funding additional recruiting initiatives. In this way, NTBFs are able to gain access to specific knowledge and capabilities, and to decrease both types of liability. This result serves as evidence for H3a.

Table 2.2 Regression models to examine the debt investment challenge

Variable	Model (1) F.*TangibleAssets*	Model (2) F.*R&D*	Model (3) F.*Employ*
Debt	-0.003	-0.870**	1.052**
	(0.005)	(0.390)	(0.448)
Team	0.034*	2.065***	2.488***
	(0.018)	(0.433)	(0.669)
Uni	-0.061***	1.914***	0.829
	(0.018)	(0.429)	(0.664)
Profit	-0.008	-1.342***	0.577
	(0.005)	(0.376)	(0.458)
VC	-0.007	3.639***	1.882**
	(0.010)	(0.682)	(0.839)
Exp	0.009**	0.064	0.254
	(0.004)	(0.152)	(0.225)
Constant	9.293***	2.859***	1.833*
	(0.021)	(0.671)	(0.994)
N	672	672	672
Wald Chi2	21.81	135.94	35.36
	(0.001)	(0.000)	(0.000)

This table shows results for the examination of how debt capital should be allocated. The table presents estimates from regression models with random effects and forward-lagged dependent variables to avoid distortion from timing issues. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

In the second step of our econometric approach, we examine which debt investments favor entrepreneurial survival. We use the fitted variables of step 1 and conduct a semiparametric Cox proportional hazards regression. The estimates are exhibited in Table 2.3. The table shows that tangible assets indeed increase survival prospects or decrease the hazard rate, respectively. This is in line with our expectations, since the more tangible assets an NTBF has, the greater is its liquidation value, which leads to a reduction of uncertainty for financiers and business clients (Harris and Raviv, 1991). NTBFs with more non-debt-backed tangible assets are more likely to reduce information asymmetry by pledging their assets as collateral (Cassar, 2004). This has a beneficial effect on entrepreneurial survival. This result serves as evidence for H1b.

Considering the relationship between R&D expenses and survival probability, we find, surprisingly, that increasing R&D expenditure has a negative effect on NTBF survival. A possible explanation for this result is that R&D activities are perceived as uncertain and risky (Miyagiwa and Ohno, 2002). While large firms are better able to spread risk while running several R&D projects simultaneously, NTBFs have to focus on only one or a few projects (Rammer et al., 2009). Failure of a single R&D project may increase the risk exposure of the NTBF as a whole substantially, since liquidating its assets could jeopardize an entire business (Rammer et al., 2009).

Table 2.3 Semiparametric Cox proportional hazards regression

Variable	Cox regression Coeff.
TangibleAssets	-16.341***
	(3.193)
R&D	0.134**
	(0.067)
Employ	-0.260***
	(0.065)
Team	0.990***
	(0.223)
Uni	-1.268***
	(0.311)
Profit	-0.147
	(0.108)
VC	-0.322
	(0.305)
N	3,556.00
Log likelihood	-8,039.66
Chi2	152.38
	(0.0000)

This table presents results for the examination of what kind of debt investments favor entrepreneurial survival. Therefore, we use the fitted variables of step 1 and conduct a semiparametric Cox proportional hazards regression. *Exp* is omitted due to collinearity. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Further, we find that number of employees positively affects entrepreneurial survival. This effect is significant at the 1% level. Arguing from an RBV perspective, increasing human capital with debt funding leads first to more specific capabilities, which might directly affect survival (Barney, 1991). Second, knowledge and competencies are indirectly helpful for business success, since they foster acquiring other important resources, such as financial and physical capital, to improve the development of organizational structures, products, and services (Brush et al., 2001). This finding is in line with the results of previous studies (Gulati and Higgins, 2003). This result serves as evidence for H3b.

Table 2.4 Accelerated failure time models

Variable	Lognormal Model (1) Coeff.	Loglog Model (2) Coeff.
TangibleAssets	9.424***	10.66***
	(1.773)	(1.740)
R&D	-0.0973**	-0.0938**
	(0.0381)	(0.0367)
Employ	0.171***	0.168***
	(0.0367)	(0.0356)
Team	-0.587***	-0.629***
	(0.126)	(0.122)
Uni	0.737***	0.806***
	(0.176)	(0.170)
Profit	0.0823	0.0991*
	(0.0603)	(0.0594)
VC	0.268	0.238
	(0.175)	(0.167)
Constant	-86.75***	-98.31***
	(16.43)	(16.13)
N	3,556	3,556
Log likelihood	-2,196.74	-2,215.73
Chi2	190.86	210.14
	(0.0000)	(0.0000)
Akaike's information criterion	4411.48	4449.45

This table shows estimates of two parametric accelerated failure time models. By employing the Akaike information criterion for model selection specifications and for non-monotonic duration dependence of the hazard rate, we calculate log-normal and log-logistic regression models. *Exp* is omitted due to collinearity. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

To check the robustness of our findings, we estimate parametric accelerated failure time models. We employ the Akaike information criterion for model selection specifications for non-monotonic duration dependence of the hazard rate (Strotmann, 2007). Thus, the presentation of estimates in Table 2.4 is restricted to the log-normal and log-logistic regression models. The results show that our previously mentioned findings do not depend on the parametrization, since all significant variables of Table 2.3 remain significant.

Further, we calculate regression models with IVs in Table 2.5 as robustness checks to account for the endogenous nature of bank loan access and the allocation and availability of scarce financial resources. The results bear the expected signs and are significant and analogous to the results highlighted in Table 2.2. Debt does not have a significant effect on accumulation of tangible assets in the following year, whereas R&D expenditures and overall employee growth are affected significantly.

Table 2.5 Regression models with IVs to check for endogeneity

Variable	Model (1) Step 1: *Debt*	Model (1) Step 2: F.*TangibleAssets*	Model (2) Step 1: *Debt*	Model (2) Step 2: F.*R&D*	Model (3) Step 1: *Debt*	Model (3) Step 2: F. *Employ*
Debt		143.769		-6.952*		8.207*
		(254.074)		(4.001)		(4.283)
Team	0.127**	775.178*	0.127**	3.429***	0.127**	2.561**
	(0.054)	(403.279)	(0.054)	(0.799)	(0.054)	(1.096)
Uni	-0.089*	-922.112**	-0.089*	0.906	-0.089*	0.229
	(0.050)	(410.176)	(0.050)	(0.719)	(0.050)	(1.038)
Profit	0.084*	-208.520	0.084*	-1.509**	0.084*	-0.257
	(0.050)	(360.078)	(0.050)	(0.747)	(0.050)	(1.032)
VC	-0.170***	441.889	-0.170***	3.438***	-0.170***	5.175***
	(0.063)	(701.754)	(0.063)	(1.173)	(0.063)	(1.439)
Exp	-0.007	246.434**	-0.007	-0.299	-0.007	0.070
	(0.020)	(102.554)	(0.020)	(0.226)	(0.020)	(0.299)
UnemploymentIV	< -0.000***		< -0.000***		< -0.000***	
	< (0.000)		< (0.000)		< (0.000)	
Constant	0.270***	10,392.310***	0.270***	5.827***	0.270***	0.987
	(0.081)	(767.074)	(0.081)	(1.265)	(0.081)	(1.422)
N	319	319	319	319	319	319

This table presents estimates of the pooled OLS regression models with IVs to investigate the effect of how debt resources are allocated. Model 1 reports no significant results for debt use to accumulate tangible assets in the next year. In the first step, we calculate *Debt* with the IV *UnemploymentIV*. In the second step, we replace *Debt* with the predicted value of *Debt* from the first step. Models 2 and 3 proceed analogously to the procedure of Model 1, only by adjusting the dependent variables. We calculate test statistics (Kleibergen-Paap: 10.095***; test of excluded instruments: 26.18***) via STATA command ivreg2. Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Furthermore, we identify *UnemploymentIV* as an instrumental variable; it indicates the number of unemployed in the administrative district where the NTBF is located. Aggregated variables on country- or regional-level are a common approach in the literature, as these instruments are able to explain shocks in the probability of receiving a treatment (Guerini and Quas, 2015). We statistically verify the validity of the instrument to the endogenous components by conducting an under-identification test (Kleinbergen-Paap: 10.095***) and an F-test of excluded instruments (26.18***).

2.6 Conclusion

This study aims to examine the role of debt capital in the survival of NTBFs by shedding light on how debt should be invested to increase entrepreneurial survival prospects. It remains unclear exactly how bank loans must be allocated from an intra-firm perspective to benefit future business prospects. We propose a two-stage model to, first, take into account the unique investment behavior of NTBFs. These growth-oriented new ventures focus strongly on the funding of costly production facilities, R&D projects, and human

capital accumulation. Second, we employ duration analysis methods to examine which investments positively influence survival prospects.

We use the KfW/ZEW Start-up panel database, which constitutes a representative sample of newly founded legally independent firms in Germany aged 1 to 7 years. After examining NTBFs and their debt investment behavior while controlling for various factors that could affect entrepreneurial survival, we do not find evidence for financial debt being invested in tangible assets, which can be traced back to the necessity for a sufficient amount of tangibles before bank loan receipt. Further, our results show, on the one hand, that NTBFs are not likely to fund R&D projects with debt resources, due to the rigidity of debt contracts and a high perception of uncertainty (Hall and Lerner, 2010; Huang and Xu, 1999). On the other hand, NTBFs tend to use bank loans to finance employment growth, since banks will provide funding at lower required returns to new ventures where the perceived value of human capital is or will be higher (Scherr et al., 1993). When considering our results in terms of entrepreneurial survival, we find that the amount of tangible assets positively affects business survival, since tangibles are necessary to improve and maintain business operations and secure business success (Foss, 1997; Kaplan and Norton, 2001). Our study also shows that R&D decreases survival prospects of NTBFs. This is due mainly to their slow speed in launching a first product, such that no or lower revenue streams are generated to maintain business operations. Finally, we find that debt-financed employee growth increases human capital stock and positively influences entrepreneurial survival, in line with the results of studies on the positive effect of employees on business success (Hunter, 1986; Unger et al., 2011).

We add to the literature in two main ways. First, we contribute to the literature on the relevance of entrepreneurial finance for the survival and growth of new ventures. We focus on bank loans as an important source of financing for new ventures (Berger and Udell, 1998). This type of funding has received only limited attention in previous academic studies. Our results highlight that financial debt resources do not, per se, increase survival prospects. Rather, only debt-backed funding of human capital accumulation increases the probability of entrepreneurial survival, while debt-backed funding of R&D projects exhibits the opposite effect. Second, our study adds to the literature on a resource-based perspective of entrepreneurial survival. We explore the allocation of financial debt relative to RBV theories of competitive advantage from an intra-firm perspective. Our study adds to previous insights that debt capital is able to

increase the specific human capital resources of an NTBF, which may consequently support development of a unique competitive advantage. On the contrary, financial debt does not stimulate an increase in intangible resources through R&D projects.

Despite our contributions, we are aware that several questions remain; these offer promising avenues for future research. We focus on three dimensions of the allocation of financial debt, which initially serve to build a fundamental understanding of intra-organizational debt allocation outcomes toward entrepreneurial survival prospects. However, NTBFs face more complex investment decisions in day-to-day practice. Debt cannot be used only to finance the accumulation of tangible assets, R&D projects, or staff recruitment. A more diverse theoretical approach should be applied to gain a detailed understanding of intra-organizational debt allocation and its effect on business survival. Another issue is, with regard to our econometric approach, that unobserved heterogeneity is included only in parametric duration models, but not in semiparametric models (Strotmann, 2007), which limits the generalizability of our findings. Even given our robustness checks, which highlight the stability of our findings, a parametric duration analysis might be fruitful for future research by including unobserved heterogeneity. Further, our two-stage procedure might be a source for bias. We estimate the average effect of how financial debt is allocated to other resources within an NTBF and, moreover, use a forward-lagged dependent variable. Similarly to the first point, this issue limits the interpretability of our results and leaves room for future improvement through use of more detailed data and statistical adjustments. Finally, endogeneity could remain a problem even though we use IVs to avoid bias in the first step of our hierarchical approach. However, the second step could also suffer from endogeneity, since business survival is dependent upon both observed as well as unobserved determinants, which potentially also affect the amount of tangible assets, R&D expenditures, and employee growth. Unfortunately, we are not able to operationalize the second step properly to conduct IV regression models or a matching procedure, due to the metrical scale of the independent variables.

3 The effect of subsidies on new ventures' access to bank loans

3.1 Introduction

Gaining access to financial resources is one of the key challenges new ventures must overcome to successfully build up their business operations (Berger and Udell, 1998). The entrepreneur is usually unable or unwilling to provide all the necessary funds from private wealth. External capital is typically difficult to obtain due to the high level of uncertainty and opacity that stems from the liability of newness of the new venture (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). Therefore, it seems that debt providers are able to select new ventures that fit their lending strategy (Hanley and Girma, 2006; Huyghebaert et al., 2007). However, little is still known about how debt providers assess the risk of new ventures and which criteria inform their lending decisions.

This study adds to the understanding of the role of public funding agencies in the lending decision of debt providers. In particular, we examine whether the receipt of subsidies as a common financing instrument for new ventures is relevant in this context. Since gaining access to financial resources might be crucial for new ventures to foster innovation, prosperity and growth, governments try to find appropriate solutions to support them (Bergström, 2000; Cumming, 2007; Koski and Pajarinen, 2013). There exist various subsidy types, such as government grants, loans, venture capital, and guarantee programs. This study focuses on governmental grants, which not only are 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 the direct liquidity effect, governmental grants could serve as a certification instrument that informs debt providers about a young firms' otherwise hard-to-observe prospects. Selective grants could then reduce information asymmetries and, thereby, lending uncertainty (Kleer, 2010).

Prior empirical studies suggest that receiving subsidies affects transactions between young firms and capital providers. Besides evidence of a positive effect of R&D grants on venture capital access (Lerner, 1999), small and medium-sized enterprises (SMEs) could benefit from subsidies through raising long-term debt (Meuleman and

DeMaeseneire, 2012) and gaining better access to other funding sources, such as federal government programs and public venture capital (Feldman and Kelley, 2006).

Further, governments tend to be committed to support and develop selective industries (Wydra et al., 2010), but sectoral differences in the role of subsidies as certification for subsequent capital providers have not yet been examined in the literature. We aim to close this research gap by explicitly accounting for sector heterogeneity with regard to demand for debt and the selection of firms into subsidy schemes and we apply econometric techniques that account for the endogenous nature of a subsidy receipt.

This study makes use of the KfW/ZEW Start-up panel database, which constitutes a representative sample of both subsidized and unsubsidized newly founded legally independent firms in Germany between one and five years old. We complement information on 10,814 new ventures founded between 2005 and 2013 in Germany with data from secondary sources, such as the German Federal Statistical Office and Creditreform's database, to gain additional information about location-specific macroeconomic characteristics. By comparing subsidized and unsubsidized new ventures and controlling for various factors that could affect bank loan access, we examine differences in the likelihood of bank loan usage and the volume of bank loans in use for new ventures. To account for differences in financing demand and information opaqueness, we distinguish between high- and low-tech industries, as well as between new knowledge-based and non-knowledge-based service ventures. The results show that the receipt of public grants increases the likelihood of new ventures raising bank debt and the volume of bank loans and that this effect is strongest for new high-tech ventures and young knowledge-based service firms. Certification through subsidy receipt thus appears to be stronger for new ventures from sectors that are prone to greater information asymmetries.

This study contributes to previous work on the relevance of public finance for new ventures' survival prospects and growth. The results not only confirm a relation between public subsidies and access to non-public financial sources, but also show that quality certification through the receipt of a subsidy is particularly valuable for information-opaque new ventures. Furthermore, this research adds to the entrepreneurial finance literature. Although bank loans are an important source of financing for new ventures (Berger and Udell, 1998; Colombo and Grilli, 2007; Meuleman and DeMaeseneire,

2012), financial debt has received little attention so far. This study thus contributes new insights on new ventures' access to bank financing.

This paper proceeds as follows. Section 3.2 briefly reviews the literature on bank loans and subsidies for new ventures. Section 3.3 presents the econometric framework and Section 3.4 describes the data. Section 3.5 discusses the results of our econometric analysis before concluding the paper in Section 3.6.

3.2   Theoretical background

3.2.1   Relationships between new ventures, subsidies, and bank loans

New ventures are subject to the liability of newness, since their future is uncertain and success or failure are difficult to predict (Stinchcombe, 1965). The failure rates of young companies are significantly higher than those of their older counterparts (Wiklund et al., 2010) and 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 the relationship between new ventures and potential investors (Cosh et al., 2009).

If a new venture aims to raise outside finance from banks or investors, information asymmetries are prevalent (Blumberg and Letterie, 2008). Founders are usually better informed than outsiders due to the difficulty of assessing the value of young firms as well as the abilities of the founders. The required information is usually uneconomic to obtain and difficult to interpret (Mason and Stark, 2004) or may 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. Since it is difficult for banks to monitor the behavior of founders, the founder could have an incentive to change her 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. Consequently, due to fixed interest payments, banks bear the risk but do not benefit from high returns in case of a successful outcome (Schröder, 2013). Anticipating this, banks could 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 that 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 (Cumming, 2006). Thus, agency problems make outside financing expensive and restraint lending decisions, especially for investments of higher uncertainty.

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

The spread of public subsidy programs has drawn attention to their role as an information factor in lending decisions (Meuleman and DeMaeseneire, 2012; Colombo et al., 2013a). Previous studies have indeed pointed out that public subsidies could serve as quality certificates because they provide outsiders with additional information (Lerner, 1999; Feldman and Kelley, 2006; Kleer, 2010).

3.2.2   Subsidy receipt as quality certification

Government initiatives to support new ventures aim at providing them with funding to close the gap in the private capital markets, which constitutes a direct effect of public grants on new venture financing. A secondary effect could arise when subsidies work as quality certificates. For such certification to be credible, three conditions must be met (Spence, 1973; Myers and Majluf, 1984; Megginson and Weiss, 1991). First, the awarding authority must have reputational capital at stake. Second, it must be costly for

the recipient (e.g., in terms of time and effort) to acquire the grant and, third, the subsidy receipt must be observable and verifiable by outsiders.

Indeed, the award process for grants is usually conditional on strict requirements, since funding agencies have an incentive to establish a thorough assessment procedure. First, the allocation of scarce public money requires the careful selection of those ventures that are likely to provide a return to the public investment. Second, it is in the agency's self-interest to pick potential successful start-ups to avoid a negative reputation (Bergström, 2000; BMWi, 2012). By delegating the assessment of the business models and founder attributes to trained and experienced personnel, funding agencies aim to ensure quality standards and the credibility of the award process. Usually, a new venture interested in receiving a subsidy must complete a time-consuming and costly application process. In Germany, for instance, in a first step, the coherence and sustainability of the business model need to be verified by the responsible Chamber of Commerce (BMWi, 2016). Second, the founders must set out their personal abilities to manage and lead a new venture and must submit a 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 could 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 could be more likely to lend to subsidized new ventures. In response to reduced information costs, a subsidy may have an effect not only on the likelihood of raising debt, but also on lending volumes and other terms and conditions offered by the bank.

In a European context, few studies have examined the effects of subsidies on financing constraints in new ventures. Lerner (1999) shows that the awardees of the SBIR program in the United States have better access to external equity due to the quality certification through subsidy receipt. Further, the authors points out that the certification is particularly important for new high-tech ventures, for which it is difficult to assess the risk of business projects. Colombo et al. (2013) find that, for new technology-based Italian firms, the receipt of public subsidies increased the investment rate and reduced investment-cash flow sensitivity. These findings suggest relaxed financing constraints because of better

access to financial debt. These results indicate that a (high-tech or complex technology-based) firm's level of information opaqueness or the type of investment (R&D versus more tangible investment) affects the need for certification and its information value.

3.2.3 Effect of subsidy receipt for new manufacturing ventures

While new ventures in general involve significant uncertainties, new firms from certain industry sectors are likely to be among the more information-opaque than others (Colombo and Delmastro, 2001; Cumming, 2012). The major reason for the uncertainty in a bank's lending decisions to new high-tech ventures can be traced back to the complex and difficult assessment procedure. In general, it is more difficult for banks to observe and monitor investment projects than assets in place (Smith and Watts, 1992). New high-tech ventures in the manufacturing industry are more likely to have more intangible assets in both absolute and relative terms and, hence, less reliably measurable collateral to invest in compared to young low-tech firms. This increases information asymmetry between new high-tech ventures and banks. Furthermore, the problem of adverse selection predominates in the high-tech sector, since the founders of high-tech firms have more relevant information and knowledge about the risks of the business model and specific business-related projects. The founders of complex products and technologies often possess greater insight into the technology than a bank, even if the bank tends to specialize in certain sectors (Hoewer et al., 2011). In case of high uncertainty, banks could decide to ration credit rather than, for example, raise interest rates, to circumvent the problem of adverse selection (Stiglitz and Weiss, 1981; Carpenter and Petersen, 2002). At the same time, high-tech firms tend to have higher financing demand than other start-ups, due to investments in specialized human capital and manufacturing tools and machinery (Colombo et al., 2014). Therefore, new high-tech ventures may benefit more from certification instruments. If the extent of information asymmetry decreases from new high-tech to new medium-tech and to new low-tech ventures, we hypothesize that the receipt of a subsidy could have a stronger effect in young high-tech firms than in young low-tech firms.

3.2.4   Effect of subsidy receipt for new service ventures

New service sector ventures play an important role in the functioning of innovation and growth (Czarnitzki and Spielkamp, 2003; Block, 2012). Nonetheless, young service companies are relatively understudied, particularly 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 usually cannot 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 new service 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, banks' perceived uncertainty of the future prospects of new service ventures could be high. In the context of service firms, adverse selection problems arise because the founders of new service ventures have more relevant knowledge about how to maintain the quality of the services' products and processes (Carman and Langeard, 1980). Human resources and organizational structure are key competitive factors for new service ventures (Nahapiet and Ghoshal, 1998; Neu and Brown, 2005). Therefore, the educational background as well as so-called soft skills of the founder and the employees and their previous work and industry experience play a major role in the success of the company. The assessment of such capabilities, however, challenges banks, since the procedure is time-consuming and requires specialized and experienced personnel. Moreover, knowledge-intensive new service ventures tend to have complex business models, such as firms offering service products based on scientific practices. Thus, the information asymmetries between these kinds of new service ventures, which offer knowledge-intensive services, and debt providers are likely to be higher compared to those service firms with simpler business models.

Based on the nature of the business model, knowledge-intensive services are both more equipment-based and human capital intensive compared to less knowledge-intensive service enterprises. For instance, conducting consulting services depends highly on well-trained employees and founders. Thus, in comparison with others, knowledge-intensive services tend to be more complex and are more difficult to assess by outsiders. Therefore, if information asymmetry is higher in knowledge-intensive sectors compared to in other service firms, we expect the information value of a subsidy to be higher for banks that

face a lending decision with knowledge-intensive service ventures in comparison to other service ventures.

3.3 Econometric framework

We adopt an econometric approach that allows us to study the effect of a venture's subsidy receipt on the accessibility and volume of bank loans. Building on the industry heterogeneity described above, we differentiate between sector-specific models for new high- and low-tech as well as new knowledge-intensive service ventures and other service firms. Given the non-random nature of subsidy awards to new firms, we implement models that correct for selection bias and endogeneity. In particular, we estimate IV models and conduct non-parametric matching procedures. We propose two-stage models in which the subsidy award is modeled in the first stage and bank loans are accessed in the second stage. The basic model can be written as

$$y_1 = y_2' \beta_1 + x_1' \beta_2 + u \qquad (6)$$

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

The subsidy award can be described as

$$y_2 = x_1' \gamma_1 + x_2' + e \qquad (7)$$

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

$$y_1 = \hat{y}_2' \beta_1 + x_1' \beta_2 + u \qquad (8)$$

It is important to note that the attributes of a new venture that affect the subsidy decision could 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 IVs (Wooldridge, 2012).[1] For

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[1] See Wooldridge (2012, pp. 512–553) for further details on the IV method.

this approach, it is necessary to identify IVs that correlate with the treatment variable but not with the error term. In the following, we therefore conduct, first, IV probit regressions to examine the probability of bank loan access and, second, IV tobit regressions to investigate the volume of financial debt. We use pooled regression models with cluster-robust standard errors.

However, the application of the IV approach is based on assumptions of valid instruments and functional forms. Non-parametric matching estimators have the advantage of not requiring IVs nor functional form or error term distribution assumptions (Angrist, 1998; Heckman et al., 1997). Therefore, we conduct a propensity score matching routine as a variant of 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 loan share in total financing, that is, the average treatment effect on the treated, can then be estimated as

$$\alpha^{TT} = \frac{1}{N^S} \sum_{i=1}^{N^S} \left(Y_i^S - \hat{Y}_i^c \right) \quad (9)$$

where Y_i^S indicates the outcome of treated firms and $\hat{Y}_i^c$ the counterfactual situation, that is, the potential outcome that would have been realized had the treatment group not been treated. The term $S \epsilon \{0,1\}$ indicates the receipt of a subsidy and N^S the number of treated firms. To ensure a suitable allocation, we imply a threshold for the maximum distance between an allocated pair of observations. If the distance exceeds the threshold, the observation will be dropped to reduce the matching bias (Smith and Todd 2005).

3.4   Data and descriptive statistics

3.4.1   Empirical setting: The KfW/ZEW Start-up panel

The KfW/ZEW Start-up panel was established in 2008 by the ZEW, KfW Bankengruppe, and Creditreform to examine newly founded legally independent firms in Germany. The firms were interviewed via a telephone survey, with a target size of 6,000 interviews per year (for a detailed description, see Fryges et al., 2009). The initial data set used for the

following analysis comprises information on approximately 6,000[2] start-ups from the 2005 to 2013 cohorts. The data contains relevant quantitative and qualitative 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) and information about the founders (e.g., gender, education, and work experience) are included. We enrich the data set with secondary sources, particularly location-specific economic data from the German Federal Statistical Office. After the elimination of incomplete records, the final sample consists of 10,814 observations from 7,531 firms between 2007 and 2013.

