UNIVERSITÄT TRIER

The Role of Venture Debt in Entrepreneurial Finance

DISSERTATION

vom Fachbereich IV – Wirtschafts- und Sozialwissenschaften der Universität Trier zur Verleihung des akademischen Grades eines Doktors der Wirtschaftswissenschaften (Dr. rer. pol.) genehmigte Dissertation.

vorgelegt von

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Eingereicht am: 12.05.2023
Disputation am: 19.07.2023

Preface

Is it even sensible to pursue a doctoral degree in business administration nowadays? With this question, I confronted myself at the end of the work on my master's thesis in 2019. There are so many paths to take and so many opportunities that open up after finally graduating. Do you really want to go down the road of a dissertation where you are faced with an uncertain outcome that can highly influence your potential future development path? It was a difficult decision process where I searched for a lot of additional input from fellow students, lecturers, former working colleagues, and family members. In the end, I chose to start this exciting journey to work on the very fascinating topic of venture debt funding. This dissertation is the result of the past 3 years working in that research field.

A dissertation is an overarching challenge and my dissertation could not have been realized without the help of my supervisors, my colleagues, my family and friends. I would like to take this opportunity to thank those who helped and accompanied me during this journey.

First of all, I would like to thank my doctoral supervisor Prof. Dr. Jörn H. Block who allowed me to start this whole project. Thank you for your straightforwardness and pragmatic leadership! I benefitted greatly from the joy that you connect with academic research, your ideas, and your perspectives. The mixture of determination to achieve the final goals and still open up the freedom to shape the path to the destination has always been meaningful and of great joy to me! You always came up with new fascinating challenges that helped me to develop further and made the time fly by. There are only a few professors with whom I would have agreed to start working in academia and I am convinced that numerous future doctoral students will benefit greatly from you as well.

Second, I would like to thank Prof. Dr. Alexandra Moritz who also supervised my dissertation as well as my master's thesis. Before you asked me whether I could imagine pursuing a PhD, I would have never seriously thought of doing so. Thank you for opening up this possibility and for your ongoing support and friendship throughout the last few years. It has always been a pleasure for me to exchange both work-related and personal matters with you.

Third, I would like to thank Prof. Dr. Jeffrey S. Petty for becoming my supervisor and providing me with helpful insights. Your course of life being a venture capital investor and turning into a highly reputable Professor is inspiring. Thank you for being part of this project and mirroring my life choices with me! You brought me a lot of joy with your great sense of humor.

In addition, I would like to thank all of my friends and colleagues from Trier University. First, I would like to thank Dr. Marcus Batkiewicz for the joyful time we had in the office and outside of the University. Second, I would like to thank Tom Willeke for your support in making patent data available for all our research projects.

Many more colleagues from our chair and other chairs contributed significantly to this work. Therefore, I want to say thank you to Adrian Schütz, Anna Schulze, Aziz Haxhijaj, Barbara Marquart, Charlotte Trillhaas, Christian Brandstetter, Prof. Dr. Christian Fisch, Dr. Christopher Hansen, Claudia Kurz, Darius Lambrecht, Fuad Morina, Dr. Holger Steinmetz, Jasmin Waziro, Joey Cheng, Lena Benz, Lilian Schweigstill, Lisa Theobald, Lovis Weiland, Matthias Johann, Miriam Gnad, Dr. Mirko Hirschmann, Natalie Welch, Patrick Schwarz, Paulina Schneider, Reza Fathollahi, Solvej Lorenzen, Valerie Sack, Victoria Orth, and Dr. Walter Diegel. Working with you has always been a great pleasure and I am sure we will stay in touch in the future. Finally, I would like to thank all the other colleagues with whom I worked in the past years at Trier University and outside.

In addition, I would like to thank my whole family for always supporting me throughout my life choices. It would have not been possible without your continuous efforts in the background to help me realize this path.

Many more friends and other companions accompanied me throughout the last years and made it possible to finish this work. Thank all of you for being part of my life and I am looking forward to what the future might bring for us!

In the end, I am cheerful to have pursued a doctoral degree and today I can say this path was one worth taking. It opened up an exciting new journey and I cannot wait until it finally starts.