3.4.2 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 one (and zero otherwise). A total of 22% 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-term bank loans in use to total capital (*ShareBankloans*) is used to measure the relative importance of bank loans in a firm's financing mix. The overall share in our sample is 12% 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. Table 3.1 presents descriptive statistics for the relevant variables.

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 one for subsidy receipt and zero otherwise. 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 to outsiders. We exclude other subsidy types, such as loans, guarantees, and equity programs, to avoid problems of reverse causality and other distorting effects. Overall, the share of subsidized firms is 22%. In our data, 26% of all subsidized new

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[2] There were 1,767 start-ups in 2005, 3,928 in 2006, 6,346 in 2007, 6,770 in 2008, 7,219 in 2009, 7,465 in 2010, 7,840 in 2011, 7,536 in 2012, and 4,967 in 2013.

ventures have access to bank loans, whereas only 18% 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-sided t-tests significant at the 1% level.[3]

Control variables: We control for founder characteristics and capabilities as key lending criteria for debt providers, since these factors could 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) and lower ratios of financial debt (Haines et al., 1999). One of the most analyzed entrepreneurial variables for human capital is the entrepreneur's education. This variable serves as a proxy for underlying factors that could directly influence how a new venture is organized and managed (Cooper et al., 1994). We include the dummy variable *Educ*, which equals one for entrepreneurs with a university degree and zero otherwise. On average, 30% of the founders in our sample graduated from a university.

Furthermore, we control for the founder's industry experience (*Exp*), because previous studies have shown that relevant work experience could increase the probability of receiving external financing (Wright et al., 1997). Therefore, we control for the founder's years of industry experience. In our sample, the average founder has 15 years of relevant work experience. In addition, we control for the founder's gender (*Gender*). In our sample, the share of female-founded businesses is 17%.

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 (*Capacity*), in percent, of all the new ventures' resources. Capacity utilization could reflect the capabilities of the founders to manage future expectations correctly and to use the resources efficiently to reduce costs and, thereby, increase the likelihood of survival (Cooper et al., 1994).

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[3] Table 3.1 exhibits the average numbers for *DBankLoans* and *SharedBankLoans* without taking into account *DSubsidy*.

Table 3.1 Descriptive statistics

Variables	Description	N	Mean	S.D.	Min	Max
Bank financing:						
DBankLoans	One for bank loans in use	10,814	0.22	0.42	0	1
ShareBankLoans	Share of bank loans in use to total capital in use	10,814	0.12	0.27	0	1
Government grants:						
DSubsidy	One for new ventures' subsidy grant receipt	10,814	0.26	0.44	0	1
Control variables:						
Gender	One for founder is female or at least one female founder	10,814	0.17	0.38	0	1
Educ	One for founders with a university degree	10,814	0.30	0.46	0	1
Exp	Founders' industry experience in years	10,814	15.51	10.10	1	58
Capacity	Capacity utilization in percent	10,814	79.70	28.72	0	200
Age	Age of the new venture	10,814	2.63	1.72	1	8
Profit	One for new ventures with profit	10,814	0.51	0.50	0	1
lnRevenue	Logarithm of the new ventures' revenue in EUR	10,814	10.53	3.72	0	20.03
lnTangibleAssets	Logarithm of new ventures' materials and equipment in EUR	10,814	5.92	4.52	0	18.60
Patents	Number of valid patents	10,814	0.18	3.70	0	300
DEquityFinance	One for new ventures using external equity finance	10,814	0.05	0.21	0	1
HighTechEmployees	Number of employees in high-tech sector in new ventures' administrative district[a]	10,814	11.09	6.62	1	55
ForestArea	Proportion of forest area in new ventures' administrative district[a]	10,814	26.09	14.49	1	65
Instrument variables:						
IndustryR&D	Average R&D costs in industry sector	10,814	74.29	44.59	6	315
Banks	Number of bank branches in new ventures' administrative district[a]	10,814	17,584.77	17,778.18	1,511.45	50,852.94
Universities	Number of universities in new ventures' administrative district	10,814	0.12	0.32	0	1
HouseholdIncome	Household income in new ventures' administrative district[a]	10,814	1,564.52	205.73	1,117.10	2,397.00
NewState	One for a new venture in a new federal state	10,814	2.97	7.61	0	40

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

Furthermore, 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. These reputation effects could increase the volume of financial debt, suggesting that older firms have better access to bank loans. Indeed, Bougheas et al. (2006) find a positive relationship between firm age and short-term as well as long-term debt, based on an examination of the FAME database covering all UK-registered SMEs up to 11 years old. In our sample of start-ups, the average new venture exists for three years.

Additionally, two major criteria for bank lending decisions are revenue (*LnRevenue*) and, if the new venture is already generating it, profit (*Profit*). Revenue from sales indicates the ability of new ventures to enter the market and attract customers, which could imply a reduction of uncertainty for banks, since the probability of survival is larger. In addition, profitability ensures that the new venture is able to meet debt obligations. Bougheas et al. (2006) find that profitable firms indeed obtain more financing overall, regardless of the funding source. The average revenue is €398,608 and 51% of new ventures make profits.

We also include the natural logarithm of new ventures' tangible assets (*LnTangibleAssets*), since the more tangible the new ventures' assets are, the greater 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 €28.150. 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 (Long, 2002; Hsu and Ziedonis, 2013; Hottenrott et al., 2016a). In our sample, the average number of patents is 0.18, whereas a maximum of 300 patents is observed for a new venture in the knowledge-based service sector.

Previous literature has pointed out that external equity financing, such as venture capital investments, has 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 have also experience in evaluating uncertain business models. Therefore, we include a variable (*DEquityFinance*) that takes the value one for 5% of the firms.

We also take into account macroeconomic regional factors. Another important macroeconomic regional factor is the number of employees in the high-tech sector (*HighTechEmployees*) in a new venture's administrative district. By including this variable, we control for opportunities to access human capital and a highly educated workforce, particularly for high-growth firms. The more specific human capital is to the type of business model, the greater a new venture's probability of success (Cooper et al., 1994). Furthermore, we suggest that new ventures' foundations in rural areas are considered more uncertain because they tend to lack relevant network partners, access to financial sources, and a greater catchment area for potential customers due to greater geographical distance. For this study, the proportion of forest area (*ForestArea*) in a new venture's administrative district is included as a control variable to address the problem that banks are simply not sufficiently reachable in rural areas. In previous literature, there is no consensus about the importance of lender proximity to firms. Alessandrini et al. (2009) show that greater functional distance between borrower and lender aggravates financing constraints, particularly for small firms. However, contradictory findings highlight an increase in lender productivity with respect to new technology usage overcoming any disadvantages for borrowers after relocation (Petersen and Rajan, 2002).

Instrument variables: We carefully select IVs for the four sectors to examine the effectiveness of subsidies correctly and take into account the specific nature of selective subsidy awarding procedures. In particular, we construct the IVs *IndustryR&D*, *Banks*, *Universities*, *HouseholdIncome*, and *NewState*. The variable *IndustryR&D* indicates the average R&D expenditures in an industry, which could influence the subsidy awarding procedure. R&D is a major determinant for the innovativeness of new ventures and governments are interested in supporting these firms in particular to release economic growth potential (Almus and Czarnitzki, 2003). The variable *Banks* indicates the number of banks in the administrative district where a new venture is located and serves as a proxy to measure the extent to which financial resources are available or physically accessible, since government agencies tend to support new ventures that are unable to obtain funding by other means (Carpenter and Petersen, 2002).

Another variable that serves as an appropriate IV is *Universities*, which indicates the number of universities in an administrative district. Scientific projects with economic potential tend to be more likely to be publicly subsidized (Czarnitzki and Fier, 2002). Similarly, *HouseholdIncome* indicates the average household income in the

administrative district, which serves as a proxy for the identification of prosperous and wealthy regions. This could also be a crucial point for the awarding of subsidies, because government agencies also aim to redress economic inequalities. New ventures located in poorer regions are therefore more likely to be supported by government initiatives (Martin, 1999; Dupont and Martin, 2006).

Table 3.2 Sector definition and distribution

	NACE Rev. 1	Occurrence (%) Mean	S.D.
High-tech (N = 2,437)	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	0.23	0.42
Low-tech (N = 2,512)	15-37 (without sectors 1 + 2), 45	0.23	0.42
Knowledge-intensive (N = 2,448)	64.2, 72 (without 72.2), 73.1, 74.2, 74.3, 73.2, 74.1-4, 74.4	0.23	0.42
Non-knowledge-intensive (N = 3,417)	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), 80.4, 90, 92, 93	0.32	0.46
Source: KfW/ZEW Start-up panel.			

The variable *NewState* also serves as an IV, since the awarding of subsidies is highly influenced by the location of the new venture. New ventures located in the eastern parts of Germany are more likely to receive government support, which is why previous research has been conducted for these locational factors in Germany (e.g., Lechner, 1999, 2001; Almus and Czarnitzki, 2003). Table A.1 in the Appendix provides an additional overview of the economic rationales behind using these IVs.

Table 3.3 Means of main variables by sector

	High-tech sector (N = 2,437)	Low-tech sector (N = 2,512)	Knowledge-intensive service sector (N = 2,448)	Non-knowledge-intensive service sector (N = 3,417)
DBanksLoans	0.179	0.310	0.165	0.236
ShareBankLoans	0.095	0.170	0.094	0.125
DSubsidy	0.261	0.300	0.239	0.243
Source: KfW/ZEWStart-up panel.				

Sector classification: We categorize new ventures according to their type of business following Fryges et al. (2009), based on NACE codes (2008), and following Muller and Zenker (2001) for service firms. Table 3.2 reports the definitions of high-tech manufacturing (23%), low-tech manufacturing (23%), knowledge-intensive services (23%), and other services (32%). Table 3.3 shows details for the different sectors. For the 2,437 new high-tech ventures and 2,512 new low-tech ventures analyzed in the following,

we see that low-tech firms use more bank loans in absolute (+13% in *DBankLoans*) and relative volume terms (+7.5% in *ShareBankLoans*) and also have a higher probability of receiving governmental grants (+3.9% in *DSubsidy*) compared to high-tech firms. Further, we examine 5,865 new ventures from the service sector and have information about 2,448 young knowledge-intensive service firms and 3,417 non-knowledge-intensive service firms. We can state that non-knowledge-intensive new service ventures have a higher probability of gaining access to bank loans (+7.2% in *DBankLoans*) as well as using more financial debt in relative terms (+3.1% in *ShareBankLoans*).

3.5   Results

3.5.1   Effect of subsidy receipt on bank loan access

Table 3.4 summarizes the results from the IV probit regression models on the likelihood of bank loan access. For each model, the table reports the first- and second-stage results. The results from Model 1 show that subsidy receipt indeed has a positive effect on the likelihood of bank loan usage for subsidized new high-tech ventures. This finding is in line with our hypothesis that subsidy receipt serves as a quality certificate, which reduces adverse selection problems between banks and new ventures. In the first stage, the IVs *IndustryR&D* and *Banks* are highly significant at the 1% level and show the expected signs. The results for new low-tech ventures (Model 2), on the other hand, do not show a significant effect of subsidy receipt on bank loan access. This finding suggests that, for these firms, a subsidy receipt does not translate into a higher probability of bank loan use. This could suggest that banks do not need (or use) additional information, since they are able to assess new low-tech ventures appropriately without taking into account additional information sources.

Model 3 in Table 3.4 indicates that, similar to high-tech manufacturing firms, subsidy receipt reduces adverse selection problems between banks and new ventures in the knowledge-intensive service sector. The assessment procedure of governmental institutions could provide relevant information about the business model and future prospects of new knowledge-based service ventures. To compare the effect of subsidy receipt on bank loan access, we run the same model on 3,410 non-knowledge-based new service ventures. As the results for Model 4 show, in this case we do not find evidence of

subsidized new ventures being more likely to gain 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 with high information asymmetry.

Table 3.4 IV probit regressions for likelihood of bank loans in use

	Model 1		Model 2		Model 3		Model 4	
	High-tech new ventures		Low-tech new ventures		Knowledge-intensive service new ventures		Non-knowledge-intensive service new ventures	
VARIABLES	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
DSubsidy		1.923***		0.967		2.113***		0.811
		-0.159		-0.859		-0.175		-0.735
Gender	-0.013	-0.106	-0.076***	-0.106	0.011	-0.106	0.030*	0.0167
	-0.029	-0.092	-0.028	-0.134	-0.029	-0.083	-0.018	-0.0652
Educ	0.069***	-0.260***	-0.057*	-0.043	-0.015	0.068	-0.043**	-0.115
	-0.02	-0.06	-0.031	-0.105	-0.02	-0.061	-0.019	-0.083
Exp	-0.002*	0.007**	-0.001	0.005	-0.0001	0.001	0.0003	0.003
	-0.001	-0.003	-0.001	-0.003	-0.001	-0.003	-0.001	-0.003
Capacity	0.002***	-0.001	0.001***	-0.0001	0.001***	-0.001	0.001***	0.0004
	-0.0002	-0.001	-0.0003	-0.002	-0.0003	-0.001	-0.0003	-0.002
Age	-0.017***	0.072***	-0.058***	0.163***	-0.041***	0.121***	-0.056***	0.125***
	-0.006	-0.018	-0.006	-0.036	-0.005	-0.014	-0.005	-0.038
Profit	-0.039*	0.191***	0.022	0.182**	-0.034	0.172***	-0.028*	0.113**
	-0.02	-0.059	-0.021	-0.08	-0.021	-0.061	-0.016	-0.053
lnRevenue	0.006**	0.023**	0.003	0.029**	0.007***	0.023	0.008***	0.050***
	-0.002	-0.01	-0.003	-0.014	-0.003	-0.014	-0.002	-0.014
lnTangibleAssets	-0.001	0.005	-0.002	0.002	-0.001	-0.001	-0.006***	-0.001
	-0.002	-0.006	-0.002	-0.007	-0.002	-0.006	-0.002	-0.008
Patents	-0.001***	0.002	0.001	-0.001	-0.003***	-0.075	-0.008	-0.015
	-0.001	-0.002	-0.005	-0.013	-0.001	-0.059	-0.005	-0.035
DEquityFinance	0.054	-0.073	0.039	0.211	-0.027	0.009	-0.114***	0.103
	-0.034	-0.113	-0.055	-0.172	-0.038	-0.115	-0.037	-0.175
HighTechEmployees	-0.003**	0.004	-0.003*	0.004	-0.001	0.006	-0.002	-0.004
	-0.001	-0.004	-0.002	-0.005	-0.001	-0.004	-0.001	-0.005
ForestArea	0.001	0.002	-0.001	0.003	0.001	-0.002	-0.002***	0.001
	-0.001	-0.002	-0.001	-0.002	-0.001	-0.002	-0.001	-0.002
IndustryR&D	00003***							
	-0.001	-0.002	-0.001	-0.002	-0.001	-0.002	-0.001	-0.002
Banks	-0.001***		-0.001**		-0.0004***		-0.001***	
	-0.0002		-0.0003		-0.0001		-0.0001	
Universities			-0.004**					
			-0.001					
HouseholdIncome					-0.0002***			
					-0.0001			
NewState							0.062**	
							-0.031	
Constant	-1.217***	-1.708***	0.428***	-1.889***	0.522***	-1.632***	0.343***	-1.874***
	-0.186	-0.216	-0.053	-0.209	-0.09	-0.279	-0.042	-0.182
Observations	2,437	2,437	2,509	2,509	2,448	2,448	3,410	3,410

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*). Model 1 reports the results for the high-tech industry examination of the effect of the dummy variable subsidy receipt on the probability of bank loans in use. In the first stage, we calculate the variable subsidy receipt with the instrument variables *IndustryR&D* and *Banks*. 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*. Model 2, Model 3 and Model 4 proceed analog to the procedure of Model 1. Standard errors are reported in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

When considering the control variables, we can show that the variable *Capacity* is relevant for government agencies. The reason for this result is twofold. First, government

agencies aim to support new ventures with proficient business founders and management teams and the ability to allocate scarce resources effectively. Second, high-capacity utilization can be interpreted as the need for even more resources to further develop a new venture and release growth potential. Furthermore, on the one hand, we find that the age of new ventures has a positive effect on bank loan access, since older firms are more likely to have established track-records that banks can observe, which could increase the likelihood of access to financial debt. On the other hand, we also find that older firms are less likely to receive government support. Both effects are consistently observable for all industry sectors and highly significant at the 1% level. Additionally, our results specifically show that profitable new ventures are more likely to receive bank financing, which is in line with our expectations, since profitability ensures the ability to meet debt obligations (Bougheas et al., 2006).

Besides whether subsidized new ventures from certain industries have better access to bank loans in terms of probability, whether subsidized new ventures receive relatively more loans might also be of interest. Table 3.5 summarizes the results from our tobit regression model with IVs for the share of bank loans in use compared to financing after subsidy receipt, since the share of bank loans is naturally censored at zero. For each model, the tables report first-and second-stage results and relevant test statistics. The results confirm the previous findings of the probit regressions highlighted in Table 3.4.

For highly information-opaque new ventures, a subsidy receipt increases the volume of bank loan 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.

Model 1 of Table 3.5 shows highly significant coefficients for subsidy receipt for new high-tech manufacturing ventures, indicating larger bank loan shares compared to those of firms in the same sectors without a subsidy. However, for new ventures from low-tech manufacturing industries, we do not find evidence that a subsidy receipt affects the share of bank loans (Model 2). Again, we interpret this result as a weak or even non-existent subsidy certification effect for less information-opaque new low-tech ventures.

Finally, Models 3 and 4 of Table 3.5 compare new knowledge-based service ventures to other service firms. For the former, we find that, on average, firms have significantly

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 new service ventures.

Table 3.5 IV tobit regressions for volume of bank loans in use

VARIABLES	Model 1 High-tech new ventures		Model 2 Low-tech new ventures		Model 3 Knowledge-intensive service new ventures		Model 4 Non-knowledge-intensive service new ventures	
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
DSubsidy		2.332***		-0.042		3.750***		0.762
		(0.496)		(0.757)		(1.239)		(0.64)
Gender	-0.014	-0.133	-0.076***	-0.117	0.011	-0.229	0.030*	0.003
	(0.029)	(0.111)	(0.028)	(0.093)	(0.029)	(0.145)	(0.018)	(0.051)
Educ	0.069***	-0.323***	-0.058*	-0.106	-0.015	0.11	-0.043**	-0.068
	(0.02)	(0.08)	(0.031)	(0.073)	(0.02)	(0.109)	(0.019)	(0.062)
Exp	-0.002*	0.009***	-0.001	0.004	-0.0001	0.001	0.00002	0.002
	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)	(0.005)	(0.001)	(0.002)
Capacity	0.002***	-0.001	0.001***	0.001	0.001***	-0.001	0.001***	0.001
	(0.0003)	(0.001)	(0.0003)	(0.001)	(0.0003)	(0.002)	(0.0003)	(0.001)
Age	-0.017***	0.100***	-0.058***	0.078*	-0.041***	0.218***	-0.056***	0.107***
	(0.006)	(0.022)	(0.006)	(0.044)	(0.005)	(0.056)	(0.005)	(0.037)
Profit	-0.038	0.280***	0.022	0.181***	-0.034	0.341***	-0.028*	0.125***
	(0.02)	(0.071)	(0.021)	(0.048)	(0.021)	(0.108)	(0.016)	(0.044)
lnRevenue	0.006**	0.023**	0.003	0.025***	0.007***	0.038**	0.008***	0.042***
	(0.002)	(0.01)	(0.003)	(0.009)	(0.003)	(0.019)	(0.002)	(0.01)
lnTangibleAssets	-0.001	0.004	-0.002	-0.003	-0.0001	-0.005	-0.006***	-0.0003
	(0.002)	(0.007)	(0.002)	(0.005)	(0.002)	(0.011)	(0.002)	(0.006)
Patents	-0.001***	0.002	0.001	-0.001	-0.003***	-0.129	-0.008	-0.002
	(0.001)	(0.003)	(0.005)	(0.01)	(0.001)	(0.103)	(0.005)	(0.027)
DEquityFinance	0.054	-0.149	0.039	0.096	-0.027	-0.039	-0.114***	0.056
	(0.034)	(0.133)	(0.055)	(0.104)	(0.038)	(0.203)	(0.037)	(0.139)
HighTechEmployees	-0.003**	0.005	-0.003*	0.0002	-0.001	0.008	-0.002	-0.003
	(0.001)	(0.005)	(0.002)	(0.004)	(0.001)	(0.007)	(0.001)	(0.003)
ForestArea	0.001	0.002	-0.001	0.002	0.001	-0.004	-0.002***	0.002
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.004)	(0.001)	(0.002)
IndustryR&D	0.00003***							
	(0.000004)							
Banks	-0.001***		-0.001**		-0.0004***		-0.001***	
	(0.0002)		(0.0003)		(0.0002)		(0.0002)	
Universities			-0.003**					
			(0.001)					
HouseholdIncome					-0.0002***			
					(0.00004)			
NewState							0.061**	
							(0.031)	
Constant	-1.237***	-2.059***	0.428***	-1.157***	0.530***	-2.922***	0.344***	-1.638***
	(0.184)	(0.182)	(0.053)	(0.325)	(0.088)	(0.394)	(0.042)	(0.238)
F-test of excl. instruments	29.68***		6.95***		8.93***		9.71***	
Underidentification test	70.37***		31.31***		23.41***		21.24***	
Hansen J statistic (p-value)	0.2		0.51		0.67		0.75	
Observations	2,437	2,437	2,509	2,509	2,448	2,448	3,410	3,410

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*). Test statistics are calculated via STATA command ivreg2. Standard errors are reported in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

When considering the control variables in Table 3.5, we find similar results compared to the IV probit regression models examining the likelihood of bank loan access. New ventures' age and revenue have a positive effect on the volume of bank loan access, since an increase of both variables can be interpreted as a decrease of perceived uncertainty by banks.

3.5.2   Non-parametric matching approach and specification tests

In addition to the parametric models presented so far, we perform propensity score matching to test the robustness of the results to the choice of instruments and functional form assumptions. The results of the matching models (see Table 3.6) 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 new high-tech ventures. We estimate a probit model in order to obtain the propensity scores, since our matching procedure compares the outcomes of program participants with those of matched non-participants (see Table A.2). The findings of the matching models are in line with the results presented in Section 3.5.1.

Table 3.6 Matching results

VARIABLES	High-tech new ventures N = 630		Low-tech new ventures N = 736		Kn.-intensive services N = 582		Non-kn.-intensive services N = 287	
	Mean delta	p-value	Mean delta	p-value	Mean delta	p-value	Mean delta	p-value
Covariates								
Gender	-0.014	-0.133	-0.076***	-0.117	0.011	-0.229	0.030*	0.003
Educ	0.069***	-0.323***	-0.058*	-0.106	-0.015	0.11	-0.043**	-0.068
Exp	-0.002*	0.009***	-0.001	0.004	-0.0001	0.001	0.00002	0.002
Capacity	0.002***	-0.001	0.001***	0.001	0.001***	-0.001	0.001***	0.001
Age	-0.017***	0.100***	-0.058***	0.078*	-0.041***	0.218***	-0.056***	0.107***
Profit	-0.038*	0.280***	0.022	0.181***	-0.034	0.341***	-0.028*	0.125***
lnRevenue	0.006**	0.023**	0.003	0.025***	0.007***	0.038**	0.008***	0.042***
lnTangibleAssets	-0.001	0.004	-0.002	-0.003	-0.0001	-0.005	-0.006***	-0.0003
Patents	-0.001***	0.002	0.001	-0.001	-0.003***	-0.129	-0.008	-0.002
DEquityFinance	0.054	-0.149	0.039	0.096	-0.027	-0.039	-0.114***	0.056
HighTechEmployees	-0.003**	0.005	-0.003*	0.0002	-0.001	0.008	-0.002	-0.003
ForestArea	0.001	0.002	-0.001	0.002	0.001	-0.004	-0.002***	0.002
Outcomes								
DBankLoans	0.076	0.000	0.038	0.116	0.069	0.000	0.070	0.058
ShareBankLoans	0.036	0.008	0.010	0.523	0.03	0.015	0.021	0.368

This table presents the 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*). We allocate each subsidy recipient with their closest non-recipient for high-tech new ventures. 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 A.2).

A further robustness check concerns the effect of increased cash resources through subsidy receipt. Arguing in this direction, better bank loan access could be explained by the cash payment, which the bank might consider as additional windfall profit, rather than by certification. To test for such a cash effect, we add an interaction term between the subsidy variable and the profit dummy. We saw in a previous specification that start-ups beyond the break-even point are more likely to use bank loans, indicating that the profit status is an important factor in banks' lending decisions. In the presence of a cash effect,

the subsidy should reduce the information value of the profit indicator, that is, the interaction term should be negative, partially or fully reducing the profit effect. The results presented in Table 3.7 show that the interaction term is not significant, rejecting the hypothesis of a cash effect. At the same time, the subsidy variable is still positive and significant.

Table 3.7 2SLS results for the "cash effect" test on subsidy certification

	Model 1	Model 2	Model 3	Model 4
	Effects for high-tech industry	Effects for low-tech industry	Effects for knowledge-intensive service new ventures	Effects for non-knowledge-intensive service new ventures
DSubsidy	0.247***	-0.333	0.410*	0.033
	-0.079	-0.257	-0.238	-0.146
Profit	0.02	-0.048	0.01	-0.061
	-0.047	-0.116	-0.079	-0.065
DSubsidy x Profit	0.17	0.367	0.231	0.419
	-0.198	-0.372	-0.318	-0.279

This table presents the interaction effects between subsidy receipt and profit in order to distangle the quality certification and the cash effect through subsidy receipt. Control variables are not reported and available upon request. Standard errors are reported in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Table 3.8 2SLS results for the effect of the financial crisis

	Model 1	Model 2	Model 3	Model 4
	Effects for high-tech industry	Effects for low-tech industry	Effects for knowledge-intensive service new ventures	Effects for non-knowledge-intensive service new ventures
DSubsidy	0.277***	-0.256	0.615***	0.202
	-0.089	-0.235	-0.222	-0.164
2008	0.168	-0.485	-0.329	0.029
	-0.181	-0.841	-0.273	-0.312
DSubsidy x 2008	0.01	0.203	0.073	-0.016
	-0.043	-0.295	-0.068	-0.089

This table presents the interaction effects between subsidy receipt and profit in order to distangle the quality certification and the credit crunch situation in 2008. Control variables are not reported and available upon request. Standard errors are reported in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Furthermore, we address the issue that part of the survey data were collected during the years of the financial crisis (Longstaff, 2010; Chor and Manova, 2012). If banks were particularly reluctant to lend during the crisis year(s), the identified effect could have been driven by the credit crunch and is not generalizable to non-crisis years. To test whether the subsidy effect is driven by the crisis, we examine the interaction between subsidy receipt and a year dummy for 2008. We find the interaction effect to be insignificant, thus rejecting the hypothesis that the effect is due to a credit crunch situation (see Table 3.8).

3.6 Conclusion

In this paper, we set out to empirically examine whether the receipt of a subsidy grant can serve as a quality certificate for young firms that banks can then use as support for their lending decisions. Due to the non-random nature of subsidy awards, we correct for selection effects to separate out the certification effect from a quality-based selection into a subsidy scheme. Moreover, we analyzed whether the level of information opaqueness of young ventures shapes the importance of subsidies as a certification device.

The results show that the receipt of public grants increases the likelihood of new ventures of raising bank debt, even if the selection into subsidy schemes is accounted for. Second, the subsidy certification effect is stronger in more information-opaque sectors. In particular, we find the subsidy receipt to have a positive effect on 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. Our study underlines the important role of subsidies not only in providing a direct financing effect, but also by serving as a quality signal for future capital providers and, in particular, affecting banks' lending behavior. The receipt of a subsidy thus appears to inform the lending decisions of banks to the benefit of the new venture. It is important to stress, however, that the effect of subsidy receipt might only function that way if the governmental program fulfills the conditions of selectivity and credibility. Government agencies should therefore ensure high standards in the selection process not only to obtain a large direct return to the public investment, but also to support the indirect value of the subsidy receipt.

This study contributes to the literature on the relevance of public finance to the survival and growth of new ventures. It highlights a certification effect for new information-opaque ventures. In addition, we add to the entrepreneurial finance literature. While bank loans remain an important source of financing for new ventures (Berger and Udell, 1998; Colombo and Grilli, 2007; Meuleman and DeMaeseneire, 2012), such financing has only received limited attention in academic studies. Our study adds important insights on factors that impact the likelihood of receiving debt finance, as well as on the volume of debt a new venture is able to raise.

Despite these contributions, our study has its limitations. In particular, our data set is unable to differentiate between new ventures that did not try to access a bank loan and

new ventures that were rejected within the loan assessment procedure. Moreover, there could be substantial heterogeneity within different subsidy programs that future research could aim to depict. We encourage more research on the certification value of public subsidies in other institutional contexts and for other types of firms. Moreover, an in-depth examination of differences in subsidy types (or awarding agencies) would be interesting. Local, national, and supranational institutions are important sources of public and financial support, but they could differ in terms of their credibility and hence in terms of the information value of their awarded grants. Access to finance remains a key challenge for young firms and further understanding of the role that public finance can play in this context will be helpful not only for new ventures, but also for public policy makers designing future programs.

4   How do public subsidies influence venture capital access? An examination of cross-national and national grants

4.1   Introduction

The funding of NTBFs has received considerable attention in academic research, with the presumption that selectively awarded subsidies provide not only direct cash resources to awardees, but also serve indirectly as quality certificates. In this role, subsidies can support new ventures to raise further capital. Lerner (1999) finds empirical evidence that awardees of the United States government SBIR program have better access to venture capital. He suggests subsidies provide "certification" that NTBFs can use as leverage to further finance. However, most studies about subsidy support do not distinguish between different subsidy types, regarding their origin, which makes it difficult to draw valid conclusions about the functionality of these funding instruments. An examination of cross-national, national, and sub-national grants seems necessary to draw out key insights that selectively awarded grants from certain government levels might differently reduce information asymmetries between NTBFs and venture capitalists.

For my study, I use the KfW/ZEW Start-up panel, which constitutes a representative sample of subsidized NTBFs between 2007 and 2011 and survey information about subsidy instruments and venture capital funding. By controlling for the endogenous nature of subsidy support and various factors that might influence venture capital access, cross-national grants have the strongest certification effect and can significantly reduce information asymmetries between subsidized NTBFs and venture capitalists. Explanations for these results might be the existence of cross-border spillover effects of subsidized NTBFs and related growth potential and high competitive awarding procedures due to the vast catchment area of supra-national government institutions. I find no significant effect for national grants on venture capital funding. However, when I consider sub-national grants, awarded by regional government agencies, I find a positive effect on both venture capital funding probability and venture capital funding volumes. This result can be assigned to particularly strong network ties on regional level, which local government agencies can use to assess NTBFs. I conclude that the reception of cross-national and sub-national grants serve as a quality certification by containing value-added information for venture capitalists. Cross-national grants exhibit a slightly higher certification effect compared to sub-national grants.

I contribute to the literature on public policy and entrepreneurial finance. First, my study extends previous literature on subsidy certification and subsidy financing by revealing that not all subsidy grants serve as quality certificates for outsiders. The certification function varies for different government levels and is strong for highly competitive cross-border grants. The effect is weaker, but still prevalent for sub-national subsidies, as business network ties enable an assessment by local government authorities of NTBFs. Second, my study contributes to previous literature on entrepreneurial finance literature, since venture capital is a major source of financing for new firms, but received rather little attention in this research context. I aim to shed new light on NTBFs' access to venture capital funding, by revealing that venture capitalists particularly use cross-national and sub-national grants to better assess NTBFs.

The paper proceeds as follows: In Section 4.2 and 4.3, I briefly review the literature on venture capital funding, subsidy certification, and subsidy types. Section 4.4 presents a description of the data and the econometric framework. In Section 4.5, I discuss the results of my econometric analysis, before making a conclusion in Section 4.6.

4.2   NTBFs and venture capital funding

Venture capitalists are organizations that aim to fund growth-oriented new ventures, which do not yet have access to other funding resources. Venture capitalists differ from other typical businesses, as they do not directly engage in operational activities. Instead, they can be characterized as intermediaries between investors and new ventures (Gupta and Sapienza, 1992). They can play an important role for developing a newly founded company, as they, first, make superior investment decisions by bringing together investors and entrepreneurs (Bygrave, 1987), and, second, provide non-financial support, e.g., network contacts (Cumming, 2008; Cumming and Johan, 2008). Hence, venture capitalists are agents that act on behalf of investors (Jensen and Meckling, 1976) and organizations with unique funding capabilities (Penrose, 2009). Thereof, a major question arises: What are the venture capitalists' criteria for evaluating potential investments?

Prior research examines this focal question for the financing of new ventures and emphasizes that uncertainty and information asymmetry are prevalent for new ventures, particularly for NTBFs (Gompers and Lerner, 2001). These problems affect the behaviour

of entrepreneurs, as they have an incentive to use outside equity funding in wasteful expenditure, as they do not bear the entire costs (Gompers and Lerner, 2001). Similarly, debt-backed new ventures might use debt capital to replace low risk-return projects with high-risk return ones (Jensen and Meckling, 1976). It is difficult for outsiders to assess the abilities of entrepreneurs and the management team. These problems particularly arise for new ventures with intangible assets and a strong reliance on R&D, such as NTBFs.

However, venture capitalists can select NTBFs that fit their funding strategy. They can identify the quality of innovative new ventures, which remain hidden to other investors, and provide these NTBFs with the necessary funding to establish business operations (Bertoni et al., 2010). Venture capitalists' superior investment capabilities can be traced back to several factors. They might focus on investing in certain business stages, industries, or regions to manage uncertainty and information asymmetry (Gupta and Sapienza, 1992). Over time, venture capitalists invest in a greater number and range of deals, through which a pool of experience investment managers can be developed (Dimov and Murray, 2008). Furthermore, because of the increase in operational experience, network contacts and the venture capitalists' capabilities of conducting due diligence might be improved (Dimov and Murray, 2008).

Entrepreneurial finance literature specifically identified criteria relevant for the venture capitalists' assessment procedure of new ventures, including founder's experience, business characteristics, and gender (Baum and Silverman, 2004). The spreading of public subsidy programs drew attention to their role as an information factor in investment (Meuleman and DeMaeseneire, 2012). Previous studies stressed that public subsidies may serve as quality certificates, because they provide outsiders with additional and value-added information (Feldman and Kelley, 2006; Kleer, 2010; Lerner, 1999).

4.3   Subsidy support for NTBFs

4.3.1   The role of subsidy certification for venture capital funding

NTBFs have attracted the interest of researchers and policy makers at both the national and international levels (Colombo et al., 2013b). Their development has been an important objective of innovation policy in most European countries during the past few decades (OECD, 2005). Particularly, attention has been drawn to the certification function

of subsidy support. Subsidies, which are competitive and selectively awarded through a screening procedure carried out by specialists with technical expertise, provide the recipient NTBFs with a certification of the quality of their business projects (Colombo et al., 2013b). This certification effect can reduce information asymmetries that might have otherwise impeded access to external financing by NTBFs (Colombo et al., 2013b).

Credible quality certificates must meet three distinctive conditions (Megginson and Weiss, 1991; Myers and Majluf, 1984; Spence, 1973). First, funding agencies must have reputational capital at stake, which is accurate for most subsidies due to the strict application and awarding requirements. It is self-interest of the authorities to pick NTBFs with high success prospects to avoid a negative reputation (BMWi, 2012; Bergström, 2000). Second, it must be costly for the recipient in terms of time and effort to acquire the certificate. This condition is also met, since the entrepreneurs must set out their personal capabilities to manage and develop a new venture. It is harder for low-quality applicants to get this certificate than for good applicants. And third, the subsidy receipt must be observable and verifiable for outsiders. A subsidy award is usually provided by the new venture or the funding agency through public statements. Hence, the receipt of a subsidy is easily observable for venture capitalists and other outsiders.

In principle, public subsidies may serve a "bridging" function to facilitate external capital investments in early-stage technology firms (Toole and Turvey, 2009). This is consistent with venture capitalists responding to reduced risk, following subsidy receipts by NTBFs (Toole and Turvey, 2009). This is in line with Lerner's (1999) results, who examined the United States government SBIR program and found that awardees have better access to external equity. He argues that subsidies provide "certification" that NTBFs can use as leverage to further finance. Meuleman and DeMaeseneire (2012) can show from an examination of 1,107 Belgian new ventures that the receipt of regional R&D grants in Flanders positively affects access to external debt capital. Similarly, Hottenrott et al. (2015) find those positive effects of regional grants depend on industry characteristics. They find that a certification is strong for subsidized new ventures from information-opaque industries, i.e., NTBFs.

The results from these studies indicate that a subsidy receipt has a certification effect for the recipient NTBFs and facilitate access to external capital. However, what remains to be done in this field is a more detailed examination of different subsidy types and,

particularly, a comparison of their origin. This would help to shed light on the functionality of public subsidy support, as both policy makers and entrepreneurs must know how they can properly use certain subsidy instruments for improvements.

4.3.2 Differences between cross-national and national grants

Subsidies can differ in many dimensions, including the content and the subsidy origin, regarding differences of subsidy awarding authorities. However, comparisons of different subsidies are scarce in academic literature, particularly of those that distinguish between selectively awarded subsidies on cross-national and national level. As one of a few studies, Busom and Fernández-Ribas (2007) can differentiate between Spanish and EU subsides. Using a sample of Spanish manufacturing firms, they examine major factors of new ventures' participation in national and in European level subsidy programs. They find that firms' participation is driven by a bundle of factors. Czarnitzki and Lopes-Bento (2013) examine the direct effect of national and cross-national subsidies on the R&D activity and the performance of NTBFs, by using microdata from the Community Innovation Survey. They show cross-national subsidies have a stronger effect on the innovative activity, compared to national support instruments and are more beneficial, regarding future innovations. Differences could be caused by specific criteria according to whether the subsidy is granted by a national or supra-national government, i.e., the European Commission. For instance, administrative requirements might differ, forcing the recipients of subsidy programs to keep track of expenses, workplans, and timetables (Czarnitzki and Lopes-Bento, 2013). This might trigger administrative know-how, a crucial factor for the management of any successful project (Czarnitzki and Lopes-Bento, 2013). It appears that a differentiation between subsidy sources, namely cross-national and national subsidies, is a widely neglected field of research that might allow shedding new light on the functionality and the success of subsidy certification.

Even if I expect different certification levels for subsidies, regarding varying government levels with certain catchment areas, evidence from previous literature of how certification levels might take shape for cross-national and national subsides is not congruent (Hottenrott et al., 2016b). It might either be the case that the higher the government level and the greater the catchment area for awarded subsidies the stronger certification effect,

or vice versa (Hottenrott et al., 2016b). In the following, I will present reasons for both directions.

Proposition 1: On one hand, cross-national subsidies might have a stronger certification effect than national ones, indicating an increase of certification strength the higher the government level and the greater the subsidies catchment area is. Busom and Fernández-Ribas (2007) emphasize that subsidies awarded by different authorities could have different economic impacts and can even be complementary support instruments, if different government levels can coordinate effectively. Cross-national subsidies are usually justified by cross-border spillovers (Huergo and Moreno, 2014). EU subsides aim to develop innovative knowledge industries and foster economic growth throughout Europe, which means these subsidy types are targeted to NTBFs with high growth potentials crossing national frontiers. In line with that, national and sub-national/regional subsidies are primarily awarded to firms that exhibit potentials to foster national or regional (cluster) prosperity.

Another reason might be that more NTBFs are applying for cross-national subsidies compared to national ones, since the catchment area of the awarding authority is greater, fostering competition within the awarding procedure. However, competition affects not only the selectivity of the awarding procedure, but particularly, the ex-ante costs for the application process and the ex-post costs for coordination efforts (Czarnitzki and Lopes-Bento, 2014). Application costs are mainly related to administrative requirements that increase when the awarding procedure is characterized by high selectivity (Huergo and Moreno, 2014). Coordination costs, e.g., the organization of network partners, are often higher for cross-national subsidies (Huergo and Moreno, 2014). NTBFs' application and coordination costs are higher for subsidy programs with a greater catchment area, which can be interpreted as a major determinant for the quality of a certificate (Megginson and Weiss, 1991; Myers and Majluf, 1984; Spence, 1973). Cross-national subsidy instruments might stronger reduce information asymmetries between NTBFs and venture capitalists, as they contain value-added information about the quality of the awardee.

Proposition 2: On the other hand, cross-national subsidies might have a weaker certification effect than national ones, indicating a decrease of certification strength the greater the subsidies catchment area is. This is in line with the findings of Shane and Cable (2002), who draw attention to the role of social network ties when entrepreneurs

suffer from information asymmetry between themselves and outsiders. They find that social network ties can reduce information asymmetry due to social obligation and access to private information. Direct and indirect network ties enhance resource acquisition and allow individuals to obtain information about others with whom they have no direct relationship or direct contact, providing access to information they could not obtain alone (Burt, 1987; Shane and Cable, 2002). Now, the crucial point for my research context is that the major characteristic of entrepreneurial network ties is the relevance of the spatial dimension (Johannissson, 1998). From a historical and practical perspective, the entrepreneur is attached to a certain place, indicating the regional socio-economic texture is a major factor of entrepreneurial success (Johannissson, 1998). Spatial distance increases costs associated with engaging in the interaction to build or maintain social relationships (Zipf, 1949). Individuals' social network ties are strong on regional area level (Sorenson, 2003). This might also affect the effectiveness of government authorities' screening mechanisms, since authorities on (sub)national level could use strong local social ties within entrepreneurial networks to assess the quality of entrepreneurial ventures. Information asymmetries can be reduced to a greater extent and recognizable value-added information for venture capitalists can be created.

4.4   Data and methodology

4.4.1   KfW/ZEW Start-up panel

For this study, I use the KfW/ZEW Start-up panel, established in 2008 by the ZEW, KfW Bankengruppe, and Creditreform, to examine German new ventures. New 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 contains survey-based information on approximately 6,000 start-ups from the cohorts 2007 to 2011. The data set contains quantitative and qualitative relevant information about the founders and about the receipt of a subsidy grant. Firm specific data and information about the financial resources of the new venture are included. Our sample comprises 1,568 new ventures after identifying NTBFs and eliminating incomplete records.

External financial resources are imperative for NTBFs to create and maintain business operations and to establish a competitive advantage (Carter and Auken, 2006). Therefore, I add two dependent variables to shed light on the relationship between subsidy certification and venture capital access. The first dependent variable indicates whether a NTBF uses venture capital funding (*VC*), coded 1 and 0 otherwise. 9% of NTBFs in my sample use venture capital capital. My second dependent variable is the share of venture capital capital to total capital (*VCshare*). This variable is used to measure the relative importance of venture capital funding in a NTBF's financing mix. This overall share of venture capital funding in my sample is 4.5%, but among new firms with at least some venture capital capital, the average ratio of venture capital funding is 51% of the NTBFs' total capital in use, which emphasizes the importance of external equity as a financing source in Germany.

The main independent variable of interest is the receipt of a subsidy. I distinguish between, first, cross-national grants awarded by institutions of the European Union (*CrossNational*), second, national grants awarded by national government agencies (*National*) and, third, German sub-national grants (*SubNational*). These variables are coded 1 for subsidy receipt in a particular year and 0 otherwise. I focus on grant-based subsidies, which are the most frequently awarded subsidy type for German NTBFs in my data set. The assessment process is well documented, bound by strict quality standards, and easily accessible for outsiders. I exclude observations for other subsidy types, such as loans, guarantees, and equity programs to avoid reverse causality and distorting effects. An overview of all variables is given on Table 4.1.

Table 4.1 The variables of the econometric model

Variables	Description	Obs.	Mean	S.D.	Min	Max
VC	One for venture capital-backed NTBFs	1,568	0.09	0.28	0	1
VCshare	Share of VC funding compared to total capital in use	1,568	4.49	17.76	0	100
CrossNational	One for NTBFs' sub-nationa subsidy grant receipt	1,568	0.04	0.19	0	1
National	One for NTBFs' national subsidy grant receipt	1,568	0.04	0.19	0	1
SubNational	One for NTBFs' EU subsidy grant receipt	1,568	0.07	0.26	0	1
Uni	One for founders with a university degree	1,568	0.57	0.50	0	1
EntrepExp	One for founder with entrepreneurial experience	1,568	0.44	0.50	0	1
IndusExp	Founders' industry experience in years	1,568	3.49	1.28	1	6
Female	Number of women within the founding team	1,568	0.16	0.40	0	2
Team	Number of entrepeneurial team members	1,568	1.57	0.91	1	5
Rev	One for NTBFs with revenue	1,568	0.93	0.26	0	1
Profit	One for NTBFs with profit	1,568	0.52	0.50	0	1
Age	Age of the NTBF	1,568	2.63	1.20	1	5
NewState	One for NTBFs' location in a new Federal State	1,568	0.16	0.37	0	1

Source: KfW/ZEW Start-up panel.

I also add a wide set of control variables, as business professionals and researchers point to human capital as a key investment criterion for venture capitalists (Carter et al., 2003). Human capital derives not only from investments in formal education and working experience (Carter et al., 1997), but also influences knowledge, managerial abilities, problem-solving skills, and self-confidence. One of the most analyzed 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). Previous literature shows that education is a major factor for external capital access (Lins and Lutz, 2016). I include the dummy variable *Uni*, which takes 1 for at least one entrepreneur with a university degree and 0 otherwise. On average, 57% of the founders in my sample graduated from a university.

As early studies show the human capital of the entrepreneurs is a relevant decision making criterion for venture capitalists (MacMillan et al., 1986, Tyebjee and Bruno, 1984), I also control for the entrepreneurial experience of the business founder. Previous literature discusses entrepreneurial experience as a major factor of unique human capital, which increases the probability of receiving venture capital (Fried and Hisrich, 1988; Wright et al., 1997). Therefore, I add the variable *EntrepExp*, which takes the value 1 for a business founder with entrepreneurial experience, and 0 otherwise. 44% of all NTBF founders have started a new business.

I also control for the industry experience (*IndusExp*) of an entrepreneur, because previous studies have shown that relevant working experience might increase the probability of receiving external financing (Wright et al., 1997) and increase survival prospects of entrepreneurial firms. Therefore, I use the years of industry experience of a founder to control for this specific type of human capital. Additionally, I include the number of female founder as the variable *Female*, because previous studies have highlighted the presence of a gender gap in venture capital access (e.g., Lins and Lutz, 2016; Marlow and Patton, 2005).

Furthermore, NTBFs founded by entrepreneurial teams are more likely to survive and to obtain financial resources compared to new firms started by single entrepreneurs (Cooper and Bruno, 1977; Eisenhardt and Schoonhoven, 1990; Harper, 2008). I include the variable *Team*, which takes the number of entrepreneurial team members. On average, a team of a German NTBF consists of 1.6 team members.

I also include firm specific variables, i.e., dummy variables for revenues (*Rev*) and profitability (*Profit*) to control for successful market entry and the functionality of the business model, which implies a reduction of risk and uncertainty for investors (Verheul and Thurik, 2001). Furthermore, I include the age of the new venture (*Age*) to control for size, since it is known that venture capitalists invest in NTBFs that have not yet developed their full potential (Audretsch and Welfens, 2002).

Another crucial factor when considering regional factors for German NTBFs and access to financial source are the so-called "neue Länder", which are five federal states of the former German Democratic Republic. The German government tends to focus its developmental support on the economically underdeveloped new states, which can be illustrate by the Solidary Law and tax subsidies for the eastern prats of Germany (Czarnitzki and Fier, 2001; Manow and Seils, 2000). Therefore, I implement the dummy variable NewState which takes the value 1 when a new firm is situated in one of the German new states and 0 otherwise.

Lastly, I take into account the industry affiliation of new ventures as previous literature claims different strengths of certification for various industry sectors when attracting external financing (Hottenrott et al., 2015). I categorize new firms according to their type of business following Fryges et al. (2009) based on NACE (2008), and Muller and Zenker (2001) for service firms in order to identify NTBFs as new high-tech manufacturing firms and knowledge-based service firms.

4.4.2 Econometric framework

I use an econometric technique that allows us to study the effect of a NTBF's subsidy reception on the accessibility and the volume of venture capital funding. Given the non-random nature of subsidy awards to NTBFs, I implement a model that allows correcting for selection bias and endogeneity. I employ a matching procedure, as I need not assume any functional form or distributional assumptions on the outcome equation (Czarnitzki and Lopes-Bento, 2013). Other models seem less appropriate for my research context, such as the difference-in-difference method and IV regressions. The difference-in-difference estimator can only be used with observation before and after the subsidy treatment, which is not applicable on my data of cross-sections of several years. IV

estimation can be employed when valid instruments can be identified for the treatment variable and implemented in my data. The identification for my research context and the implementation in my sample turns out to be very challenging, which is why I employ a matching procedure.

Previous literature has discussed matching estimators (Angrist, 1998; Heckman et al., 1998; Lechner, 1999). Matching compares the outcomes of program participants with those of matched non-participants (Diaz and Handa, 2006). In my study, I can estimate the counterfactual situation of not being subsidized (a) from the sample of NTBFs with public subsidies (b) (Czarnitzki and Lopes-Bento, 2013). I create a sample of two comparable samples, based on a set of a-priori defined characteristics, i.e., my covariates. I follow the approach of Gerfin and Lechner (2002). In the first step, I estimate a probit model to obtain propensity scores. The dependent variables in my probit regressions indicate the probability of receiving cross-national, national, and sub-national subsidies. In the second step, I employ a threshold (caliper) to the maximum distance allowed between the treated and the control unit to avoid bias through "bad matches" (Czarnitzki and Lopes-Bento, 2014).

The matching estimator must fulfil the condition that the outcome is statistically independent of the treatment. Therefore, Rubin (1977) introduced the conditional independence assumption, which indicates the selection problem is overcome when, based on the a-priori defined characteristics, the samples in states (a) and (b) have been balanced. Remaining differences in the outcome between both samples can be traced back to the treatment variable. See Lechner (2001) or Czarnitzki and Lopes-Bento (2013) for a more detailed explanation of the matching procedure.

4.5   Results

Table 4.2 presents the probit regression, which I have to calculate to obtain the predicted probabilities of receiving cross-national, national, and sub-national grants, respectively. The results show the variables *Uni* and *Team* are the most important drivers for receiving subsidy support. This is in line with the results of previous studies, since human capital is a major factor for entrepreneurial survival and access to external resources (Cooper and Bruno, 1977; Eisenhardt and Schoonhoven, 1990; Harper, 2008). I find for national and

sub-national grants that NTBFs in the German "neue Länder" (see Section 4.4.1) are more likely to receive subsidy support. A reason for this result might be that the German government focuses its developmental support on the economically underdeveloped new states (Czarnitzki and Fier, 2001; Manow and Seils, 2000).