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List of Abbreviations

B. Arts	Bachelor of arts
Bn	Billion
B. Sc.	Bachelor of science
CEO	Chief executive officer
CFO	Chief financial officer
E.g.	Exempli gratia (for example)
EIB	European Investment Bank
Et al.	Et alii (and others)
Etc.	Et cetera (and so on)
EU	European Union
I.e.	Id est (that is)
IRR	Internal rate of return
M	Million
MBA	Master of business administration
Misc.	Miscellaneous
M. Sc.	Master of science
N.a.	Not available
PhD	Doctor of Philosophy
RQ	Research question
SMEs	Small and medium-sized enterprises
US	United States
VC	Venture capital
VD	Venture debt

z.B.	Zum Beispiel
σ	Standard deviation

Zusammenfassung

Startups sind wesentliche Akteure für die Entwicklung von Volkswirtschaften und der kreativen Zerstörung etablierter Marktbedingungen zum Nutzen einer effektiveren und effizienteren Wirtschaft. Ihre Bedeutung zeigt sich darin, dass sie Innovationen und technologische Fortschritte vorantreiben, neue Arbeitsplätze schaffen, zum Wirtschaftswachstum beitragen und den Wettbewerb und die Markteffizienz steigern. Um ihre Rolle erfüllen zu können, benötigen Startups Zugang zu ausreichenden finanziellen Ressourcen. Aufgrund ihrer Neuheit und ihrer geringen Größe ist der Zugang zu externen Finanzmitteln für Startups oft schwierig. Obwohl Startups von hoher praktischer Relevanz sind, ist die akademische Forschung erst vergleichsweise spät auf die Startup-Finanzierung als Untersuchungsgegenstand aufmerksam geworden. Mit dem Aufkommen von Venture Capital begann die akademische Forschung die Bedeutung der Finanzierung von Unternehmensgründungen hervorzuheben und Entrepreneurial Finance entwickelte sich in den letzten drei Jahrzehnten zu einem neuen Forschungsgebiet. Die bisherige Forschung zur Startup-Finanzierung untersucht unter anderem die Kapitalstruktur von Startups, verschiedene Finanzierungsinstrumente, das Finanzierungsumfeld in bestimmten Regionen und die Auswahlkriterien für Investoren. Meine Dissertation leistet einen Beitrag zu diesem Forschungsbereich, indem sie das immer wichtiger werdende Finanzierungsinstrument von Venture Debt untersucht. Bisherige Forschungen zu Venture Debt haben lediglich das Geschäftsmodell von Venture Debt (z.B. Hesse et al., 2016), das Konzept von Venture Debt (Ibrahim, 2010), die Auswahlkriterien von Venture Debt-Anbietern (z.B. de Rassenfosse & Fischer, 2016) und die Rolle von Patenten im Auswahlprozess der Venture Debt-Anbietern (z.B.

Hochberg et al., 2018) untersucht. Auf der Grundlage qualitativer und quantitativer Methoden skizziert die Dissertation die Entstehung von Venture Debt in Europa sowie die Auswirkungen von Venture Debt auf Startups, um ein besseres Verständnis von Venture Debt zu ermöglichen.

Zunächst werden in Kapitel 2 Venture Debt als neues Finanzierungsinstrument vorgestellt und Venture Debt von Venture Capital, Bankkrediten und anderen privaten Fremdkapitalstrategien abgegrenzt.

In Kapitel 3 wird der Frage nachgegangen, warum und wie Venture Debt in Europa entstanden ist. Auf der Grundlage von 28 Interviews mit Venture Debt-Anbietern, Unternehmern und Venture Capital Investoren zeigt dieses Kapitel, dass die einzigartige "Venture Debt Anbieter Persönlichkeit" und die "Venture Debt-Unternehmerchance" erklären können, wie Venture Debt in Europa entstanden ist. Die Ergebnisse zeigen, dass Venture Debt auf der Grundlage einer "Kirznerschen" unternehmerischen Chance entstanden ist. Im Detail, durch die Einführung von disruptiven Startupfinanzierungsinstrumenten (z.B. Venture Capital) und Regulierungen (z.B. Basel III) wurde der Markt zur Startupfinanzierung in ein Ungleichgewicht geführt und Finanzierungslücken sind entstanden. Venture Debt Anbieter haben dieses Ungleichgewicht identifiziert und tragen dazu bei die entstandenen Finanzierungslücken zu schließen.