I calculate the correlation matrix in Table 4.3 for all variables of my econometric approach to check for multicollinearity issues. The approach relies on various variables to account for NTBFs' human capital, which could suffer from high correlations due to redundant information and are conclusively insignificant. However, the correlation matrix does not give evidence for any multicollinearity issues.

Table 4.2 Probit estimations on cross-national, national and sub-national grants

VARIABLES	Model (1) Cross-national	Model (2) National	Model (3) Sub-national
Uni	0.550***	0.544***	0.593***
	(0.150)	(0.150)	(0.127)
EntrepExp	-0.105	-0.002	-0.024
	(0.132)	(0.129)	(0.111)
IndusExp	-0.024	0.026	-0.006
	(0.050)	(0.050)	(0.042)
Female	-0.794***	-0.419**	-0.135
	(0.273)	(0.203)	(0.135)
Team	0.157**	0.109	0.180***
	(0.066)	(0.066)	(0.054)
Rev	0.0980	-0.144	0.112
	(0.238)	(0.221)	(0.188)
Profit	-0.082	-0.197	-0.306***
	(0.131)	(0.132)	(0.111)
Age	-0.035	0.135**	-0.061
	(0.053)	(0.054)	(0.045)
NewState	0.346**	0.244	0.890***
	(0.145)	(0.148)	(0.113)
Constant	-2.249***	-2.571***	-2.157***
	(0.319)	(0.326)	(0.260)
LR chi2(9)	44.68	39.61	125.53
	0.000	0.000	0.000
Log likelihood	-232.29	-234.83	-348.36
Observations	1,568	1,568	1,568

Table 4.2 presents the probit regression, which we have to conduct in order to obtain the predicted probabilities of receiving cross-national, national and sub-national grants respectively. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Table 4.4 exhibits the results of the matching procedure by propensity scores for NTBFs with cross-national subsidies and their counterfactual group. The covariates are well-balanced after the matching, as the means and the corresponding t-tests show. I find no significance in the mean differences of the exogenous variables. The only significant variables are the outcome variables, indicating the mean differences for *VC* and *VCshare*

can be assigned to the cross-national subsidy reception. NTBFs with cross-national subsidies cannot gain better access to venture capital, but receive more venture capital funding compared to their non-subsidized counterparts. This is in line with my expectations, since cross-national grants are mainly awarded to NTBFs that are more likely to generate cross-border spillovers and release enormous growth potentials (Huergo and Moreno, 2014).

Table 4.3 Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) *VC*	1.00													
(2) *VCshare*	0.82	1.00												
(3) *CrossNational*	0.16	0.16	1.00											
(4) *National*	0.13	0.15	0.15	1.00										
(5) *SubNational*	0.20	0.16	0.32	0.15	1.00									
(6) *Uni*	0.13	0.14	0.08	0.07	0.10	1.00								
(7) *EntrepExp*	0.03	0.03	0.02	0.04	0.05	0.14	1.00							
(8) *IndusExp*	-0.03	-0.05	-0.01	0.03	-0.01	0.00	0.09	1.00						
(9) *Female*	0.04	0.03	-0.02	-0.02	0.00	0.09	0.03	-0.01	1.00					
(10) *Team*	0.17	0.15	0.06	0.06	0.12	0.28	0.26	0.03	0.23	1.00				
(11) *Rev*	-0.06	-0.06	-0.01	-0.02	-0.02	-0.06	-0.07	0.08	-0.05	-0.11	1.00			
(12) *Profit*	-0.18	-0.16	-0.04	-0.07	-0.08	-0.06	-0.11	0.07	-0.03	-0.13	0.29	1.00		
(13) *Age*	0.03	0.05	-0.02	0.05	-0.03	-0.01	-0.03	0.13	-0.01	-0.06	0.19	0.19	1.00	
(14) *NewState*	0.00	0.00	0.07	0.03	0.16	0.03	-0.03	-0.03	0.04	0.02	-0.02	0.00	0.03	1.00

Source: KfW/ZEW Start-up panel.

Cross-national grants are more competitive and selective, due to the vast catchment area of supra-national authorities, i.e., the European Commission. Hence, I suggest that venture capitalists use the value-added information as quality certificates provided by cross-national subsidies to decrease information asymmetry and to assess NTBFs.

Table 4.4 Matching results for cross-national subsidies

VARIABLES	Selected control group N = 60		NTBFs with cross-national subsidies N = 60		p-value on the t-test on mean difference
	Mean	S.D.	Mean	S.D.	
Covariates					
Uni	0.814	0.042	0.837	0.040	0.345
EntrepExp	0.419	0.054	0.465	0.054	0.271
IndusExp	3.407	0.139	3.477	0.145	0.364
Female	0.081	0.030	0.081	0.030	0.500
Team	1.872	0.109	1.860	0.105	0.531
Rev	0.942	0.025	0.930	0.028	0.379
Profit	0.581	0.054	0.547	0.054	0.323
Age	2.558	0.126	2.639	0.126	0.324
NewState	0.349	0.052	0.326	0.051	0.626
Outcomes					
VC	0.063	0.043	0.317	0.061	0.001
VCshare	2.187	1.664	18.417	4.345	0.000

Table 4.4 exhibits the results of the matching procedure by propensity scores for NTBFs with cross-national subsidies and their counterfactual group. I use the estimates of the probit regression in Table 4.2 to obtain the propensity scores. For this matching procedure, a threshold (caliper) to the maximum distance allowed between the treated (subsidized) and the control unit (non-subsidized) has been employed, in order to avoid bias through bad matches.

When considering the matching procedure for NTBFs with national subsidies and their non-subsidized counterparts on Table 4.5, I see that all my covariates are well-balanced.

I find no significant mean differences, not even for my outcome variables. This indicates the reception of national subsidies does not influence the probability of venture capital access nor the volume of venture capital funding that a NTBF can use. While I expected a weaker or stronger certification effect compared to cross-national subsidy grants, my results exhibit no value-added information provided by national grants for venture capitalists. A possible explanation might be that, for my econometric model, I have to assume to include all important determinants driving selection into national grant reception. Now it might be the case, there is a relevant determinant missing, which biases the results in the matching procedure.

Table 4.5 presents the results of the matching procedure by propensity scores for NTBFs with sub-national subsidies and their counterfactual group. The outcome variables show significant mean differences after matching. I suggest these significant results can be attributed to the reception of sub-national grants, which enable the recipients, first, to gain better access to venture capital and, second, to receive relatively more venture capital funding. This is in line with my expectations, as network ties are strong on regional area level (Sorenson, 2003), and local government agencies can use these ties for appropriately assessing NTBFs. Hence, I suggest that venture capitalists use the value-added information as quality certificates provided by sub-national grants to decrease information asymmetry between them and NTBFs.

Table 4.5 Matching results for national subsidies

VARIABLES	Selected control group N = 60		NTBFs with national subsidies N = 60		p-value on the t-test on mean difference
	Mean	S.D.	Mean	S.D.	
Covariates					
Uni	0.827	0.038	0.796	0.041	0.293
EntrepExp	0.582	0.050	0.541	0.051	0.284
IndusExp	3.795	0.134	3.826	0.128	0.435
Female	0.092	0.029	0.102	0.031	0.405
Team	1.949	0.109	1.878	0.093	0.691
Rev	0.939	0.024	0.929	0.026	0.612
Profit	0.469	0.051	0.469	0.051	0.500
Age	3.112	0.112	3.204	0.113	0.283
NewState	0.173	0.038	0.224	0.042	0.187
Outcomes					
VC	0.205	0.066	0.267	0.058	0.241
VCshare	12.205	4.698	17.633	4.348	0.199

Table 4.5 exhibits the results of the matching procedure by propensity scores for NTBFs with national subsidies and their counterfactual group. I use the estimates of the probit regression in Table 4.2 to obtain the propensity scores. For this matching procedure, a threshold (caliper) to the maximum distance allowed between the treated (subsidized) and the control unit (non-subsidized) has been employed, in order to avoid bias through bad matches.

Table 4.6 Matching results for sub-national subsidies

VARIABLES	Selected control group N = 114		NTBFs with national sub-subsidies N = 114		p-value on the t-test on mean difference
	Mean	S.D.	Mean	S.D.	
Covariates					
Uni	0.833	0.028	0.816	0.029	0.337
EntrepExp	0.529	0.038	0.529	0.038	0.500
IndusExp	3.569	0.100	3.552	0.096	0.550
Female	0.132	0.027	0.155	0.028	0.276
Team	1.971	0.080	2.006	0.077	0.378
Rev	0.937	0.019	0.931	0.019	0.585
Profit	0.460	0.038	0.494	0.038	0.261
Age	2.598	0.095	2.603	0.091	0.483
NewState	0.420	0.038	0.443	0.038	0.333
Outcomes					
VC	0.056	0.027	0.287	0.042	0.000
VCshare	1.667	1.395	14.461	2.690	0.000

Table 4.6 exhibits the results of the matching procedure by propensity scores for NTBFs with sub-national subsidies and their counterfactual group. I use the estimates of the probit regression in Table 4.2 to obtain the propensity scores. For this matching procedure, a threshold (caliper) to the maximum distance allowed between the treated (subsidized) and the control unit (non-subsidized) has been employed, in order to avoid bias through bad matches.

When comparing the significant results between cross-national and sub-national grants, I can show that cross-national grants have a stronger certification effect than sub-national ones. Cross-nationally subsidized NTBFs exhibit, on average, a 25%-higher probability of gaining access to venture capital, while sub-nationally subsidized NTBFs exhibit only a 23%-higher probability. Cross-nationally subsidized NTBFs show not only a higher probability of venture capital access, but can also receive more venture capital funding (16% vs. 13% of venture capital share compared to total capital in use). However, I cannot verify this difference is statistically significant, but I suggest that the probability gaps are large enough to assume that cross-national subsidies serve as stronger quality certificates and provide more value-added information.

4.6   Conclusion

NTBFs have received considerable attention from researchers and policy makers, because selectively awarded subsidies provide not only direct cash resources to awardees, but also serve indirectly as quality certificates. Thereby, subsidies can reduce information asymmetry between awardees and financiers (Colombo et al., 2013a). However, there is no evidence of how subsidies, awarded from different government levels, serve and vary as quality certificates for venture capital funding. In this study, I examine the role of cross-

national, national, and sub-national grants, and their quality certification effect for NTBFs, regarding venture capital access and venture capital funding volumes.

I use the KfW/ZEW Start-up panel, which constitutes a representative sample of subsidized NTBFs and detailed information about the origin and type of awarded subsidies. By controlling for the endogenous nature of subsidy support, the results illustrate that cross-national subsidies have the strongest certification effect in reducing information asymmetries between subsidized NTBFs and venture capitalists. Two possible reasons for this finding might be that cross-national grants are mainly awarded to NTBFs with expected cross-border spillovers, and the awarding procedure is highly competitive due to the vast catchment area of potential subsidy awardees. Surprisingly, I find no significant effect for national grants on venture capital funding. However, I can show that sub-national grants, awarded by regional government agencies have a positive effect on both venture capital funding probability and venture capital funding volumes. This is in line with my expectations, as network ties are strong on regional level, and local government agencies can use these ties for appropriately assessing NTBFs. As a result, sub-national grants possess value added information for outsiders and can particularly decrease uncertainty between NTBFs and venture capitalists to the benefit of the new venture and the venture capitalists' funding decision.

I extend to previous literature on subsidy certification and subsidy financing by revealing that subsidies from cross-national authorities convey value-added information, particularly when spillover effects and competition are supposed to be high. I can also show that spatial proximity can positively affect the subsidies' certification function, as network ties on a regional level are high and that can be used by local government authorities to assess NTBFs. I contribute to previous literature on entrepreneurial finance literature, since venture capital is a major source of financing for new firms, but received rather little attention in this research context. Hence, my study contributes new insights on NTBFs' access to venture capital funding, by revealing that venture capitalists, particularly, use cross-national and sub-national grants by providing them with positive value-added information about the NTBF.

I encourage further research on the comparison of different subsidy types and using appropriate control groups. It might be interesting to take into account NTBFs that applied for certain subsidy instruments, but have been rejected within the application procedure.

This approach would help to shed more light on subsidies' certification. My study suffers from one econometrical limitation, as the matching procedure only controls for the selection on observables, so I have to assume observing all important factors for subsidy reception. I recommend future research to employ the IV approach and conduct further robustness checks.

5 Bridging the gender funding gap: Do female entrepreneurs have equal access to venture capital?

5.1 Introduction

New ventures must overcome the obstacle of gaining access to financial resources to start their business and fund business operations. Previous studies point 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), and less external equity financing, such as private equity or venture capital (Verheul and Thurik, 2001). We add to the current literature by empirically examining gender differences in accessing venture capital funding with regard to human capital and firm characteristics. By applying socialization theory and the discrimination hypothesis, we examine gendered effects of entrepreneurs' educational background and the innovativeness of new ventures, thereby controlling for structural differences.

In recent years, the role of gender in the finance industry received a lot of attention in the press and public discussions. In 2012, a gender discrimination claim against Kleiner Perkins Caufield & Byers turned the spotlight on the venture capital industry. Ellen Pao, a former employee of Kleiner Perkins Caufield & Byers filed a gender discrimination suit and, in March 2015, the jury found in favour of the venture capital firm on all counts (Bloomberg, 2015). Other recent examples of women who voiced their concern about discrimination against women by venture capital firms include the cases of Kathryn Trucker, founder of RedRover, and Rachel Sklar, founder of Change the Ratio. Both founders reflect on their experience with venture capitalists who allegedly stated that they are reluctant to invest into female founded start-ups (Wired, 2014). These cases emphasize the practical relevance and timeliness of our research topic.

Previous studies show indeed that female entrepreneurs are relatively disadvantaged in accessing external equity capital. Amatucci and Sohl (2004) show that female entrepreneurs have less access to informal venture capital, based on in-depth interviews with business founders. Further, (Greene et al., 2001) find gendered patterns of venture capital investments in longitudinal US venture capitalist data. We build on the work of Carter et al. (2003), who find that higher levels of human capital increase the likelihood of external equity funding among female entrepreneurs. We extend this study by examining gender differences across investment criteria of entrepreneurial characteristics

and firm innovativeness (MacMillan et al., 1986). Our analysis of the gender gap in venture capitalists' investment criteria helps us shed light on the particular disadvantages of female founders.

We use the KfW/ZEW Start-up panel, which comprises information about legally independent German firms one to five years old. By comparing new female- and male-founded ventures while controlling for various factors that could affect venture capital funding, we search for gendered differences in the volume of venture capital in use. We find a significantly lower amount of venture capital funding for female entrepreneurs once we control for individual and firm characteristics. We find that the gender gap is greater among new ventures with high R&D activity. Surprisingly, we further find that the gender gap is particularly high for entrepreneurs with a university degree. These results highlight the multiple interdependencies of gendered effects and shed light on reasons for the gap in accessing venture capital funds. Our interpretation of the results is based on socialization theory and the discrimination hypothesis (Fischer et al., 1993; Rosario et al., 1988). Both approaches are appropriate for explaining gender differences in entrepreneurship and entrepreneurial finance theory.

This study extends the current literature in two main ways. First, we analyse the relations between gender, education, and innovativeness in detail to contribute to the literature on gender in entrepreneurship. Second, we extend the literature on entrepreneurial finance and venture capital in particular by taking into account the effect of human capital and innovativeness on equity funding decisions.

This study proceeds as follows: The next section presents the theoretical background on venture capital and female entrepreneurship. Section 5.3 develops the research hypotheses. Section 5.4 presents the data, relevant descriptive statistics, and the analytic approach. Section 5.5 interprets our empirical results. Finally, Section 5.6 discusses the results and draws conclusions regarding gender-specific access to venture capital.

5.2   Background literature

5.2.1   Role of venture capital in new ventures

Venture capitalists play an important role in new venture financing, since the high levels of uncertainty and adverse selection and moral hazard problems involved in financing young companies restrict access to other, traditional forms of finance. Banks are seldom able to obtain enough collateral on debt from new ventures, because young firms usually have fewer tangible assets and banks perceive great uncertainties in the functionality of these firms' business models and managerial acumen (Sapienza and Gupta, 1994). Venture capital can fill this gap and provide financing in a venture's critical, early development stages, corresponding to significant developments in the life of the new venture (Baldock and Mason, 2015). Based on the concept of staged financing, the venture capitalist can periodically revalue an investment and abandon it if the expected net present value becomes negative (Barry et al., 1990). This concept resolves agency conflicts between the venture capital firm and new ventures, because the new firm's founders have a stronger incentive to make their business successful, compared to a situation where all the capital needed is provided at once. The new venture becomes less risky over time and the venture capital firm accepts a proportionately smaller equity stake for a given investment volume at each subsequent stage (Barry et al., 1990).

The provision of external equity capital by both informal and formal venture capitalists have additional advantages compared with debt providers (Ramadani, 2014). These investors have not only developed conceptual abilities to deal with adverse selection and moral hazard problems, but have also gained extensive experience evaluating uncertain business models (Gompers and Lerner, 2001). Several studies examine the criteria used by venture capital firms to assess new ventures (MacMillan et al., 1986; Zacharakis and Meyer, 1998). They identify five general criteria: the entrepreneur's personality and experience, the business characteristics of the product or service, the characteristics of the market, and financial considerations (MacMillan et al., 1986). We focus on the entrepreneur's characteristics, or, to be more precise, the founder's gender and educational background, as well as on business characteristics with respect to the innovativeness of business operations.

In the research context of entrepreneurial finance, gender differences appear to limit the accrual of social, cultural, human, and financial capital, which limits women's abilities to

engage the interest of venture capitalists (Marlow and Patton, 2005). Since scant empirical evidence exists on this gendered effect on venture capital access and interactions with other factors relevant to external equity providers, we examine the interplay of gender, the entrepreneur's education, and the innovativeness of business operations.

5.2.2 The role of female entrepreneurs

In Germany, a gender gap prevails between the shares of women and men classified as entrepreneurs: In 1991, only 26% of entrepreneurs were female (Lauxen-Ulbrich and Leicht, 2005) and, even though this share has increased in recent years, it remains low, at 30%, in 2012, according to the German Federal Ministry of Economics and Technology (BMWi, 2012). Prior studies investigating gender-based differences in financing have focused on two related topics. First, researchers have focused on the relation between entrepreneurs' gender and access to finance in regards to financing volume and perceived attitudes of bank lending officers toward female entrepreneurs (Fay and Williams, 1993). Second, previous studies have examined whether gender-based differences stem from discrimination by financial debt providers or from structural dissimilarities between new male-and female-founded ventures (Buttner and Rosen, 1989; Fabowale et al., 1994). Even though more recent studies examine gendered access to equity capital (Amatucci and Sohl, 2004; Carter et al., 2003; Greene et al., 2001), little is known of how social and institutional norms as well as personal characteristics influence women's ability to acquire venture capital (Carter et al., 2003).

The gender differences could be explained through two theoretical approaches: Socialization theory and the discrimination hypothesis. Socialization theory states that a person maintains a set of ideas constructed in and by society (Orser et al., 2006). These patterns help individuals position themselves within a social construct (Crowley and Himmelweit, 1992). This theory is based on the fact that socialization is a learning process that begins in childhood and lasts throughout adulthood. However, we assume that women are socialized differently from men, since they develop a gender-specific perception of social norms and a different perception of entrepreneurial opportunities (Marlow and Patton, 2005). Structural dissimilarities, such as smaller numbers of female entrepreneurs, could enforce the gendered perceptions.

The discrimination hypothesis, on the other hand, suggests that women's and men's socialization discourages women in particular from developing their full capabilities. In the context of female entrepreneurship, studies show that women entrepreneurs face language, social, regional and cultural barriers, e.g., in transition economies of South-Eastern Europe, and lack of acceptance in parts of the economy that are relevant to starting a business (Hisrich and Brush, 1983; Orser et al., 1999; Ramadani et al., 2013; Ramadani et al., 2015). Further, a similar aspect that potentially discourages women of seeking external equity might be due to systematically different firm characteristics of female founded businesses compared to male started ones (Cosh et al., 2009; Ramadani, 2015). Stereotypes could also affect the socialization process to different extents for the two genders, due to negative gender stereotypes in the social environments of female business owners (Baron et al., 2001; Brush, 2002). Male and female business professionals might act in response to the stereotypes with which they have become familiar and intentionally disadvantage female entrepreneurs.

5.3   Hypothesis development

5.3.1   Gender differences and access to venture capital

The extent to which venture capital funding differs for female entrepreneurs compared to their male counterparts is difficult to examine due to a lack of data on this subject, particularly for new ventures at the very beginning of the life cycle. However, a gender gap appears to apply to the search for venture capital. Greene et al. (2003) show that, in 1998, female business owners received only 4% of all venture capital investments. Further, Carter et al. (2003) find that, among 235 new female-founded ventures, only 17% of female entrepreneurs gained access to external equity funds. Verheul and Thurik (2001) find similar results for Dutch female entrepreneurs.

These gender differences in venture capital access could be explained by socialization theory and the discrimination hypothesis. The first theoretical approach could serve to explain gender differences, since women perceive starting their own business as less desirable than men perceive such ventures, due to how they were shaped by society's prejudices and stereotypes. For instance, women are unlikely to fit the entrepreneurial roles for which men have been socialized, even if barriers in the entrepreneurial

environment are removed (Crowley and Himmelweit, 1992). In line with that, women tend to have a higher risk aversion compared to males, which might be disadvantageous in fast paced entrepreneurial environments (Cumming et al., 2014b). The implications of these findings provide further reasons to believe that female entrepreneurs may be less likely than their male counterparts to generally seek business growth and, in particular, may be less likely to seek external equity.

The discrimination hypothesis, on the other hand, suggests that women are less likely to be welcome in certain professions, even if they have equal abilities and qualifications (Orser et al., 2006). Gender discrimination can be observed in various situations, including lower approval rates in terms of financing and lower volumes of approved external equity. Research concludes that female entrepreneurs might be discouraged from applying for external equity capital (Orser et al., 2006). This conclusion leads to two alternative explanatory approaches to the indications that women receive a lower share of capital compared to their male counterparts (Verheul and Thurik, 2001). First, women could be facing discrimination as victims of deliberate attempts to disadvantage them. Second, women could be more likely to fear being turned down when trying to access external equity, which could stem from perceived social norms, stereotypes, and a lack of female role models (Stewart et al., 1999).

According to Fischer et al. (1993), it is necessary to examine access to external equity by both male and female entrepreneurs and to take into account systematic factors such as industry affiliation and firm size. Further, it is necessary to consider the specific characteristics of the founders' personal background. Gender differences due to discrimination could persist if female entrepreneurs obtain a significantly lower share of external equity access compared to male entrepreneurs, given founder- and firm-specific factors. We hypothesize the following.

H1: Female entrepreneurs receive less venture capital compared to male entrepreneurs.

5.3.2 Founders' education and access to venture capital

Business professionals and researchers point to human capital as a key investment criterion for venture capitalists (Carter et al., 2003). Human capital not only derives from

investments in formal education, working experience, and further training (Carter et al., 1997), but also influences knowledge, managerial abilities, problem-solving skills, motivation, and self-confidence. Further, the more specific human capital is to the type of business model, the greater the probability of success of a new venture (Cooper et al., 1994). Early studies, based on surveys or interviews with venture capitalists, indeed show that the human capital of the entrepreneurs is a relevant decision making criterion for venture capitalists (MacMillan et al., 1986; Tyebjee and Bruno, 1984).

One of the most analyzed entrepreneurial variables for human capital is the entrepreneur's education. This variable can be seen as a proxy for underlying factors that could directly influence how a new venture is organized and managed (Cooper et al., 1994). The founder's education extends to judgement, insight, creativity, vision, and intelligence and the success and performance of the new venture. Engel and Keilbach (2007), using the data of mostly privately held young German companies, show that the education of the entrepreneurs has a positive effect on the probability of gaining access to venture capital. These findings are in line with the results of Kaplan and Strömberg (2004), who analyze 11 venture capitalists and their investments in 67 companies. A main criterion for a positive investment decision is the quality and ability of the management team.

Since we want to better understand the relation between gender and venture capital access, consideration of the entrepreneurs' higher education from a gendered perspective is necessary. We find no evidence of a gender gap among German university students in terms of absolute numbers, since the ratio of enrolled female to male students remained almost constant between 2000 (48/52) and 2012 (49/51), according to the German Federal Ministry of Education and Research (BMBF, 2014). More interestingly, the data suggest that the gender ratio of German graduates in 2012 was 51/49 for female students. Thus, no severe structural gender differences are observed for university students.

Venture capitalists seek high-growth business projects, which are more likely to be established by higher-educated entrepreneurs, since education is directly linked to a new venture's success and performance. With a higher education, such as a university degree, the entrepreneur is certified by the university as a third party. This degree serves as a signal for reduced information asymmetries between the investor and investee regarding the investee's abilities. Female entrepreneurs with a university degree should therefore suffer from fewer disadvantages than those without such a degree. They were as

socialized in the competitive environment of higher education as their male colleagues, which should also have prepared them to compete in obtaining external finance.

In addition, the third party signal should reduce discrimination by investors, since it serves as an objectified certificate of qualification. There is increasing evidence that female students are outperforming their male counterparts in terms of performance and productivity. For instance, Strahan (2003) shows that female undergraduate students' grade point averages are higher than those of their male peers after the first year of study. The literature also shows that female students appear to exhibit a more motivated personality structure (Vallerand and Bissonnette, 1992). Therefore, a university degree from a female could be a particularly strong signal of the above-mentioned abilities.

Therefore, we suggest that the gender funding gap between female and male entrepreneurs for external equity financing is less pronounced in the case of highly educated founders. We hypothesize the following.

H2: Higher education positively moderates the relation between female gender and receiving venture capital: This relationship becomes more positive if the female entrepreneur has a university degree.