Drittens wird in Kapitel 4 auf der Grundlage desselben Interview-Datensatzes die Auswirkung von Venture Debt auf Unternehmensgründungen untersucht. Das Kapitel zeigt, wie Venture Debt Startups durch stärkere (finanzielle) Disziplin, Handlungsfreiheit, Zeit bis zur Finanzierung, Zertifizierungseffekte und andere wertschöpfende Praktiken beeinflussen. Die Auswirkungen zeigen verschiedene Wirkungsmechanismen durch die sowohl positiven als auch negativen Effekte.

Auf der Grundlage dieser Ergebnisse konzentriert sich Kapitel 5 auf die empirischen Auswirkungen von Venture Debt auf die Fähigkeit von Startups, zusätzliche finanzielle Ressourcen zu akquirieren, sowie auf die Rolle der Reputation von Venture Debt-Anbietern. Unter Verwendung der Datenbank "Crunchbase" und

einer Stichprobe von 41.706 Startups deuten die Ergebnisse darauf hin, dass Venture Debt die Wahrscheinlichkeit erhöht, zusätzliche Finanzmittel über nachfolgende Finanzierungsrunden und Verkäufe an Industrieunternehmen zu erhalten. Darüber hinaus erhöht ein höheres Ansehen des Anbieters von Venture Debt die Wahrscheinlichkeit, zusätzliche Finanzmittel über Börsengänge zu erhalten.

Schließlich haben frühere Untersuchungen gezeigt, dass Anbieter von Venture Debt besondere Kriterien für die Auswahl von Investitionen anwenden (z. B. de Rassenfosse & Fischer, 2016). In Kapitel 6 werden die quantitativen Auswirkungen von Venture Debt auf Startups weiter untersucht und es wird beleuchtet, ob die positiven Auswirkungen von Venture Debt auf Startups auf einen "Behandlungs-" („Treatment“) oder einen "Selektionseffekt" („Selection“) zurückzuführen sind. Im Einzelnen wird in diesem Kapitel die Frage beantwortet, ob die Anbieter von Venture Debt einen direkten Behandlungseffekt (Treatment Effect) haben, der eine bessere Entwicklung von Startups ermöglicht, oder ob sich mit Venture Debt finanzierte Startups besser entwickeln, weil die Anbieter von vornherein die besseren Startups auswählen. Auf der Grundlage der gleichen Datenbank wie in Kapitel 5 wird ein zweistufiger Heckman-Ansatz angewendet. Die Ergebnisse zeigen beides: Anbieter von Venture Debt haben einen direkten positiven Behandlungseffekt (Treatment Effect) auf Startups und es findet eine Positivselektion statt. Daher, Venture Debt-Anbieter wählen vielversprechendere Startups aus.

Abstract

Startups are essential agents for the evolution of economies and the creative destruction of established market conditions for the benefit of a more effective and efficient economy. Their significance is manifested in their drive for innovation and technological advancements, their creation of new jobs, their contribution to economic growth, and their impact on increased competition and increased market efficiency. In order to fulfill their role, startups need access to sufficient financial resources. Because of their attributes of newness and smallness, startups often experience a limitation in accessing external financial resources. Although startups are of high practical relevance, academic research has only become aware of startup financing as a subject of investigation comparatively late. With the rise of venture capital, academic research started to highlight the importance of startup financing, and entrepreneurial finance emerged as a new research area during the last decades. Extant research on entrepreneurial finance examines the capital structure of startups, various funding tools, financing environments in specific regions, and investor selection criteria among other topics. My dissertation contributes to this research area by examining the becoming increasingly important funding instrument of venture debt. Prior research on venture debt investigated up to this date the business model of venture debt (e.g., Hesse et al., 2016), the concept of venture debt (Ibrahim, 2010), the selection criteria of venture debt providers (e.g., de Rassenfosse & Fischer, 2016), and the role of patents in the venture debt provider's selection process (e.g, Hochberg et al., 2018). Based on qualitative and quantitative methods, this dissertation outlines the emergence of venture debt in Europe as well as the impact of venture debt on startups to open up a better understanding of venture debt.

First, chapter 2 introduces venture debt as a new funding instrument and distinguishes venture debt from venture capital, bank loans, and other private debt strategies.