5.3.3 Firm innovativeness and access to venture capital

External equity provided by venture capitalists has become the form of financial intermediation most closely associated with dynamic and innovative entrepreneurial new ventures, particularly in the high-tech sector, such as biotechnology and information technology (Bottazzi and Da Rin, 2002). An appropriate proxy for innovative businesses is therefore their R&D activity. R&D is considered the major criterion for innovation and growth (Audretsch and Feldman, 1996). Similarly, venture capitalists invest in R&D-active new ventures to spur innovation and release growth potential. Sahaym et al. (2010) find that R&D investments have a strong influence on the use of corporate venture capital in industries that are rapidly growing and technologically changing. Gompers and Lerner (1999) examine the fundraising of venture capital firms between 1972 and 1994 and show that R&D expenditure is positively related to venture investments.

Since we are particularly interested in gaining a more complete understanding of the relation between gender and venture capital access, consideration of the new ventures' innovativeness from a gendered perspective is appropriate. First, since we have highlighted the importance of R&D activity for venture capitalists, we suggest that new ventures with low R&D activity do not obtain as much venture capital funding as those with high R&D activity. Further, R&D activity indicates strong growth opportunities for venture capital firms, which is why equity investors are reluctant to invest in either female and male founders of new ventures with low R&D activity. Thus, the gender gap is small for new ventures with low R&D activity.

Second, Gottschalk and Niefert (2013) find that female entrepreneurs are underrepresented in new technology-based firms and exhibit less R&D activity. Similarly, Cosh et al. (2009) find systematic differences, e.g., in R&D, across firms started by males and females, which affects the seeking of external capital. Hence, we observe structural gender differences with respect to R&D and conclude that female-founded new ventures with high R&D activity have less access to venture capital funding compared to their male-founded counterparts, since we know that women have less access to venture capital than men do.

The observation that female entrepreneurs have less access to venture capital funding with respect to R&D activity can be illustrated by two combined explanatory approaches: Structural gender differences in R&D and the discrimination hypothesis. Arguing from the discrimination hypothesis perspective, such a gender gap could lead to the discrimination of women by venture capitalists, due to stereotypization and/or underrepresentation. Female entrepreneurs are rarely found in new technology-based firms, which is why venture capitalists might cling to their beliefs that women cannot bring to fruition the innovative potential of a new venture as well as their male counterparts. Further, in terms of socialization theory, the entrepreneurs' social perceptions might also increase the fear of being turned down when trying to access external equity. Women working in the information technology industry seem to be less concerned with challenges and entrepreneurship and perceive more problems keeping up with new technology (Korunka et al., 2006). We hypothesize the following.

H3: Higher R&D activity positively moderates the relation between female gender and receiving venture capital: This relation becomes more negative as R&D activity increases.

5.4   Data and method

The data used in this paper are from the KfW/ZEW Start-up panel on newly founded firms in Germany. This data set was established in 2008 by the ZEW, KfW Banking Group, and Creditreform to analyze the financing, economic activity, and ownership development of start-ups in Germany. We use data from the first three initial waves – 2008, 2009, and 2010 – of the panel data set. The initial data set used for the following analysis comprises information on 6,374, 6,645, and 6,191 new ventures in 2008, 2009, and 2010, respectively. For a detailed description of the data set, see Fryges et al. (2009).

Variables: Our dependent variable indicates the share of external equity to total capital (*ShareVentureCapital*) to measure the relative importance of venture capital in a firm's financing mix. This variable comprises both governmental and independent venture capital investments. Since no other information about external equity is included in our database, we are not able to control for venture capitalists' characteristics. We believe that this might be a promising opportunity for further research, particularly the distinction according to fund size, fund type and contractual variables (Cumming et al., 2014a, Cumming and Johan, 2013).

The first independent variable of interest (*Female*) indicates whether a new venture was founded by a female or a team of female entrepreneurs in a particular year. This variable is coded as one for a female or a team of female entrepreneurs and zero otherwise. We follow the approach of Johnsen and McMahon (2005) to identify female entrepreneurs. We separate mixed-gender founder teams when conducting our empirical analysis because this approach will lead to more robust findings regarding gender differences. Therefore, a new venture is founded by a female entrepreneur if there is at least one female founder and no male founder. When applying this definition, we find that 9.42% of the new ventures in our sample are founded by female entrepreneurs (Table 5.1).

Our second explanatory variable indicates whether an entrepreneur graduated from university, since we know that education can be a proxy for underlying factors that may directly influence how an entrepreneur organizes and manages a new venture (Cooper et al., 1994). The variable takes the value of one if the entrepreneur has a university degree and zero otherwise (*Unidegree*).

Table 5.1 New ventures by the gender of the founders

	Obs.	Share
Single female founder	297	8.74%
Single male founder	2,068	60.54%
Team of female founders only	23	0.68%
Team of male founders only	749	21.95%
Team of mixed male and female founders	261	7.68%
Total	3,398	100.00%

Source: KfW/ZEW Start-up panel.

The third explanatory variable of interest indicates how many people work in R&D (*R&Dactivity*). We believe that this variable is an appropriate proxy for the efforts a new venture expends into innovative product and process development (Gompers and Lerner, 1999).

The entrepreneurs' characteristics are important criteria for venture capitalists. Therefore, we control for the founders' motives and their experience. First, we include two dummy variables, indicating whether an entrepreneur was driven by necessity (*MotivNecess*), that is, the entrepreneur was formerly unemployed (Ritsilä and Tervo, 2002), and whether the entrepreneur identified a market gap or developed a new product (*MotivOpport*), thus offering high growth potential (Praag and Ophem, 1995). Second, we control for the founder's entrepreneurial experience (*EntrpExper*) and industry experience (*IndExp*), since both could increase the probability of receiving venture capital (Fried and Hisrich, 1988).

We include the age of the new venture (*Age*) to control for size, since we know that venture capitalists invest in young and small companies that have not yet developed their full potential (Audretsch and Welfens, 2002). Since a new venture's growth prospects are a major criterion for venture capitalists' investment decisions, we control for industry affiliation and investment volume. Therefore, we employ a variable that indicates whether a new venture is from the high-tech manufacturing industry (*Hightech*) or a young non-knowledge-based service (*nkbServices*), which has fewer chances of extensive growth (Greene et al., 2001). Further, we include the natural logarithm of the investment volume (*lnInv*) of the new venture, since it might indicate the feasibility of bringing forth its growth potential (Audretsch and Welfens, 2002).

Table 5.2 Variables of the econometric models

Variable	Description	Mean	S.D.	Min	Max
Dependent variable					
ShareVentureCapital	Share of venture capital to total capital in use	2.67	13.60	0	100
Explanatory variables					
Female	Founder is female or there is at least one female founder and no male founders	0.10	0.30	0	1
Unidegree	Single founder has graduated / at least one graduate in the team of founders	0.41	0.49	0	1
R&Dpers	Number of R&D personnel	0.42	1.22	0	14
MotivOpport	Business idea or identification of market gap	0.37	0.48	0	1
MotivNecess	Driven by necessity	0.15	0.36	0	1
IndustExper	Single founder/at least one in the team of founders has relevant industry experience	3.37	1.35	1	16
EntrpExper	Single founder/at least one in the team of founders has entrepreneurial experience	0.37	0.48	0	1
Age	Age of new venture	2.33	1.27	1	5
Hightech	New venture in high-tech industry	0.17	0.38	0	1
nkbServices	Non–knowledge-based new service venture	0.22	0.42	0	1
lnInv	Logarithm of the new ventures' investment volume	8.26	3.91	0	15.52
lnRev	Logarithm of the new ventures' revenue	10.65	3.45	0	16.81

Source: KfW/ZEW Start-up panel.

Lastly, we include the natural logarithm of revenues (*lnRevenues*) to control for successful market entry and the functionality of the business model, which implies a reduction of risk and uncertainty for investors (Verheul and Thurik, 2001). Table 5.2 provides an overview of the variables.

Methodology: We consider two complementary analytic approaches. First, we use descriptive statistics to compare male and female entrepreneurs regarding venture capital access in particular. Second, we employ a pooled OLS regression model with interaction effects to examine the gendered impact of education and R&D activity, respectively, on venture capital access. Therefore, we employ gender specificity as our main explanatory variable of interest. In the regression models, errors are clustered by new venture identification numbers and the error term takes into account that multiple observations of the new venture are not independent from each other. Hence, we are able to calculate models with robust errors.

5.5 Results

The descriptive statistics in Table 5.3 show that the gender of German entrepreneurs has an impact on the share of venture capital. Female entrepreneurs use a lower share of venture capital compared to total capital. The results of the entrepreneur-specific variables for men and women show that slightly fewer female entrepreneurs have a university degree. Further, women are more likely to create a business out of necessity, whereas male entrepreneurs more often identify market gaps or tend to develop innovative ideas. We also find that male entrepreneurs have more years of industry and entrepreneurial experience, which could also positively affect venture capitalists when making their investment decisions and hence needs to be controlled for in our analysis.

Table 5.3 Comparison of female and male founders and their firms

Variable	Obs.	Mean (S.D.)	Obs.	Mean (S.D.)
		Men		Women
Dependent variable				
ShareVentureCapital	2,817	2.933***	320	0.372***
		(14.223)		(5.173)
Explanatory variables				
Unidegree	2,817	0.425***	320	0.313***
		(0.494)		(0.464)
R&Dpers	2,817	0.451***	320	0.144***
		(1.274)		(0.569)
MotivNecess	2,817	0.137***	320	0.250***
		(0.344)		(0.434)
MotivOpport	2,817	0.386***	320	0.281***
		(0.487)		(0.450)
EntrExper	2,817	0.388***	320	0.244***
		(0.487)		(0.430)
IndustExper	2,817	3.417***	320	2.938***
		(1.338)		(1.372)
Age	2,817	2.318**	320	2.444**
		(1.268)		(1.273)
Hightech	2,817	0.181***	320	0.066***
		(0.385)		(0.248)
nkbServices	2,817	0.193***	320	0.472***
		(0.395)		(0.500)
lnInvest	2,817	8.384***	320	7.141***
		(3.846)		(4.305)
lnRev	2,817	10.716***	320	10.114***
		(3.455)		(0.186)

This table shows the descriptive statistics for the regression sample. Results for the business foundations of men and of women, drawn from one-sided t-tests: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

When comparing the business-specific variables between female and male founders, we find that female entrepreneurs are more likely to create new service ventures, with low innovation and low growth potential, whereas male entrepreneurs are more likely to

create new high-tech ventures. Further, male founders exhibit more R&D and investment activity and have more revenues. These results are in line with our expectations.

Table 5.4 OLS regression analysis with interaction effects

VARIABLES	(1) Share Venture Capital	(2) Share Venture Capital	(3) Share Venture Capital	(4) Share Venture Capital	(5) Share Venture Capital	(6) Share Venture Capital
Founder-specific variables						
MotivNecess	-0.994**	-0.885*	-0.714	-0.603	-0.758*	-0.679
	(0.464)	(0.462)	(0.451)	(0.449)	(0.439)	(0.436)
MotivOpport	1.717***	1.685***	1.454**	1.394**	0.392	0.374
	(0.619)	(0.618)	(0.619)	(0.618)	(0.586)	(0.585)
EntrExper	1.792***	1.735***	1.361**	1.295**	0.513	0.487
	(0.598)	(0.597)	(0.602)	(0.602)	(0.567)	(0.566)
IndustExper	-0.451**	-0.481**	-0.410**	-0.429**	-0.480***	-0.512***
	(0.191)	(0.193)	(0.188)	(0.190)	(0.182)	(0.184)
Firm-specific variables						
Age	0.765***	0.773***	0.741***	0.752***	0.507**	0.501**
	(0.263)	(0.263)	(0.260)	(0.261)	(0.226)	(0.225)
Hightech	1.842*	1.788*	1.695*	1.610	0.144	0.161
	(1.006)	(1.005)	(0.989)	(0.985)	(0.909)	(0.910)
nkbServices	-1.630***	-1.406***	-1.258***	-1.079**	-0.660	-0.546
	(0.455)	(0.455)	(0.441)	(0.443)	(0.428)	(0.431)
lnInvest	0.084	0.076	0.073	0.068	-0.046	-0.047
	(0.087)	(0.087)	(0.086)	(0.087)	(0.079)	(0.079)
lnRev	-0.186	-0.194	-0.180	-0.186	-0.078	-0.088
	(0.126)	(0.126)	(0.125)	(0.125)	(0.113)	(0.113)
Gender effects						
Female		-1.787***		-0.957***		-0.967***
		(0.450)		(0.342)		(0.352)
Unidegree			2.804***	2.997***		
			(0.559)	(0.611)		
Female x *Unidegree*				-2.271**		
				(1.100)		
R&Dpers					3.799***	3.854***
					(0.572)	(0.583)
Female x *R&Dpers*						-3.294***
						(0.963)
Constant	2.575**	2.970**	1.526	1.771	2.623**	2.953**
	(1.311)	(1.352)	(1.273)	(1.310)	(1.248)	(1.283)
Observations	3,137	3,137	3,137	3,137	3,137	3,137
F-statistic	5.27	5.80	5.33	6.73	6.97	8.17
R-squared	0.026	0.027	0.036	0.037	0.130	0.133

This table presents the results of the pooled OLS regression models to examine gendered access to venture capital funding. Model 1 exhibits only the impact of the control variables. Model 2 illustrates the main explanatory variable, F*emale.* Model 3 exhibits the impact of the variable *R&Dpers* on *ShareVentureCapital.* Model 4 illustrates the interaction effect of gender and R&D activity. Model 5 shows the impact of education on the volume of venture capital in use. Model 6 shows the interaction term of *Female* and *Unidegree.* Standard errors are in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

The descriptive statistics show significant differences between female and male entrepreneurs, which could have an impact on venture capital access. To test our hypotheses and examine whether gender, education, and R&D activity have a relevant

impact on the share of venture capital in use, we use multiple pooled OLS regression analysis. Thus, we calculate six regression models to examine the gender gap (Table 5.4).

Model 1 exhibits the impact of the control variables on the volume of venture capital in use. The results illustrate that all founder-specific variables are significant. The firm-specific variables show a significant effect at the 1% level for *Age* and *nkbService* and have the expected signs. New ventures from the service sector with low innovation potential are less likely to have large shares of venture capital.

When considering the founder's gender in Model 2, we find strong empirical evidence at the 1% level that female entrepreneurs do not use as much venture capital compared to their male counterparts. This serves as strong evidence to support H1. Socialization theory and the discrimination hypothesis (see Section 5.3.1) serve to explain that female entrepreneurs either perceive starting their own business as less desirable or are disadvantaged with respect to business funding due to discrimination.

Regarding the effect of education on the volume of venture capital in use, Model 3 shows empirically strong evidence at the 1% level that education has a positive effect on the share of venture capital in use. This result is in line with our expectations, since a higher education enables entrepreneurs to develop more complex and innovative business models, which affects the investment decisions of venture capitalists.

Figure 5 Gender, education, and volume of venture capital
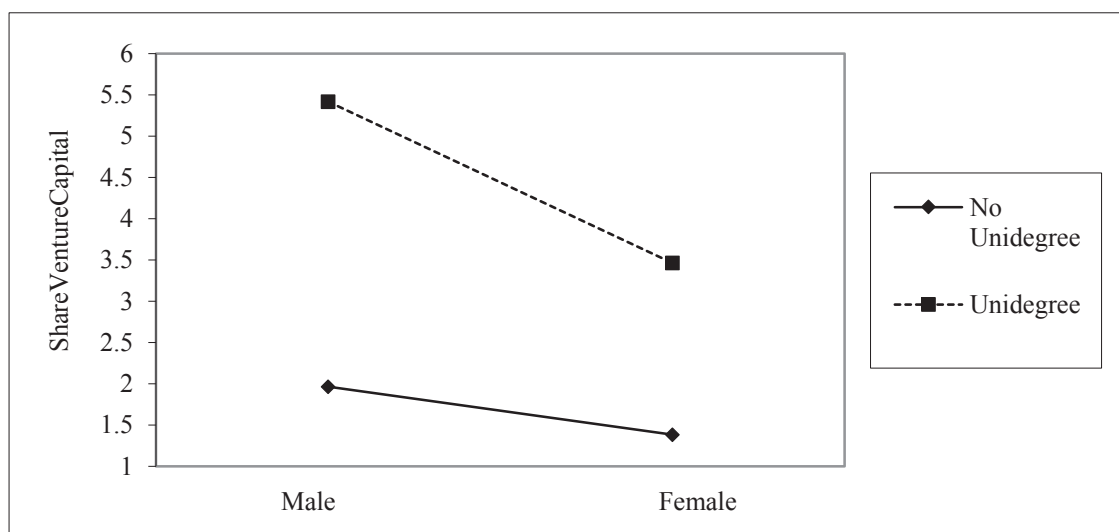
In Model 4, we include the interaction term of female and unidegree. The result is significant at the 5% level but, surprisingly, has a negative sign. Therefore, we reject H2, since this result indicates a gender effect in the opposite direction expected. We plot the interaction term to explain this result. Figure 5 illustrates that female entrepreneurs with a university degree are more disadvantaged in receiving venture capital. Countering our hypothesis, it seems that higher education is unable to bridge the gap between male and female entrepreneurs in terms of external financing. A possible explanatory approach from socialization theory is that while female entrepreneurs focus largely on their university degree during their time of study, as manifested in female outperformance, male entrepreneurs might invest more time in extracurricular activities that help build skills and networks useful for their entrepreneurial career. Based on the discrimination hypothesis, it could be argued that venture capitalists value university degrees from female entrepreneurs less than those from male entrepreneurs. Future research is required to better understand these gendered effects.

Figure 6 Gender, R&D activity, and volume of venture capital
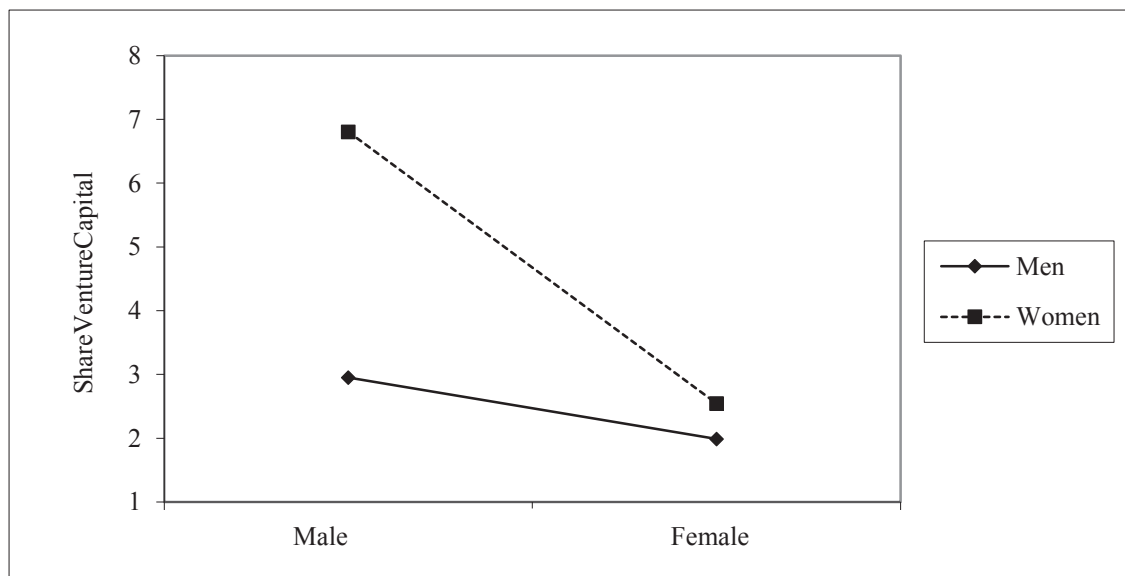
The interaction effect of gender specificity and R&D activity is significant at the 1% level (Model 6). To illustrate the effect of female and *R&Dpers*, we plot the interaction term (Figure 6) for a small number and a large number of R&D employees, respectively. We use the 10th percentile of the variable *R&Dpers* (low *R&Dpers*) and the 90th percentile (high *R&Dpers*) to visualize the interaction term. We can see that female-founded new ventures with high R&D activity are more constrained relative to similar male-founded new ventures than new ventures with low R&D activity are. This finding supports H3.

The result can be traced back to structural dissimilarities with respect to R&D, since women exhibit less R&D activity.

5.6   Conclusion

Funds from venture capital firms play a major role in financing young firms in Germany. They are able to select new ventures that offer promising prospects for the future. Since little is known about the decision making criteria regarding the applicants' gender, we draw attention to the interactions between gender and human capital as well as between gender and firm innovativeness. Our study makes an important contribution to the literature on gender in entrepreneurship (Fischer et al., 1993; Greene et al., 2003; Hisrich and Brush, 1983) and entrepreneurial finance (Carter et al., 2003; Greene et al., 2001; Verheul and Thurik, 2001): We compare female and male entrepreneurs' access to external equity capital with respect to important venture capitalist investment criteria, which could help understand the disadvantages of female founders.

We use the KfW/ZEW Start-up panel. We find strong evidence of gendered access to external equity capital, since we find a significantly lower volume of venture capital funding for female founders. Contrary to our expectations, higher education is unable to bridge this gap and, instead, leads to even more pronounced differences between male and female entrepreneurs. Following socialization theory, it might be that male entrepreneurs are better able to use their time of study to build skills and networks that help them in their entrepreneurial projects. It could also be that venture capitalists subconsciously discriminate against women by valuing their university degree less than those of men. Future research, possibly following a qualitative research approach with in-depth interviews with venture capitalists and/or an experimental design, is required to further explain our results.

In addition, we find that new female-founded ventures with high R&D activity receive less venture capital funding compared to their male counterparts with similar R&D activity and this difference is stronger for new ventures with low R&D activity. These gender differences could be attributed to structural dissimilarities due to individual characteristics and business features. Further, structural differences are also relevant factors in the interpretation of socialization theory and the discrimination hypothesis,

where men and women have different perceptions of business opportunities and financial access. The presence of venture capitalists actively disadvantaging female entrepreneurs is a potential explanation for the gender funding gap.

We encourage further research on the selection procedure of male and female founders trying to access external equity capital. A study that can control for entrepreneurs who applied for venture capital but were rejected in the assessment procedure is desirable. It could be interesting to compare this group of entrepreneurs and their financing mix with similar but venture capital-backed new ventures from a gendered perspective. Further, two more directions for future research seem promising: First, an in-depth examination of the criteria of venture capitalists regarding gender differences remains to be conducted. More insight into the functionality, interaction, and development of decision making criteria would be beneficial in explaining the gender gap in more detail. Second, a closer look should be taken of how venture capitalists evaluate new ventures. A procedural examination with a focus on gender differences would be interesting to obtain a deeper understanding of how venture capitalists evaluate new ventures and entrepreneurs in particular.

6   Effects of impression management tactics on crowdfunding success

6.1   Introduction

In recent years, crowdfunding has emerged as a new funding channel for entrepreneurial and/or innovative projects and now serves as an alternative financing source besides traditional financial instruments (Mollick, 2014). Crowdfunding allows individuals to fund projects directly, even with small amounts, often in return for equity stakes, interest, and/or a non-monetary reward (Belleflamme et al., 2014) via online platforms. The information embedded in the project descriptions on crowdfunding platforms is a main driver in transmitting the relevant aspects of projects to the crowd (Cumming et al., 2015). While hard facts on the project are relevant to the crowd in making their funding decision, less explicit information could also be an important decision driver. In particular, tactics such as self-promotion, through either positive language or emphasizing innovativeness or supplication, could impact the impression made on potential crowdfunders and, hence, crowdfunding success. Our aim is to shed light on the role of impression management tactics in crowdfunding by analyzing the reward-based crowdfunding platform Kickstarter, where individuals pledge money in exchange for one of various rewards offered by the entrepreneur (Kuppuswamy and Bayus, 2014). We focus on how the linguistic behaviors of entrepreneurs that are manifested in their project descriptions affect the likelihood of raising funds.

Previous literature shows that the information on crowdfunding platforms is a major determinant of successful outcomes. Moritz et al. (2014) find that information on platforms, particularly pseudo-personalized communication via videos and chats, increases the trustworthiness perceived by funders and affects the funding decision to the benefit of the entrepreneur. Furthermore, Cumming et al. (2015) examine campaign descriptions with regard to how the crowd perceives the descriptions' readability. However, they find no evidence that the readability necessarily affects funding outcomes, even if communication efforts are relevant to convincing the crowd. In line with this, Tirdatov (2014) focuses on certain rhetorical techniques applied in project descriptions and conducts a qualitative analysis of 13 crowdfunding campaigns. The main results of the author's study indicate that successfully funded projects use basic types of rhetorical appeals. Overall, most previous studies have focused on the manifestations of certain language patterns but they have mainly overlooked contextual patterns (Parhankangas

and Ehrlich, 2014). We build on these studies by applying an impression management approach, as a theoretical and empirically reliable construct. We can thus quantitatively investigate conceptualized language patterns that indicate certain behaviors and which could impact success in reward-based crowdfunding environments (Allison et al., 2015).

We draw upon impression management theory (Bolino and Turnley, 1999; Bozeman and Kacmar, 1997) to assess how crowdfunders react on certain impression management tactics in campaign descriptions. According to Wayne and Liden (1995), we define impression management strategies as the behaviors individuals use to protect their self-images and alter the way they are perceived by others. Previous literature finds impression management tactics to be particularly relevant in situations in which entrepreneurs try to convince a powerful audience to gain their approval (Carter, 2006) and when uncertainty makes it challenging to assess entrepreneurial projects (Bansal and Kistruck, 2006). We examine language in impression management theory and the related success of crowdfunding campaigns, that is, the funding probability, the number of crowdfunders and the total amount raised. We use data from 221 Kickstarter projects and a total of 195,217 words embedded in their descriptions retrieved from the Kickspy and Kickstarter websites between January and March 2015. We expand this sample with information from secondary sources, particularly entrepreneur-specific information from LinkedIn, Facebook, and company websites.

Our results contribute to the literature in two main ways: First, we add to the previous literature by testing the effect of specific words that are related to certain impression management tactics. In this context, our study differs from those that examine the reactions of crowdfunders evoked by phrase structures in project descriptions (e.g., Mitra and Gilbert, 2014): We are interested instead in the effect of impressions of competence, innovativeness, and vulnerability created by the entrepreneur's language to the benefit of crowdfunding success. We therefore contribute to the literature on impression management theory by revealing how entrepreneurs can effectively communicate and demonstrate their confidence while providing relevant information about the crowdfunding project and personal characteristics. We operationalize impression management strategies and, thereby, focus on the role of positive language, the promotion of innovativeness, and supplication behavior as relevant factors in crowdfunding success.

Second, we contribute to the entrepreneurial finance literature by examining whether and how crowdfunders react to certain language patterns and compare the results to traditional financiers. The previous literature emphasizes that traditional financiers have developed conceptual abilities and extensive experience in evaluating uncertain business models (Gompers and Lerner, 2001; Macht and Weatherston, 2014), whereas crowdfunders usually have less detailed financial and market-related experience (Ahlers et al., 2015; Freear et al., 1994). Nonetheless, the crowd is able to select and fund promising projects (Kim and Viswanathan, 2014). A comparison of our results with those of Parhankangas and Ehrlich (2014) about business angels' perceptions toward impression management tactics helps to gain a deeper understanding of funders' decision making process.

This study proceeds as follows: The next section presents the theoretical background of crowdfunding, introduces impression management theory, and develops our research hypotheses. Section 6.3 section presents our data, descriptive statistics and the analytic approach and Section 6.4 interprets the results. In Section 6.5, we discuss our findings and draw our conclusions regarding determinants for successful crowdfunding projects.

6.2 Theoretical background and hypothesis development

6.2.1 Crowdfunding and funding criteria

Crowdfunding has recently emerged as an opportunity to raise funds for entrepreneurial and/or innovative projects (Kraus et al., 2016; Tomczak and Brem, 2013). There are numerous definitions of crowdfunding, which could, in the best sense, be described as raising funds provided by a general public, essentially through the Internet, with or without some type of reward for the capital providers (Belleflamme et al., 2014). Various forms of crowdfunding exist, such as crowd lending, crowd equity, crowd donations, crowd pre-selling, and reward-based crowdfunding (Hemer, 2011). Crowd lending and crowd equity can be compared to the corresponding traditional financing instruments of bank loans and venture capital, while crowd donations are the unconditional payment pledges of funders made to the entrepreneur with no repayment obligation (Agrawal et al., 2014). Crowd pre-selling implies that the entrepreneur commits to providing the funders with early products or services for a previously stipulated price. In a reward-based crowdfunding model, crowdfunders pledge money in exchange for one of from various

rewards offered by the entrepreneur (Colombo et al., 2015). These rewards can be either presents of appreciation, such as autographs or customized clothes, or pre-purchases of products.

Our study uses data from Kickstarter, a large and well-known reward-based crowdfunding platform that operates worldwide and is currently the largest crowdfunding platform in terms of money raised (Kuppuswamy and Bayus, 2014). Kickstarter hosts projects in a large number of categories, for instance, art, comics, fashion, film, games, music, photography, publishing, and technology. We consider all campaigns as entrepreneurial endeavors and all project initiators as entrepreneurs, in line with recent and prominent studies on reward-based crowdfunding platforms and Kickstarter in particular (e.g., Colombo et al., 2015; Cumming et al., 2015; Kuppuswamy and Bayus, 2014). Furthermore, Kickstarter's guidelines require crowdfunding projects to create products or services that have to be shared (either for profit or for-free).

Recent empirical investigations on crowdfunding focus on heterogeneous investment determinants. First, studies highlight the relevance of network aspects. Mollick (2014) uses data from the Kickstarter platform to examine the effects of the network connections and quality signals of the project on the funding decision of the crowd and is indeed able to show the relevance of both factors. Additionally, Giudici et al. (2013) extracted information from 11 Italian crowdfunding platforms and show that the success of a crowdfunding campaign is positively correlated with individual social capital, for which they use the number of contacts in social network services as a proxy. In line with that, Gerber and Hui (2013) performed 83 semi-structured interviews and uncovered crowdfunder motivations, which include the desire to collect rewards, help others, and be a part of a community. Agrawal et al. (2011) use the data of 4,712 projects from the crowdfunding platform Sellaband between 2006 and 2009 to determine a geographical effect, such that local and distant crowds exhibiting different patterns in their investment behavior.

Second, communication efforts are also shown to be relevant in convincing entrepreneurs. Moritz et al. (2014) use semi-structured interviews of 23 market participants to show that funder-perceived sympathy and trustworthiness are able to reduce information asymmetries between the entrepreneur and project backers and thus affect the crowd's funding decision to the benefit of the entrepreneur. In particular, the authors highlight that

pseudo-personal communications by the entrepreneur, for example, via video presentations and chats, are important to convince the crowd. Furthermore, Cumming et al. (2015) focus on the readability of crowdfunding campaign descriptions by applying the so-called automated readability index for 22,850 fundraising projects. Even if they emphasize the importance of the information given in project descriptions, they find no reliable results indicating readability has an effect on crowdfunding outcomes. However, Tirdatov (2014) analyzes 13 campaign descriptions and finds certain rhetorical patterns influencing the success of crowdfunding projects. We add to this research by delving deeper into how entrepreneurs can communicate effectively to promote their projects.

6.2.2   Impression management

Impression management is a process through which people aim to alter the perceived image others have of them (Bolino and Turnley, 1999; Bozeman and Kacmar, 1997; Parhankangas and Ehrlich, 2014). Impression management studies have been conducted at the individual and intra-organizational levels, as well as between an organization and its key stakeholders (Bolino et al., 2008; Parhankangas and Ehrlich, 2014), for which researchers propose different frameworks of impression management. For this study, we use the approach of Jones and Pittman (1982) to examine the use of impression management tactics in crowdfunding. Their approach is suitable for our purposes for two main reasons. First, their taxonomy is the only model that has been empirically validated (Bolino and Turnley, 1999). Therefore, we suggest that their approach is well founded and corresponds accurately to reality. Second, Jones and Pittman (1982) propose tactics encompassing behaviors that could be relevant when trying to obtain funding through crowdfunding. According to the authors, individuals typically use five different tactics: first, self-promotion, which describes the intent of individuals to be viewed as competent by presenting their capabilities; second, supplication, which indicates that individuals want to be viewed as indigent and in need of support by showing their weaknesses; third, exemplification, where individuals want to be perceived as dedicated; fourth, ingratiation, whereby individuals intend to be viewed as honorable; and, fifth, intimidation, where individuals seek to be viewed as intimidating by threatening other individuals.

Previous studies have identified two main impression management tactics that entrepreneurs are likely to use when trying to convince investors: Entrepreneurs have to

convince investors of the competitiveness and innovativeness of their entrepreneurial projects and their vulnerability and dependence on external support (Highhouse et al., 2009; Jones and Pittman, 1982; Parhankangas and Ehrlich, 2014). Therefore, we focus on self-promotion and supplication, since we believe that these tactics are appropriate for illustrating the impression management strategies most applied in crowdfunding.

6.2.3 Hypotheses on impression management in crowdfunding

Self-promotion through positive language: The promotion of a project can be described as the behavior of the project leader to present an idea as being successful and effective (Mohamed et al., 1999). Hence, the promotion of a crowdfunding project could become visible through the use of a positive language that is applied when presenting the idea on the platform referring to one's strengths and capabilities (Bolino and Turnley, 1999; Ellis et al., 2002). The promotion of a project is particularly useful when the entrepreneur is not well known or competing with other entrepreneurs for funding resources (Judge and Bretz, 1994; Parhankangas and Ehrlich, 2014). This situation is applicable to entrepreneurs describing their ideas on crowdfunding platforms and trying to convince platform users to provide funding to their projects rather than other projects listed on the platform.

Entrepreneurs are usually aware that many users of crowdfunding platforms are perceived as early adopters, a group that is risk taking and supportive of revolutionary ideas (Schramm and Carstens, 2014). The use of positive language could promote these factors in particular and therefore affect the investment decisions of the platform users to the benefit of the entrepreneur. This suggestion is in line with previous studies on the taxonomy of impression management approaches, which show that promotional impression strategies using positive language patterns have a positive effect on the likelihood of hiring or promoting someone (Kacmar et al., 1992; Parhankangas and Ehrlich, 2014; Stevens and Kristof, 1995).

Viewing crowdfunding from a general entrepreneurial perspective, we can also distinguish between crowdfunders and traditional financiers regarding different perceptions of language. When considering solely the reactions of crowdfunders to positive descriptions of future opportunities for entrepreneurial endeavors, they are likely

to lack the financial experience of angel investors, who are usually proficient in assessing entrepreneurial endeavors and entrepreneurs (Ahlers et al., 2015; Freear et al., 1994). Crowdfunders might have, unlike traditional financiers, less detailed knowledge about industry specifics (Ahlers et al., 2015), which is why they might be more easily convinced through positive promotional speech by entrepreneurs. We believe that crowdfunders are more receptive to boasting through the excessive use of positive language patterns, whereas boasting has an investment-repelling effect on traditional financiers (Wosinska et al., 1996). We therefore hypothesize the following.

H1: Using positive language to describe a crowdfunding project has a positive effect on crowdfunding success.

Self-promotion through emphasizing innovativeness: Crowdfunding allows innovative ventures in particular to receive funding, which is why this financing instrument can be described as a catalyst for innovation (Schmiedgen, 2014). Furthermore, this instrument is a relevant tool for raising funds for visionary crowdfunding projects (Schwienbacher and Larralde, 2010). The previous literature finds that business angels indeed focus on the innovativeness of an entrepreneurial project, particularly with regard to product uniqueness (Mason and Stark, 2004). The promotion of innovation could be appealing to crowdfunders looking to access new and untapped markets (Parhankangas and Ehrlich, 2014).

Crowdfunders are able to determine what innovative products consumers will prefer, since crowdfunders are likely to contain a similar population as consumers. Crowdfunding enforces the wisdom of the crowd to choose promising and innovative projects that consumers will embrace (Bechter et al., 2011). Traditional financiers prefer investing in innovative projects from high-tech industries. They are able to determine promising ventures due to their conceptual abilities and extensive experience in evaluating uncertain business models (Gompers and Lerner, 2001). Parhankangas and Ehrlich (2014) find that business angels react only up to a certain point of promoting innovativeness to the benefit of the entrepreneur. They perceive very high levels of innovativeness as unfamiliar and evoking reluctance among potential consumers (Arndt and Bigelow, 2000; Zuckerman, 1999).

Due to the similarities between crowdfunders and business angels with regard to preference for innovative products, we believe that, in the context of crowdfunding, the promotion of innovativeness is also likely to be beneficial only up to a certain point. High levels of innovativeness could also be associated with radical new products or services, which may violate accepted conventions and create resistance (Arndt and Bigelow, 2000; Zuckerman, 1999). Hence, the crowd could perceive a highly innovative project as too risky due to the related challenges associated with the project's product or service acceptance and capital appropriation (Branscomb and Auerswald, 2002; Parhankangas and Ehrlich, 2014). The entrepreneur's goal of striking a balance between the emphasis of the project's innovativeness and its appeal to convention is therefore likely to be an important factor in impression management tactics and its applicability to crowdfunding. We therefore hypothesize the following.

H2: Promoting the innovativeness of a crowdfunding project has a curvilinear relation with the success of receiving funds, with both high and low levels of innovativeness promotion associated with lower funding success.

Supplication: An entrepreneur uses supplication tactics to create an impression of neediness by presenting the project's weaknesses and limitations (Bolino and Turnley, 2003). Supplication stresses certain characteristics of the entrepreneur or the project to create sympathy and enhance the willingness of others to be supportive (Gardner and Cleavenger, 1998; Jones and Pittman, 1982). In the context of entrepreneurial finance, supplication could address a lack of human resources, particularly insufficient capabilities with regard to the industry experience of the founding team, inadequate research and development funding, or deficient administrative capacity to establish distribution channels for products or services (Parhankangas and Ehrlich, 2014).

Supplication impression management strategies aim to present an entrepreneurial endeavor as being incapable of being successful without support and, therefore, opposes the management tactics previously discussed in this study (Mohamed et al., 1999). Literature on this topic has not been able to agree on a common understanding of the success of this strategy. On the one hand, some studies find evidence for an unfavorable effect of supplication, since the project or the entrepreneur might be perceived as desperate with regard to lacking individual capabilities (Avery and McKay, 2006; Bolino and Turnley, 2003; Jones and Pittman, 1982). Further, supplication could also weaken the

bargaining position of the entrepreneur or new venture (Parhankangas and Ehrlich, 2014). On the other hand, entrepreneurs take the view that it could be advantageous to appear limited and/or weak under certain circumstances. By emphasizing their limitations and pointing out that they need assistance, the supplicating entrepreneur or project might generate feelings of obligation and social responsibility (Bolino and Turnley, 1999; Jones and Pittman, 1982). Thus, supplication impression management strategies might evoke sympathy for the entrepreneur or the project.

Traditional financiers of entrepreneurial projects are often described as proactive and hands-on, and aim to compensate for any missing capabilities of the entrepreneurs (Parhankangas and Ehrlich, 2014). They also aim proactively to become involved in the start-ups they invest in (Mason and Stark, 2004), which is why they react positively to supplication strategies due to the feeling of being needed (Parhankangas and Ehrlich, 2014). We suggest that this strategy is also applicable to crowdfunding. Crowdfunders aim to fund projects that are innovative and/or are able to create a social return (Schramm and Carstens, 2014). They easily feel committed to needy entrepreneurs' projects aiming to promote the common good and connected to a community with similar interests and ideals (Gerber et al., 2012). Moreover, crowdfunders might seek to find a trustworthy entrepreneur in whom to invest. Trust, in particular, could be generated when the entrepreneur actively admits to his or her weaknesses.

However, we suggest that supplication tactics are beneficial up to a certain point, where this behavior leads to the perception of being incompetent, particularly with regard to developing an entrepreneurial project (Jones and Pittman, 1982; Turnley and Bolino, 2001). Since there are limits to the crowd's willingness to support entrepreneurs who are needy or limited, funders tend to perceive high levels of supplication as a sign of desperate behavior and a lack of managerial acumen (Rozell and Gundersen, 2003). Hence, we hypothesize the following.

H3: The use of supplication strategies for crowdfunding has a curvilinear relation with the success of receiving funds, with both high and low levels of supplication associated with lower funding success.

6.3 Methodology and variables

Our data set consists of data collected from Kickstarter.com and Kickspy.com between February and March 2015, when Kickspy was shut down. Kickspy was a website that collected all available information about Kickstarter projects and publicly provided data for both successful and failed crowdfunding projects. We decided to use Kickstarter data not only because of data availability and economic relevance but also because of the large number of previous studies on Kickstarter (e.g., Colombo et al., 2015; Kuppuswamy and Bayus, 2014). Thus, we believe that our choice of also using Kickstarter data is beneficial for a better comparability of crowdfunding research. Our initial data set consisted of 264 campaigns that reached their end date of funding between January and March 2015. We enrich our sample with data from secondary sources, particularly personal information about the previous work experience of the entrepreneurs via LinkedIn, Facebook profiles, and company websites. After the elimination of incomplete records, our final sample consists of 221 crowdfunding projects.

We recognize that our sample is relatively small, for example, in comparison with other studies on Kickstarter data (e.g., Colombo et al., 2015; Kuppuswamy and Bayus, 2014; Mollick, 2014), but our multi-step data collection procedure (see Table 6.1) that is necessary to follow an impression management approach, did not allow us to automatically collect large amounts of campaign information. Our impression management approach is based on a language analysis for each entrepreneur, which makes it neither expedient nor feasible to collect data for large amounts of Kickstarter campaigns with automated web scraping programs. Instead, we set our focus on the extensive analysis of the total of 195,217 words embedded in 221 project descriptions and examine their relation with other information available on Kickstarter.com, such as funding probability and the number of backers. This amount of language data is, on the one hand, sufficient to conduct an analysis about impression management variables in entrepreneurial finance and, on the other hand, also applicable to our methodological approach (Parhankangas and Ehrlich, 2014). To analyze the language in the descriptions of crowdfunding projects, the texts of all observed projects were read into the text analysis tool TextSTAT, a program to calculate the frequency of words used in a certain text document (Diniz, 2005).

Table 6.1 Data collection and preparation procedure

Step 1	Step 2	Step 3	Step 4
Campaign identification on Kickpsy.com and Kickstarter.com	Manual collection of personal Information from Linkedin, Facebook, and firm/ personal/ bibliographic websites (variables for 221 individuals: WorkExp, University)	Analysis of created text files with TextSTAT:	Merging of collected data
1. Identification of 264 entrepreneurs/ entrepreneurial teams		1. Creation of word count summary for each campaign as Excel documents	1. Merging of word counts (264 created Ecxel files) into aggregated file
2. Manual collection of 264 campaign descriptions: Seperate text files necessary for further analysis		2. Identified impression management words: Manual check of contextual correctness	2. Merging of the aggregated files of word counts with data from Kickstarter/ Linkedin/ Facebook/ other websites
3. Manual collection of campaign information (variables: Funding, Backers, Avgfunding, Targetkusd, Picture, Video, Male, Team, Category)			3. Analysis with STATA

Our small sample leads to concerns regarding its representativeness. We therefore compare our sample to other Kickstarter samples to address this limitation. Table 6.2 compares the means of our dependent variables with those of prior studies on crowdfunding based on Kickstarter data. We adopt this approach from Colombo et al. (2015), who were thus able to demonstrate the usability of relatively small Kickstarter samples by emphasizing similarities in mean values. Table 6.2 shows fluctuations in the probability of funding success in a range between 16% (Colombo et al., 2015) and 54% (Zvilichovsky et al., 2014), indicating that there might be changes over time. Those changes might be either economic, for instance the financial crisis of 2008 (Campello et al., 2010), or legal, such as changes in US securities regulation (Bradford, 2012; Cumming and Johan, 2013). Nonetheless, our mean for funding success (36%) is somewhat in the middle of the range, which is why we believe that our sample and particularly this variable can be utilized to search for empirical evidence of impression management tactics in crowdfunding. However, our second and third dependent variables, *Backers* and *Amountraised*, exhibit the highest means compared to previous studies. Nonetheless, comparing the mean range of 62 backers (standard deviation 189.54; Kuppuswamy and Bayus, 2014) to 84 backers (standard deviation 302.30; Zvilichovsky et al., 2014), we believe the mean value of 204 backers in our study is still within an empirically legitimate range to be investigated for our research purposes. Similarly, we suggest that a mean value for the total amount raised of US$13,823

compared to US$4,633 (standard deviation 13,759.15; Kuppuswamy and Bayus, 2014) still appears to fit in the range of previous studies. Overall, we therefore believe our sample to be comparable to other Kickstarter samples. Another area of concern might be the short time frame, from January to March 2015, used to collect data. In our view, this timeframe does not entail dramatic market circumstances such as economic turbulence that might impact our results. In contrast, one advantage of such a short time frame is that long term economic movements do not have an impact. Colombo et al. (2015) argue similarly for their Kickstarter data observed between October 2012 and January 2013.

Table 6.2 Comparison of data sets on Kickstarter campaigns

	This study	Kuppuswamy & Bayus (2014)	Mollick (2014)	Colombo et al. (2015)	Zvilichovsky et al. (2014)
N	221	14,704	48,034	502	68,057
Time period	Jan 2015 - Mar 2015	May 2009 - Feb 2012	May 2009 - Jul 2012	Oct 2012 - Jan 2013	May 2009 - Mar 2013
Funding	0.33	0.41	0.49	0.16	0.54
Backers	204.33	62.59	66.66	-	84.08
Amountraised	13,822.96	4,633.17	-	-	-

Our dependent variables serve to present a manifold picture of the success of a crowdfunding project. Most studies focus on whether a project has reached its funding goal to be considered successful (Mollick, 2014; Xu et al., 2014). However, recent studies on this topic tend to focus on the role of the backers of crowdfunding projects (e.g., Kuppuswamy and Bayus, 2014). They examine how crowdfunders' support varies based on timing issues and project success. Therefore, our aim is threefold: Our first dependent variable, *Funding*, takes the value one for a crowdfunding project that has reached or even exceeded its funding target and zero otherwise. We use this variable as a proxy to determine how the crowd's investment determinants affect the probability of being successfully funded. On average, 31% of the crowdfunding projects observed were successfully funded. Second, we use the variable *Backers* to investigate not only the monetary effect of crowdfunding success, but also whether certain behaviors affect the number of supporters who provide funds and potentially promote the crowdfunding project in their social/business networks (Mollick, 2014). Third, the main goal for an entrepreneur is to receive money from project backers. Therefore, we use the variable *Amountraised* as another proxy for crowdfunding success. This variable indicates the total amount raised during the crowdfunding campaign.

We consider two complementary econometric approaches. First, we use logistic regression models to examine the effect of the language used for project descriptions on

the probability of being funded. Second, we use multiple linear regression models to investigate the language effect on the number of backers and the amount raised to gain detailed insight into the relevance of impression management strategies.

To examine language patterns as our main explanatory effects, we operationalize self-promoting activities by distinguishing between the uses of positive language and innovativeness promotion, as well as investigating the effect of supplication. The variable *Positiveness* indicates the number of positive words used in the project description. This variable is a count measure and uses the number of positive words or word combinations that contain any positive words based on the list presented by Henry (2008). This list includes the number of words, such as positive, strong, and great, that have been collected from research examining behavior in response to written communications addressed to stakeholders (Henry, 2006; Smith and Taffler, 2000). In our study, entrepreneurs use an average of eight positive words to describe their crowdfunding projects.

The variable *Innovativeness* implies counting the number of words used to describe the innovativeness and creativity of the crowdfunding project and is based on the assumptions of Michalisin (2001). Terms that refer to innovativeness are, for instance, new products, great progress, and significant improvements, or word combinations that contain any of these terms referring to innovativeness. Our operationalization includes both market- and technology-based aspects of a given project's innovativeness to illustrate how entrepreneurs present innovative and creative characteristics, but not to capture the actual innovativeness of the crowdfunding project. In our sample, entrepreneurs use 0.5 words, on average, to describe their crowdfunding projects.

The independent variable *Supplication* is operationalized by counting the number of words that indicate the entrepreneur's or the crowdfunding project's vulnerability, for instance, the lack of resources and weakness in being able to properly compete with others. We use the negative word list of Henry (2008), which contains a number of negative words such as failure, disappointment, and less, to count these words or word combinations that contain any negative words referring to supplication tactics. In this study, entrepreneurs use, on average, five supplication-related words to describe their crowdfunding projects. An example of the identification of the variables Supplication, Innovativeness and Positiveness in a campaign description is shown in Figure 7.

Figure 7 Procedure of impression management analysis
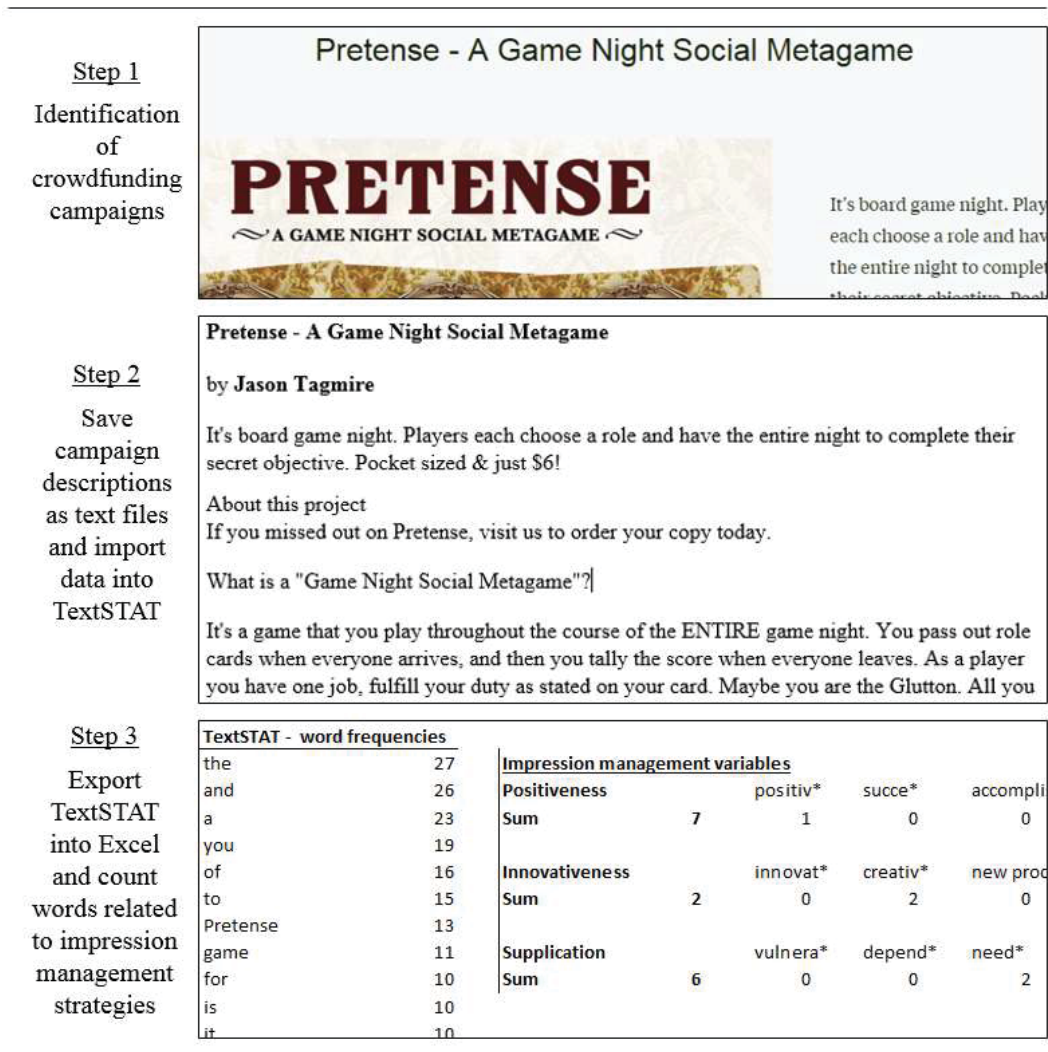
We include a set of control variables. Moritz et al. (2014) show for equity-based crowdfunding that pseudo-personal communication through presentation videos and visualizations in social media channels appear to be a main channel to transmit relevant information. Thus, we add the variable *Picture*, which takes the value one for crowdfunding descriptions with illustrations and/or photos and zero otherwise, as well as the variable *Video*, which takes the value one for the use of a promotional video. On average, 68% of the observed crowdfunding projects use videos.

Previous studies examine gender-based differences in financing and have indeed found that women are disadvantaged when trying to access external funding sources (Greenberg and Mollick, 2014; Lins and Lutz, 2016). Therefore, we use the variable *Male*, which takes the value one for a male entrepreneur or a male crowdfunding campaign team. From

our data, we can show that 77% of all crowdfunding projects are initiated without female support.

Table 6.3 Variables of the econometric models

Variable	Description	Mean	S.D.	Min	Max
Dependent variables					
Funding	One for successful funding	0.36	0.48	0.00	1.00
Backers	Number of backers	204.33	746.31	1.00	6,466.00
Amountraised	Total amount raised in USD	13,822.96	43,212.89	1.00	313,341.00
Language variables					
Positiveness	Number of words referring to positivenesss	8.60	7.17	0.00	38.00
Innovativeness	Number of words referring to innovativeness	0.55	1.12	0.00	7.00
Supplication	Number of words referring to supplication	5.40	3.29	0.00	34.00
Control variables					
Pictures	One for at least one picture	0.80	0.40	0.00	1.00
Video	One for at least one video	0.68	0.47	0.00	1.00
Male	One for now women involved in project	0.77	0.42	0.00	1.00
Team	One for team project	0.48	0.50	0.00	1.00
WorkExp	One for work experience	0.91	0.28	0.00	1.00
University	One for at least one graduated person	0.70	0.46	0.00	1.00
Targetkusd	Funding target in kUSD	17.07	80.62	0.01	1,200.00
Category dummies					
DCat_Art	One for an art project	0.21	0.41	0.00	1.00
DCat_Comics	One for a comic project	0.02	0.13	0.00	1.00
DCat_Cooking	One for a cooking project	0.04	0.19	0.00	1.00
DCat_Crafts	One for a crafts project	0.14	0.35	0.00	1.00
DCat_Design	One for a design project	0.00	0.07	0.00	1.00
DCat_Fashion	One for a fashion project	0.08	0.27	0.00	1.00
DCat_Film	One for a film project	0.03	0.17	0.00	1.00
DCat_Food	One for a food project	0.01	0.11	0.00	1.00
DCat_Games	One for a games project	0.11	0.32	0.00	1.00
DCat_Journalism	One for a journalism project	0.03	0.17	0.00	1.00
DCat_Music	One for a music project	0.17	0.37	0.00	1.00
DCat_Publishing	One for a publishing project	0.05	0.21	0.00	1.00
DCat_Tech	One for a technology project	0.09	0.28	0.00	1.00
DCat_Theater	One for a theater project	0.02	0.15	0.00	1.00

We also include a control variable for team projects. If an entrepreneur aims to raise external funding, he or she needs to convince crowdfunders not only with the project idea, but also with the entrepreneur's capabilities of reacting well to risk, being familiar with the target market, and having staying power (MacMillan et al., 1986). Those characteristics could increase the likelihood of funding of teams. Therefore, we add the variable *Team*, which indicates whether a project is carried out by two or more individuals. We find that 47% of our observations are team projects.

Table 6.4 Covariance matrix

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Funding	1														
(2) Backers	0.260*	1													
(3) Amountraised	0.313*	0.772*	1												
(4) Positiveness	0.148*	0.204*	0.265*	1											
(5) PositivenessSquared	0.144*	0.103	0.160*	0.688*	1										
(6) Innovativeness	0.066	0.189*	0.210*	0.367*	0.263*	1									
(7) InnovativenessSquared	-0.018	0.044	0.062	0.272*	0.285*	0.828*	1								
(8) Supplication	0.099	0.103	0.194*	0.565*	0.322*	0.185*	0.128	1							
(9) SupplicationSquared	0.111	0.049	0.102	0.199*	0.169*	-0.017	-0.004	0.661*	1						
(10) Pictures	0.093	0.100	0.120	0.214*	0.144*	0.060	0.003	0.128	0.066	1					
(11) Video	0.081	0.138*	0.169*	0.296*	0.135*	0.188*	0.122	0.261*	0.073	-0.335*	1				
(12) Male	-0.012	0.063	0.106	0.070	-0.041	0.043	0.009	0.053	0.047	0.019	0.127	1			
(13) Team	0.077	0.159*	0.208*	0.179*	0.146*	0.190*	0.081	0.179*	0.085	0.019	0.358*	0.369*	1		
(14) WorkExp	0.094	0.092	0.080	0.168*	0.057	0.102	0.048	0.102	0.030	-0.069	0.242*	0.024	0.109	1	
(15) University	0.067	0.162*	0.138*	0.141*	0.020	0.212*	0.120	0.078	-0.073	0.159*	0.116	0.024	0.160*	0.156*	1
(16) Targetkusd	0.029	0.119	0.287*	0.123	0.183*	0.061	0.058	0.079	0.080	0.057	0.018	0.079	0.045	0.063	0.094
(17) DCat_Art	-0.032	-0.006	0.039	-0.140*	-0.064	-0.037	-0.052	-0.164*	-0.047	0.061	-0.260*	-0.116	-0.134*	-0.042	0.184*
(18) DCat_Comics	0.035	0.166*	0.071	-0.024	-0.026	-0.008	-0.015	-0.049	-0.013	0.066	-0.053	0.071	0.067	0.042	0.088
(19) DCat_Cooking	0.057	0.103	0.151*	0.101	-0.004	0.025	-0.031	0.059	-0.012	0.105	0.052	-0.090	-0.041	0.067	0.045
(20) DCat_Crafts	0.146*	-0.069	-0.081	-0.079	0.019	-0.014	0.018	-0.027	-0.015	-0.021	-0.241*	-0.205*	-0.121	-0.109	-0.140*
(21) DCat_Design	0.025	0.591*	0.357*	0.054	-0.026	0.077	-0.003	-0.014	-0.011	0.046	0.063	0.050	0.094	0.021	0.044
(22) DCat_Fashion	0.160*	-0.001	-0.027	0.118	0.092	0.010	-0.039	0.075	0.002	0.103	0.195*	-0.077	0.050	0.023	0.065
(23) DCat_Film	0.176*	-0.035	-0.041	-0.134*	-0.032	-0.045	-0.028	-0.033	-0.018	0.087	0.065	0.034	0.127	0.051	0.047
(24) DCat_Food	0.070	-0.020	-0.005	-0.013	-0.061	-0.024	-0.026	0.088	-0.004	0.057	-0.005	0.061	0.039	-0.104	-0.010
(25) DCat_Games	-0.157*	-0.050	-0.077	0.136*	0.066	0.075	0.099	0.073	-0.011	0.142*	0.093	0.190*	0.057	0.059	0.105
(26) DCat_Journalism	-0.081	-0.028	-0.039	-0.092	-0.065	-0.022	-0.029	-0.064	-0.016	0.087	-0.098	0.094	0.027	-0.037	0.060
(27) DCat_Music	-0.080	-0.088	-0.105	-0.107	-0.141*	-0.178*	-0.094	-0.117	-0.057	-0.586*	0.204*	0.047	-0.031	0.086	-0.385*
(28) DCat_Publishing	-0.086	-0.042	-0.051	0.067	0.006	-0.059	-0.050	-0.008	-0.022	0.110	-0.068	0.022	-0.059	-0.004	-0.035
(29) DCat_Tech	-0.124	-0.017	0.084	0.079	0.015	0.137*	0.057	0.132*	0.008	0.086	0.123	0.067	0.091	-0.060	0.082
(30) DCat_Theater	0.070	0.036	0.075	0.203*	0.349*	0.242*	0.304*	0.285*	0.428*	0.073	0.036	0.079	0.149*	0.047	0.031

Table 6.4 Covariance matrix (continued)

VARIABLES	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
(16) Targetkusd	1														
(17) DCat_Art	0.001	1													
(18) DCat_Comics	-0.011	-0.067	1												
(19) DCat_Cooking	0.019	-0.108	-0.027	1											
(20) DCat_Crafts	-0.072	-0.207*	-0.053	-0.084	1										
(21) DCat_Design	-0.016	-0.048	-0.012	-0.019	-0.037	1									
(22) DCat_Fashion	-0.028	-0.152*	-0.039	-0.062	-0.118	-0.027	1								
(23) DCat_Film	-0.038	-0.090	-0.023	-0.037	-0.070	-0.016	-0.051	1							
(24) DCat_Food	-0.003	-0.058	-0.015	-0.024	-0.045	-0.010	-0.033	-0.020	1						
(25) DCat_Games	0.149*	-0.181*	-0.046	-0.073	-0.141*	-0.032	-0.103	-0.061	-0.040	1					
(26) DCat_Journalism	-0.037	-0.090	-0.023	-0.037	-0.070	-0.016	-0.051	-0.030	-0.020	-0.061	1				
(27) DCat_Music	-0.061	-0.228*	-0.058	-0.093	-0.178*	-0.041	-0.130*	-0.077	-0.050	-0.155*	-0.077	1			
(28) DCat_Publishing	-0.034	-0.114	-0.029	-0.046	-0.088	-0.020	-0.065	-0.038	-0.025	-0.077	-0.038	-0.098	1		
(29) DCat_Tech	0.055	-0.165*	-0.042	-0.067	-0.128*	-0.029	-0.094	-0.056	-0.036	-0.112	-0.056	-0.141*	-0.070	1	
(30) DCat_Theater	0.080	-0.076	-0.019	-0.031	-0.059	-0.014	-0.043	-0.026	-0.017	-0.051	-0.026	-0.065	-0.032	-0.047	1

Furthermore, we control for the entrepreneur's working experience (*WorkExp*), since this variable could increase the probability of receiving external funding from investors (Fried and Hisrich, 1988). In some cases, the working experience of the entrepreneur was stated on the Kickstarter website. However, in most cases, we had to screen social business networks, such as LinkedIn, Facebook profiles, and company websites to collect relevant information. Overall, we find that 91% of all initiators of crowdfunding projects had previous working experience. The dummy variable *WorkExp* takes the value one for any previous working experience.

One of the most analyzed entrepreneurial variables for founder characteristics is the entrepreneur's educational background. This variable serves as a proxy for underlying factors that may influence how a crowdfunding project is organized or managed (Cooper et al., 1994). Hence, we include the variable *University*, which takes the value one for entrepreneurs with a university degree and zero otherwise.

Prior empirical work on crowdfunding has focused on the funding goal set by entrepreneurs trying to raise capital on crowdfunding platforms. Hakenes and Schlegel (2014) show that funding goal levels indeed influence the success of a campaign by attracting a larger amount of crowdfunders. Furthermore, funding goal levels contain valuable information and serve as a decision making tool for crowdfunders (Cumming et al., 2015; Hakenes and Schlegel, 2014). Therefore, we add the variable *Targetkusd* to indicate the funding goal level in thousands of US dollars.

Crowdfunding projects are highly heterogeneous, which is why the amount of funding as well as the number of backers might vary. Therefore, we include 14 dummy variables for different project categories based on Kickstarter's categorization to control for project heterogeneity (Fisk et al., 2011). An overview of all the variables we use in our study is provided in Table 6.3.

We test for multicollinearity problems in two main ways. First, we calculate the correlations between the main variables (Table 6.4). No correlation exceeds the threshold of 0.7, which indicates that there are no multicollinearity issues for our study (Anderson et al., 2002). Second, we calculate the variance inflation factors and find all the values are below the threshold of 10. A crucial point to mention is, however, the simultaneous use of impression management variables and their squared terms in our regression models

to examine hypothesized U-shaped relations. Multicollinearity might occur between these variables, which is common in these empirical research contexts (Greenwood et al., 2005). To lessen this problem of high correlations between impression management variables and their squared terms, we follow the approach of Aiken et al. (1991) and center the impression management variables on their mean and then square them for our regression models. This approach minimizes potential multicollinearity in the squared terms (McFadyen and Cannella, 2004). However, when we consider the values of the squared terms in Table 6.4, at least moderate levels of multicollinearity emerge. We calculate variance inflation factors to check for multicollinearity problems and find variance inflation factors above 10 for the variables *WorkExp* (11.79), *DCat_Art* (13.90), *DCat_Crafts* (10.44), and *DCat_Music* (12.07). Therefore, we checked whether our results change when we remove these predictors from our regression models. Our regression results remain quite stable compared to the main analysis reported in Section 6.4 (see Appendix A.3). This fact, coupled with the low correlations between the majority of the other variables, leads us to conclude that multicollinearity does not hamper the directional interpretation of our language variables (McFadyen and Cannella, 2004), but caution is advised.

6.4 Results

The logistic regression models in Table 6.5 show that certain impression management tactics indeed have an effect on the likelihood of success. When considering the results for Positiveness in Models 2 and 3, we find no evidence that the use of positive language patterns in project descriptions has a significant effect on the likelihood of reaching the targeted funding amount. However, in Model 5, we find a significant effect for the use of positive language patterns, indicating that positive words associated with the crowdfunding project have a positive effect on the number of project backers. We expected this result, since the use of positive language can particularly promote revolutionary ideas, directly address crowdfunder enthusiasm, and therefore affect the investment decision of the platform users to the benefit of the entrepreneur. However, we need to be cautious when interpreting this result, because the estimate is only significant at the 10% level. In turn, Models 8 and 9 exhibit no significant results for the use of positive language patterns in project descriptions indicating no effect on the total amount

of funding received. Overall, our results do not reliably show that the use of optimistic and positive speech can convince crowdfunders, which is why we cannot verify H1.

Table 6.5 Regression analysis

VARIABLES	*Logit* Model 1: Funding	*Logit* Model 2: Funding	*Logit* Model 3: Funding	*OLS* Model 4: Backers	*OLS* Model 5: Backers
Control variables					
Pictures	1.092**	0.820	0.728	483.74***	374.55**
	(0.539)	(0.572)	(0.593)	(180.50)	(186.70)
Video	1.063**	0.815*	0.834	577.68***	455.66***
	(0.459)	(0.493)	(0.511)	(147.93)	(154.01)
Male	0.120	0.144	0.0549	29.81	39.63
	(0.408)	(0.415)	(0.430)	(139.57)	(137.49)
Team	0.0248	-0.0161	-0.0119	160.26	132.33
	(0.379)	(0.384)	(0.397)	(123.38)	(121.87)
WorkExp	0.723	0.665	0.609	-29.51	-78.33
	(0.672)	(0.669)	(0.687)	(195.69)	(193.45)
University	0.276	0.255	0.310	65.98	22.93
	(0.405)	(0.414)	(0.434)	(132.96)	(130.86)
Targetkusd	0.002	0.002	0.001	2.20***	2.11***
	(0.002)	(0.002)	(0.002)	(0.57)	(0.56)
Language variables					
Positiveness		0.041	0.044		17.08*
		(0.031)	(0.044)		(9.77)
PositivenessSquared			0.001		
			(0.003)		
Innovativeness		0.037	0.624**		90.47
		(0.158)	(0.298)		(51.27)
InnovativenessSquared			-0.185**		
			(0.092)		
Supplication		-0.010	-0.145		-3.54
		(0.059)	(0.093)		(19.64)
SupplicationSquared			0.024		
			(0.017)		
Constant	-2.744*	-2.532*	-2.362	-1,015.56*	-708.83
	(1.421)	(1.511)	(1.847)	(528.61)	(534.24)
Observations	221	221	221	221	221
VIF	11.79	11.79	12.16	13.36	13.60
R-squared	0.163	0.171	0.203	0.328	0.359

This table presents the results of the logit (Models 1, 2 and 3) and pooled OLS regression models (Models 4, 5, 6, 7, 8 and 9) to examine the effect of impression management strategies used in crowdfunding project descriptions on project success. Results for category dummies are not included and available upon request. Pseudo R-squared values are reported for logit models. Standard errors are in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

When considering the results for *Innovativeness* in Model 3, we find that the use of innovative words to describe a project is advantageous up to a certain point, but diminishes and even becomes negative when overemphasizing the innovativeness of a crowdfunding project. We expected this result, since crowdfunders are particularly interested in proactively supporting innovative ideas. However, very high levels of innovative potential could violate accepted conventions and create resistance. We plot our findings in Figure 8 and the results are significant at the 1% and 5% levels. Figure 8 illustrates the U-shaped relation between the use of language to promote innovativeness

and the probability of successful funding. The positive relation is only present up to an optimal turning point of approximately 1.5 words. Any further increase in the use of language referring to words associated with innovativeness diminishes the positive effects on the probability of successful funding. The use of more than three words even decreases the likelihood of successful funding. The turning point appears low, however, two words referring to innovativeness are actually three times the average value in the project descriptions (see the previous section and Table 6.2). This result confirms that crowdfunders indeed attach significance to the novelty and creativity of the project.

Table 6.5 Regression analysis (continued)

VARIABLES	OLS Model 6: Backers	OLS Model 7: Amountraised	OLS Model 8: Amountraised	OLS Model 9: Amountraised
Control variables				
Pictures	356.81*	49,088.1**	36,689.9*	35,342.2
	(184.39)	(20,951.3)	(21,797.2)	(21,899.3)
Video	456.93***	52,765.0***	38,183.9**	38,253.8**
	(151.28)	(17,170.6)	(17,980.3)	(17,965.7)
Male	26.94	15,151.7	16,502.6	15,663.5
	(137.12)	(16,199.4)	(16,052.2)	(16,295.6)
Team	93.53	21,942.8	19,177.8	16,192.4
	(121.07)	(14,321.8)	(14,229.6)	(14,375.5)
WorkExp	-108.99	1,814.2	-3,558.4	-5,883.2
	(190.48)	(22,714.6)	(22,585.5)	(22,635.6)
University	45.05	5,821.5	2,699.9	3,198.7
	(131.47)	(15,317.8)	(15,277.2)	(15,622.2)
Targetkusd	2.05***	352.3***	342.8***	340.8***
	(0.56)	(66.1)	(65.6)	(66.6)
Language variables				
Positiveness	17.57		1,382.3	1,313.1
	(13.22)		(1,141.1)	(1,571.5)
PositivenessSquared	0.25			15.8
	(0.82)			(97.1)
Innovativeness	308.41***		6,988.8	22,896.8**
	(88.00)		(5,985.2)	(10,457.1)
InnovativenessSquared	-63.27***			-4,773.7*
	(22.12)			(2,628.1)
Supplication	-31.54		2,101.0	1,061.2
	(26.81)		(2,292.4)	(3,186.9)
SupplicationSquared	2.08			71.9
	(1.41)			(167.9)
Constant	-525.89	-101,895.9*	-75,952.9	-63,565.6
	(532.89)	(61,356.2)	(62,373.2)	(63,324.1)
Observations	221	221	221	221
VIF	13.90	13.36	13.60	13.90
R-squared	0.392	0.278	0.303	0.315

This table presents the results of the logit (Models 1, 2 and 3) and pooled OLS regression models (Models 4, 5, 6, 7, 8 and 9) to examine the effect of impression management strategies used in crowdfunding project descriptions on project success. Results for category dummies are not included and available upon request. Pseudo R-squared values are reported for logit models. Standard errors are in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Figure 8 Plots of impression management variables
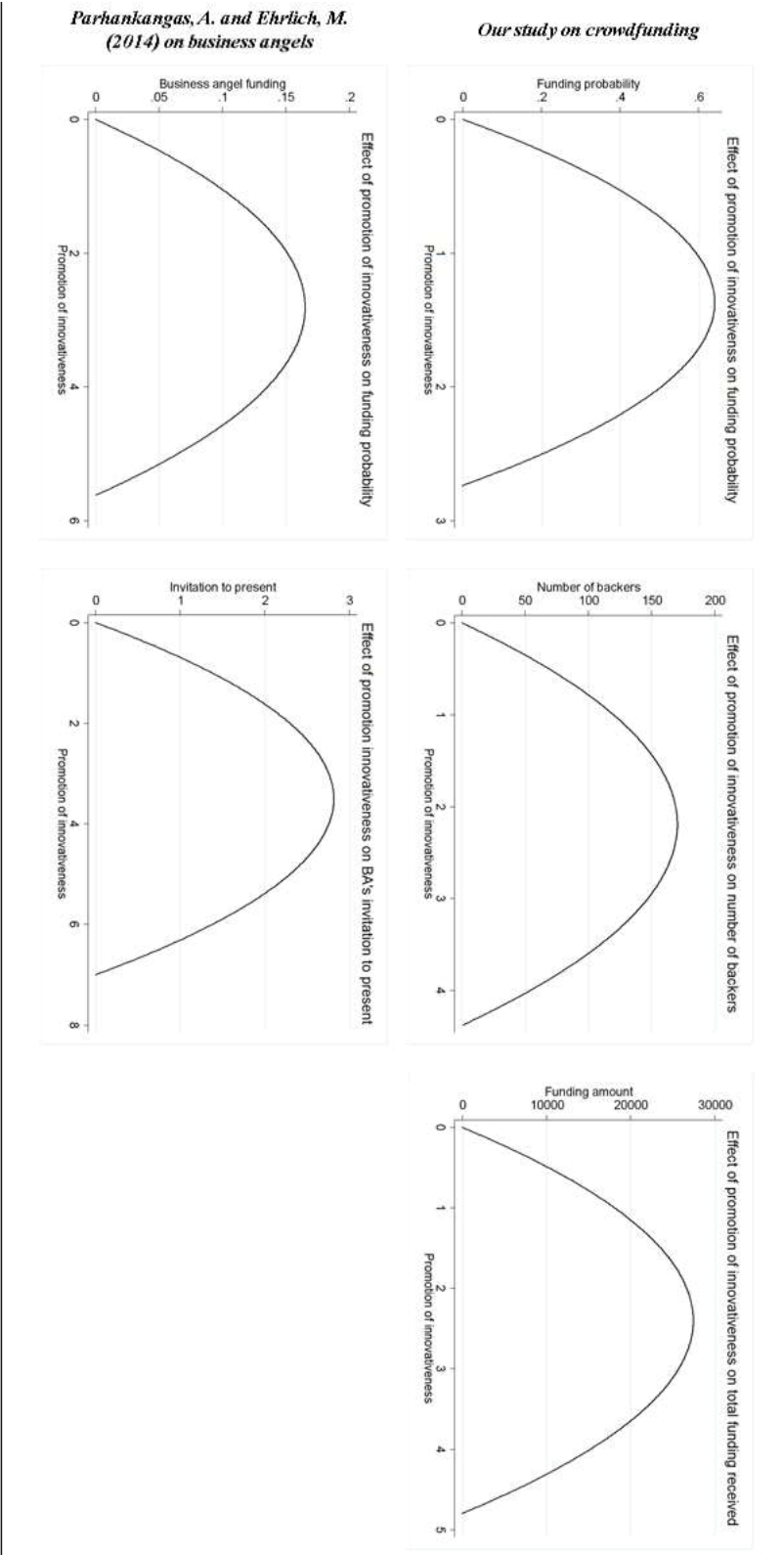
Parhankangas and Ehrlich (2014) find a similar turning point at a word count of 2.8 for business angels and confirm an inverted U-shaped relation between Innovativeness and funding probability, also depicted in Figure 8. Thus, business angels perceive the novelty of a project as particularly important for their funding decision. They therefore attach slightly more relevance to the innovativeness of a project's concept than crowdfunders do when comparing the turning points of the word counts. Furthermore, the low optimal turning points for both crowdfunders and business angels serve as evidence of entrepreneurs' need to strike a delicate balance between solely describing the innovations of a project with humility, on the one hand, and the exaggerated promotion of visionary and revolutionary potentials, on the other.

To gain detailed insight into the effect of impression management strategies, we also examine the effect of language patterns on the number of backers and the total funding received. Considering Model 6, we find similar results compared to those in Model 3. For Innovativeness, the results again exhibit an inverted U-shaped relation (see also Figure 2). The higher the level of innovative and creative characteristics during a project's promotion, the higher the number of project backers. Furthermore, we find the same effect when taking into account the total amount raised in Model 9, which is also plotted in Figure 8 to better illustrate the inverted U-shaped relation. Our results show that words referring to creativity and novelty positively affect the pledged amount of money up to a certain point where this effect turns negative. Since the U-shaped relation between Innovativeness and funding success can be found in each model, we can verify H2.

The results of the examination of supplication behavior do not provide any significant outcomes and two potential explanations for this are proposed. First, we are not able to find significant results due to the relatively small number of observations. We use a data set of 221 crowdfunding campaigns for our econometric approaches, which might hamper our efforts to gain significant outcomes. Thus, an examination of language patterns by focusing on supplication behaviors with a large data set could be a promising direction for future research. Second, there might indeed be no effect for supplication behavior on crowdfunding success, which again indicates different investment behaviors between crowdfunders and traditional financiers; for example, business angels prefer modest levels of supplication behavior (Parhankangas and Ehrlich, 2014). However, this would be a surprising outcome, since there is no evidence in the previous literature that somewhat justifies the entirely indifferent attitude of crowdfunders toward supplication.

6.5   Discussion and conclusion

Internet-based crowdfunding, as an alternative financing source, has recently emerged to raise funds for various types of projects (Belleflamme et al., 2014). Crowdfunding projects are presented on funding platforms where investors are able to provide funding. However, only little is known about how projects can effectively be presented to convince the crowd to provide capital (Kuppuswamy and Bayus, 2014). In this study, we gain a deeper understanding of whether crowdfunders perceive certain language patterns in project descriptions to the benefit of their funding decision. We conduct the first empirical examination of impression management tactics in descriptions of crowdfunding campaigns and their perceptions of crowdfunders based on an empirically validated model (Bolino and Turnley, 1999). In addition, we use previous evidence to compare crowdfunders and business angels, as well as drawing thereof practical implications for entrepreneurs seeking financing on crowdfunding platforms.

For our study, we used the data of 221 Kickstarter projects and a total of 195,217 words embedded in their campaign descriptions. We find strong evidence that the promotion of a project's innovative aspects increases the likelihood of convincing the crowd to provide funding. This relation holds up to a certain point, where this promotional effect reverses and decreases the likelihood of funding success. This reversal is due to the fact that the crowd particularly aims to support innovative ideas but fears high levels of innovative potential, which might violate accepted conventions and create resistance. Overall, we were able to establish that certain language patterns, operationalized by impression management strategies, are a determinant of crowdfunding success. From a practical perspective, our results help entrepreneurs to effectively communicate their determination in the success of their crowdfunding project by striking a balance between emphasizing the project's innovativeness and its appeal to convention, likely an important factor in impression management tactics and its applicability to crowdfunding.

This study extends the previous research in several aspects. First, it contributes to the impression management literature by differing from studies that examine the reactions of investors evoked by phrase structures in project descriptions (e.g., Mitra and Gilbert, 2014; Tirdatov, 2014). Instead, we are interested in the receptivity to impressions of competence, innovativeness, and vulnerability created by the entrepreneurs' language in the project descriptions. Hence, we contribute to the literature on impression management

theory by revealing how entrepreneurs can purposefully communicate and demonstrate their confidence while providing relevant information about the crowdfunding campaign with certain impression management tactics. Therewith, we particularly follow the advice of Allison et al. (2015) to shed light on impression management in reward-based crowdfunding environments. Second, this study adds to previous entrepreneurial finance theory by examining the behavior of crowdfunders. Little is known about the decision making process of crowdfunders and how they can be distinguished from traditional financiers, such as business angels (Macht and Weatherston, 2014). The literature suggests that these traditional financiers have developed exceptional skills in assessing entrepreneurial projects (Gompers and Lerner, 2001). In contrast, crowdfunders seldom have such a profile. Nonetheless, crowdfunders are able to select promising crowdfunding campaigns and provide funding. A comparison of crowdfunders and business angels with regard to impression management strategies will help to gain a better understanding of how they make funding decisions.

This study has certain limitations and we encourage further research on the topics. We do not have information about the crowdfunders. It might be interesting to know how our results vary for funders with different characteristics, such as investment experience. Furthermore, it might be interesting to know more about the technical terms and colloquial speech in project descriptions. In our research context, we were not able to implement these factors, since, to our knowledge, there is no valid and reliable approach to apply impression management strategies on technical terms and colloquial speech. Additionally, our sample size is relatively small as shown in Section 6.3, and therefore leaves room for future improvements. Finally, our study is limited in its analysis of written descriptions of crowdfunding projects. This restricts the applicability of impression management tactics, since an examination of the language used in videos presenting the crowdfunding projects might be particularly beneficial for further research.

We draw upon the literature on impression management theory and crowdfunding and portray the perceptions of crowdfunders in response to language patterns related to certain impression management tactics. We test our hypotheses within the context of a valid and reliable econometric model with data on reward-based crowdfunding campaigns. We demonstrate that crowdfunders prefer high levels of positive language patterns and moderate levels of innovativeness promotion. For entrepreneurship research, our results suggest that certain impression management tactics directed at crowdfunders indeed have

an effect on crowdfunding success. For entrepreneurs, this study provides information of how they should communicate their confidence in the future success of their crowdfunding campaign and how to reveal their weaknesses and vulnerabilities.

7 Final remarks

7.1 Conclusion

A major question in entrepreneurship research is what financial resources new ventures use and why some firms are more likely to access funding (Cassar, 2004). New ventures' financial decisions, regarding whether to use debt and/or equity capital, has shown to affect survival and firm growth (Shane and Venkataraman, 2000). While research on entrepreneurial finance has been increasing in the last decades, we still have a limited understanding of new venture financing (Cassar, 2004). Therefore, this dissertation comprehensively examines research gaps of important financing sources for entrepreneurs, debt capital, public policy, venture capitalists and crowdfunding, to examine current issues and open up new possibilities for future research.

This dissertation shows, for debt capital, new ventures are not likely to use bank loans to fund R&D, mainly due to the rigidity of debt contract and a high perception of uncertainty (Hall and Lerner, 2010; Huang and Xu, 1999). New ventures are likely to use debt capital to finance human capital accumulation, because banks usually provide funding at lower required returns, when the perceived human capital value is or will be high (Scherr et al., 1993). Furthermore, my results show that debt financed human capital accumulation has a positive effect on business success, which is in line with the results of previous studies (Hunter, 1986; Unger et al., 2011).

When considering banks' lending decision determinants, this dissertation reveals subsidy grants can decrease information asymmetries between new ventures and banks to the benefit of new ventures. The certification effect through subsidy receipt is particularly strong for new ventures of information-opaque industries. A subsidy receipt has a positive effect on access to bank loans for high-tech manufacturing and knowledge-intensive service new ventures. This underlines the important role of subsidies not only in providing a direct financing effect, but also by serving as a quality signal for future debt capital providers. It is relevant to mention, however, the effect of subsidy receipt might only function that way if the governmental initiatives fulfill the conditions of selectivity and credibility.

Not only does a subsidy receipt serve as a quality certificate for banks, but also for venture capitalists when making an investment decision. This dissertation illustrates that cross-

national subsidies have the strongest certification effect in reducing information asymmetries between subsidized new ventures and venture capitalists. Reasons for this finding might be that, first, cross-national subsidies are mainly awarded to new ventures with expected cross-border spillovers, i.e., high growth potential, and, second, the awarding procedure is highly competitive due to the vast catchment area of potential subsidy awardees. When considering national subsidy grants, no significant results can be found. However, sub-national or regional grants have indeed a positive impact on venture capital funding, because network ties are particularly strong on regional level and local government agencies can use these ties for appropriately assessing new ventures.

Determinants for venture capital funding are of fundamental interest in entrepreneurial finance research. Besides certificates provided by institutions and authorities, which might increase the probability of venture capital funding, characteristics of the entrepreneurs are imperative for a funding decision (e.g., Smallbone et al. 2003; Marlow and Patton 2005). This dissertation shows evidence of a gender bias when accessing venture capital. Female founders exhibit significantly lower volumes of received funding sums. Contrary to our expectations, higher education cannot bridge this gender gap and leads to even more pronounced differences between male and female entrepreneurs.

There are different types of external equity providers for new ventures. Recently, equity-crowdfunding emerged as alternative funding sources for new ventures, but the question of how and why only certain entrepreneurial projects receive funding has not been fully answered. By focusing on impression management tactics in campaign descriptions, this dissertation shows that promotion of a project's innovative aspects increases the probability of convincing crowdfunders to provide equity funding. This relation holds up to a certain point, where this effect reverses and decreases the probability of funding success. As an explanatory approach, I suggest the crowd particularly aims to support innovative ideas but fears extreme levels of innovative potential, which might infringe accepted conventions and create social resistance. It is overall shown that only certain language patterns are determinants of crowdfunding success.

7.2   Discussion and implications

This dissertation adds to the literature in several ways. Chapter 2 contributes to the literature on the relevance of allocation strategies of financial debt for the survival of new ventures. Since debt has received only limited attention in previous academic studies on this relation (Berger and Udell, 1998), I focus on this important financing source for new ventures. The results imply that debt capital does not, per se, increase survival and growth prospects. Rather, only debt-backed funding of human capital positively affects the probability of entrepreneurial survival, while debt-backed funding of R&D leads to the opposite effect. Those results are to my knowledge the first attempt to unlock the black box of how debt capital must be allocated from intra-firm perspective for new ventures and enables future research to build upon these results by shedding light on a more detailed and diverse way. Furthermore, practitioners are recommended to apply my findings since they can positively affect business strategy and new ventures' success. In line with these implications mentioned before, this dissertation adds to previous studies on a resource-based perspective on entrepreneurial survival. Financial debt can increase specific human capital resources of new ventures, necessary to develop a unique product or service and thus a competitive advantage. On the contrary, the use of financial debt on R&D projects hampers entrepreneurial survival and an applicable competitive advantage.

Chapter 3 contributes to the literature on the relevance of public finance to close the funding gap of new ventures. It highlights a certification effect for new information-opaque ventures through subsidy receipt and the ensuing decrease of information asymmetries between new ventures and banks. This is valuable information, particularly for entrepreneurs, who can kill two birds with one stone when trying to close the funding gap. Subsidy grants not only provide new ventures with non-refundable cash injections, but also ease future access to debt capital. In addition, this dissertation contributes to the entrepreneurial finance literature similarly as Chapter 2. Important insights can be shown from an industry-specific perspective on factors that impact the likelihood of receiving debt finance. This might help entrepreneurs to better assess and even increase their chances of gaining access to bank loans.

The following Chapter 4 extends to previous literature on subsidy financing by revealing that government grants from cross-national authorities convey value-added information. Therefore, new ventures should try to receive cross-national subsidies, e.g., awarded by

EU authorities, which can reduce information asymmetries between new ventures and venture capitalists to an extent greater than subsidies awarded by national authorities. On the contrary, this dissertation can also show that spatial proximity can positively affect the subsidies' certification function. This means new ventures can also try to use strong local network ties to gain access to regional subsidy grants. Those regional subsidies also reduce information asymmetries between new ventures and venture capitalists to an extent greater than subsidies awarded by national authorities. Furthermore, I contribute to previous literature on venture capital funding literature, since my dissertation reveals that venture capitalists particularly use cross-national and sub-national grants by providing them with positive value-added information about the NTBF.

Chapter 5 contributes by considering the entrepreneur's characteristics, and particularly the founder's gender and educational background, as important investment determinants of venture capitalists. I emphasize that higher education cannot bridge a gendered funding gap and, instead, leads to even more pronounced differences between male and female entrepreneurs. A possible explanation might be that venture capitalists subconsciously discriminate against women by valuing their university degree less than those of men. Overall, this result for a German research context might help, for instance, the German government, which has to find effective solutions or provide incentives to close or at least scale down the gender funding gap. In line with that, future research should follow a qualitative research approach with in-depth interviews with venture capitalists to further explain our results.

Last, Chapter 6 extends previous research on crowdfunding in several aspects. First, this Chapter contributes to the literature on impression management theory by revealing how entrepreneurs can successfully communicate and demonstrate their confidence while providing necessary information about a crowdfunding campaign. Particularly, I point out that entrepreneurs must strike a delicate balance when describing the innovativeness of their business idea. Second, this dissertation adds to previous entrepreneurial finance research by examining the behavior of crowdfunders. Little is known about the decision making process of crowdfunders and how they can be distinguished from business angels (Macht and Weatherston, 2014). I show that certain impression management tactics directed at crowdfunders and business angels indeed have a similar effect on funding success, whereas other tactics, such as positive language patterns, have only an impact for business angels' funding decisions.

7.3   Limitations and future research

Despite the contributions of this dissertation, I am aware that several questions remain, which offer promising avenues for future research. Chapter 2 focuses only on three dimensions of the allocation of financial debt. However, new ventures face more complex investment decisions in day-to-day practice, which is why a more diverse theoretical approach should be applied to gain a detailed understanding of intra-organizational debt allocation and its effect on business survival. Another issue concerns the econometric approach. Unobserved heterogeneity is included only in parametric duration models, but not in semiparametric models (Strotmann, 2007), which limits the generalizability of the findings. Therefore, an advanced parametric duration analysis might be fruitful for future research by including unobserved heterogeneity, even though I conducted robustness checks, which highlight the basic stability of the findings. Furthermore, endogeneity could remain a problem in the second step of our hierarchical approach because business survival is dependent upon both observed as well as unobserved determinants. Unfortunately, the methodology could not be operationalized properly to conduct IV regression models or a matching procedure for the second step.

In Chapter 3, the data set cannot differentiate between new ventures that did not access a bank loan and new ventures rejected within the loan assessment procedure. Additionally, there could be substantial heterogeneity within different government initiatives that future research could aim to examine in more detail. In this line, I encourage more research on the certification value of public subsidies in other institutional contexts and for other types of firms.

When considering Chapter 4, similar to the limitations mentioned for Chapter 3, it might be interesting to take into account new ventures that applied for certain government initiatives, but have been rejected within the application procedure. I believe that this approach would help to gain a deeper understanding of subsidies' certification. Furthermore, this Chapter suffers from an econometrical limitation, as the matching procedure only controls for the selection on observables. Consequently, I have to assume to observe all important factors for subsidy receipt, which does not reflect reality. I recommend future research to employ econometrical approaches that tackle this issue.

For Chapter 5, I encourage further research on the selection procedure of male and female founders trying to access venture capital. Future research should check for entrepreneurs, who applied for venture capital, but were rejected by venture capitalists. It could be interesting to compare this group of new ventures and their financing sources with similar, but venture capital-backed new ventures from a gendered perspective. Furthermore, an in-depth examination of the investment determinants of venture capitalists remains to be conducted. More insight into the functionality, interaction, and development of decision making determinants from a gendered perspective would be beneficial in explaining the gender funding gap.

Last, Chapter 6 focuses only on information about the entrepreneurs and their crowdfunding projects. Data on characteristics of crowdfunders was not available. Future research might examine, whether the results of this dissertation vary for funders with different characteristics, such as investment experience. Furthermore, in the research context of Chapter 6, this dissertation was not able to control for technical terms and colloquial speech in project descriptions, since to our knowledge, there is no valid and reliable approach to apply impression management strategies on this issue. A study, which is able to examine the effect on technical terms and colloquial speech in project descriptions, would add to the understanding of the perception of language in crowdfunding campaigns and its relation to funding success. Finally, Chapter 6 is limited to an analysis of written descriptions of crowdfunding projects. Many crowdfunding campaigns use videos to better present themselves, which is why an examination of the language used in videos might be particularly fruitful for future research.

We know that entrepreneurial finance topics are diverse and complex, which is why most studies focus on, at most, one of these topics at one time (Cumming, 2012). However, this dissertation has uncovered cross-connections and examined current issues on entrepreneurial finance. For instance, little has been known about the decision making process of crowdfunders and how they can be distinguished from traditional financiers, such as business angels (Macht and Weatherston, 2014). This dissertation exposes a resemblance in the perception of impression management strategies between crowdfunders and business angels. This comparison has helped to gain a better understanding of how they make funding decisions. Therefore, my results emphasize the relevance and necessity for simultaneous research on multiple financing sources to uncover and understand still unknown, but economically relevant, cross-connections and

similarities. I suggest this to be a promising way for future research, because not losing sight of the bigger picture might enable us to gain entirely new perspectives and new insights into the world of entrepreneurial finance.

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Appendix

Table A.1 Applicability of the instrument variable approach

Dependent variable	Instrument variable	Applicability of instrument variables
DSubsidy (For high-tech new ventures)	*IndustryR&D*	*Highly correlated with x_i:* R&D is a major determinant for the innovativeness of young firms. Government agencies 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.
	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)	*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.
	Universities	*Highly correlated with x_i:* Large numbers of subsidies are particularly suited for students or scientific business projects. Therefore, government agencies might be more actively granting subsidies in areas, where large numbers of universities are located.
		Weak correlation with u_i: Banks focus on profitability figures while reaching an investment decision. The numbers of universities in an administrative district are less important for debt providers.
DSubsidy (For knowledge-intensive service new ventures)	*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.
	HouseholdIncome	*Highly correlated with x_i:* Subsidies aim to support young companies situated in underdeveloped areas.
		Weak correlation with u_i: Banks' investment decisions are based upon the generation/availability of revenue, profit, and securities.
DSubsidy (For other new service ventures)	*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.
	NewState	*Highly correlated with x_i:* The German government tends to focus its economic-developmental subsidy support on the so-called "neue Länder", which are five federal states of the former German Democratic Republic. They can be illustrate by the Solidary Law and tax subsidies for the eastern prats of Germany.
		Weak correlation with u_i: Banks focus on profitability figures while reaching an investment decision. The location of whether a new ventures is located in eastern or western parts of Germany is a subordinate factor.

Table A.2 Probit regression results for propensity score matching

	Model 1	Model 2	Model 3	Model 4
	Effects for high-tech industry	Effects for low-tech industry	Effects for knowledge-intensive service new ventures	Effects for non-knowledge-intensive service new ventures
Gender	0.007	-0.233***	0.045	0.111**
	(0.078)	(0.086)	(0.088)	(0.054)
Educ	0.218***	-0.175**	-0.034	-0.161***
	(0.058)	(0.080)	(0.060)	(0.062)
Exp	0.0003	-0.003	-0.0002	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)
Capacity	0.004***	0.005***	0.003***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Age	-0.045**	-0.185***	-0.148***	-0.209***
	(0.018)	(0.017)	(0.019)	(0.018)
Profit	-0.114*	0.072	-0.104*	-0.083
	(0.063)	(0.061)	(0.063)	(0.053)
lnRevenue	0.020***	0.014	0.0251***	0.029***
	(0.007)	(0.010)	(0.009)	(0.008)
lnTangibleAssets	-0.007	-0.006	-0.001	-0.020***
	(0.006)	(0.006)	(0.006)	(0.005)
Patents	-0.008	0.004	-0.012	-0.051
	(0.011)	(0.012)	(0.013)	(0.066)
DEquityFinance	0.136	0.107	-0.095	-0.495***
	(0.100)	(0.162)	(0.129)	(0.181)
HighTechEmployees	-0.009**	-0.009**	-0.010**	-0.008**
	(0.004)	(0.004)	(0.005)	(0.004)
ForestArea	0.003	-0.001	0.001	-0.006***
	(0.002)	(0.002)	(0.002)	(0.002)
Constant	-1.103***	-0.358**	-0.686***	-0.478***
	(0.132)	(0.145)	(0.135)	(0.129)
Observations	2,437	2,512	2,448	3,417

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. Standard errors are reported in parentheses. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Table A.3 Analysis after removing predictors which suffer from multicollinearity

Variables	*Logit* Model 1: Funding	*Logit* Model 2: Funding	*Logit* Model 3: Funding	*OLS* Model 4: Backers	*OLS* Model 5: Backers
Control variables					
Pictures	1.100**	0.815	0.719	551.9***	446.5***
	(0.537)	(0.571)	(0.592)	(165.0)	(170.1)
Video	1.127**	0.862*	0.878*	566.2***	450.7***
	(0.456)	(0.491)	(0.509)	(146.2)	(152.5)
Male	0.0982	0.129	0.0326	30.90	44.11
	(0.406)	(0.413)	(0.429)	(137.7)	(135.9)
Team	0.0548	0.0106	0.0142	157.8	128.4
	(0.377)	(0.382)	(0.395)	(122.9)	(121.5)
WorkExp				-44.00	-89.53
				(194.1)	(192.0)
University	0.329	0.303	0.354	126.6	84.79
	(0.401)	(0.410)	(0.431)	(119.8)	(119.5)
Targetkusd	0.00194	0.00179	0.00148	2.219***	2.138***
	(0.00167)	(0.00182)	(0.00187)	(0.568)	(0.561)
DCat_Art	-0.403	-0.101	-0.302		
	(1.031)	(1.178)	(1.355)		
DCat_Comics	-0.0230	0.313	0.216	1,961***	1,997***
	(1.419)	(1.545)	(1.740)	(398.6)	(393.0)
DCat_Cooking	-0.289	-0.0614	-0.216	588.5**	558.6**
	(1.176)	(1.289)	(1.508)	(265.0)	(261.5)
DCat_Crafts	0.767	1.050	1.005		
	(1.072)	(1.203)	(1.386)		
DCat_Design				-729.9	-721.4
				(777.0)	(767.3)
DCat_Fashion	0.0954	0.376	0.124	-274.3	-280.9
	(1.095)	(1.228)	(1.421)	(223.9)	(220.7)
DCat_Film	1.397	1.998	2.048	-565.8*	-405.9
	(1.478)	(1.595)	(1.707)	(332.6)	(334.7)
DCat_Food	0.631	0.999	1.277	-451.8	-406.8
	(1.587)	(1.643)	(1.823)	(456.8)	(454.0)
DCat_Games	-2.480**	-2.272*	-2.345	-548.4***	-584.1***
	(1.145)	(1.251)	(1.430)	(192.1)	(189.8)
DCat_Journalism	-1.790	-1.330	-1.521	-244.1	-188.0
	(1.464)	(1.573)	(1.703)	(307.2)	(303.8)
DCat_Music	-0.413	-0.188	-0.214		
	(1.123)	(1.275)	(1.493)		
DCat_Publishing	-1.523	-1.327	-1.466	-307.7	-326.5
	(1.254)	(1.384)	(1.582)	(249.3)	(246.7)
DCat_Tech	-1.889*	-1.642	-1.811	-349.9*	-386.7**
	(1.106)	(1.205)	(1.414)	(194.8)	(194.6)
DCat_Theater				-10.66	-269.5
				(364.0)	(381.7)
Language variables					
Positiveness		0.0417	0.0455		16.12*
		(0.0311)	(0.0440)		(9.674)
PositivenessSquared			0.000954		
			(0.00286)		
Innovativeness		0.0410	0.638**		93.57
		(0.158)	(0.298)		(50.63)
InnovativenessSquared			-0.190**		
			(0.0929)		
Supplication		-0.00858	-0.145		-3.578
		(0.0586)	(0.0931)		(19.48)
SupplicationSquared			0.0236		
			(0.0167)		
Constant	-2.136*	-1.975	-1.798	-654.7***	-406.8
	(1.294)	(1.400)	(1.731)	(251.0)	(265.7)
Observations	221	221	221	221	221
VIF	7.43	8.30	8.77	1.75	1.96
R-squared	0.159	0.168	0.200	0.324	0.353

Table A.3 Analysis after removing predictors which suffer from multicollinearity (continued)

Variables	OLS Model 6: Backers	OLS Model 7: Amountraised	OLS Model 8: Amountraised	OLS Model 9: Amountraised
Control variables				
Pictures	405.9**	56,942***	44,837**	42,045**
	(167.2)	(19,154)	(19,859)	(19,878)
Video	455.5***	51,400***	37,660**	38,007**
	(149.6)	(16,969)	(17,805)	(17,789)
Male	33.30	15,201	17,055	16,468
	(135.8)	(15,982)	(15,864)	(16,144)
Team	88.39	21,687	18,709	15,520
	(120.4)	(14,257)	(14,184)	(14,321)
WorkExp	-114.2	113.8	-4,802	-6,762
	(189.0)	(22,527)	(22,417)	(22,468)
University	91.32	12,734	9,750	9,436
	(118.8)	(13,908)	(13,947)	(14,129)
Targetkusd	2.060***	354.6***	346.1***	342.4***
	(0.558)	(65.93)	(65.53)	(66.40)
DCat_Art				
DCat_Comics	1,990***	36,191	40,902	41,077
	(385.1)	(46,256)	(45,874)	(45,790)
DCat_Cooking	533.2**	51,998*	47,980	45,275
	(257.8)	(30,753)	(30,521)	(30,648)
DCat_Crafts				
DCat_Design	-897.6	-79,773	-71,795	-82,582
	(754.9)	(90,167)	(89,569)	(89,765)
DCat_Fashion	-314.0	-47,130*	-48,710*	-51,610**
	(217.3)	(25,987)	(25,769)	(25,836)
DCat_Film	-356.9	-61,051	-46,973	-44,279
	(331.1)	(38,594)	(39,075)	(39,373)
DCat_Food	-304.7	-33,772	-36,870	-32,321
	(448.5)	(53,006)	(52,994)	(53,333)
DCat_Games	-521.0***	-75,178***	-79,537***	-75,286***
	(186.9)	(22,290)	(22,158)	(22,221)
DCat_Journalism	-195.7	-36,392	-30,786	-31,214
	(297.7)	(35,652)	(35,468)	(35,402)
DCat_Music				
DCat_Publishing	-306.3	-34,683	-36,878	-35,715
	(241.9)	(28,933)	(28,795)	(28,761)
DCat_Tech	-393.9**	-9,959	-15,768	-17,241
	(191.6)	(22,602)	(22,717)	(22,779)
DCat_Theater	-301.8	-5,085	-39,754	-33,951
	(425.4)	(42,242)	(44,553)	(50,587)
Language variables				
Positiveness	16.44		1,275	1,155
	(12.89)		(1,129)	(1,532)
PositivenessSquared	0.319			24.90
	(0.800)			(95.16)
Innovativeness	315.8***		7,329	23,906**
	(86.76)		(5,910)	(10,316)
InnovativenessSquared	-64.78***			-4,976*
	(21.98)			(2,614)
Supplication	-32.78		2,092	904.1
	(26.55)		(2,274)	(3,157)
SupplicationSquared	2.184			85.38
	(1.405)			(167.1)
Constant	-295.8	-78,467***	-51,043	-41,312
	(279.2)	(29,133)	(31,017)	(33,199)
Observations	221	221	221	221
VIF	3.95	1.75	1.96	3.95
R-squared	0.389	0.273	0.297	0.311