Chapter 3 examines the questions of why and how venture debt emerged in Europe. Based on 28 interviews with venture debt providers, entrepreneurs, and venture capital investors, this chapter reveals that the unique „venture debt provider personality“ and the „venture debt entrepreneurial opportunity“ can explain how venture debt emerged in Europe. The results indicate venture debt was formed based on a ‘Kirznerian’ entrepreneurial opportunity. In detail, due to the introduction of disruptive startup financing instruments (e.g. venture capital) and regulations (e.g. Basel III), the market for startup financing has been led into an imbalance, and financing gaps have emerged. Venture debt providers have identified this imbalance and are helping to close the financing gaps that have arisen.

Third, based on the same interview dataset, the impact of venture debt on startups is assessed in chapter 4. The chapter shows different mechanisms of how venture debt influences startups via stronger (financial) discipline, freedom to operate, time to funding, certification effects, and other value-adding practices. The impacts can be both positive and negative.

Based on these results, chapter 5 focuses on the empirical impact of venture debt on a startup’s ability to acquire additional financial resources as well as the role of the reputation of venture debt providers. Using the database ‘Crunchbase’ and a sample of 41,706 startups, the results suggest that venture debt increases the likelihood of acquiring additional financial resources via subsequent funding rounds and trade sales. In addition, a higher venture debt provider reputation increases the likelihood of an IPO.

Last, prior research has shown that venture debt providers have unique investment selection criteria (de Rassenfosse & Fischer, 2016). Chapter 6 investigates the quantitative effect of venture debt on startups further and focuses on whether the positive effect of venture debt on startups can be attributed to a ‘treatment’ or a

'selection' effect. In detail, this chapter answers the question if venture debt providers have a direct treatment effect that facilitates better startup development, or if venture debt-funded startups show better development because venture debt providers select the better startups in the first place. Based on the same database as chapter 5, a two-step Heckman approach is employed. The results show both: venture debt providers have a direct positive treatment effect on startups and venture debt providers select more promising startups.

Chapter 1

Introduction

The following introductory chapter (Chapter 1) describes the motivation of this dissertation (Section 1.1), outlines the examined research questions (Section 1.2), and provides an overview of the structure of this dissertation (Section 1.3).

1.1. Motivation

Headlines such as "Europe Births Tech Unicorns – Only To See Them Leave" (Pless, 2022) continuously spawn European newspapers and journals and depict one of the main pain points in the European startup ecosystem. Although the European Union (EU) offers several direct and indirect funding programs (e.g., European Regional Development Fund, Horizon Europe) to develop the European entrepreneurial finance landscape, startups seem to face uncovered funding gaps within Europe. Since small and medium-sized enterprises (SMEs) are the main drivers for new job creation, they are of high importance to the economic system. For example, US SMEs generated 12.9 million new jobs while US large businesses only generated 6.7 million new jobs in the last 25 years (Wilmoth, 2022).

In the company lifecycle, various equity and debt-based funding opportunities to grow a nascent business exist (Berger & Udell, 1998). During the startup phase, companies face severe funding gaps (Honjo et al., 2014; Lam, 2010; Moritz et al., 2016). Early-stage gaps have been closed through new funding opportunities such as business angel groups (e.g., Mason et al., 2016), crowdfunding (Moritz & Block, 2016), and initial coin offerings (Fisch, 2019). However, funding gaps are prevailing in the scale-up phase where startups require larger funds to enter the next steps (Max an Bhaird & Lucey, 2011). Additionally, during financial downturns, this funding gap can become even more severe as has been shown during the financial crisis in 2008 (Block & Sandner, 2009).

The emigration of European startups to other countries shows there are distinct differences in the scale-up funding gap between geographic borders. In Europe, the scale-up funding gap is especially large, and European startups attract 54% less funding compared to US startups nine years after their foundation (Reypens et al., 2020). Due to the higher attractiveness of other financial markets, European economies see themselves spawning new unicorn startups (startups reaching a valuation of $1B) that emigrate to the US (e.g., Bucak, 2022; Pan Finance, 2022; Pless, 2022; Rist, 2022).

Against this background, regional economies should develop a working entrepreneurial finance landscape and address funding gaps over the company lifecycle to persist in the global competition for the attraction and development of the world's leading companies.

In recent years, venture debt (VD) providers are addressing the scale-up funding gap and established themselves at the intersection of venture capital (VC) and bank financing (Block et al., 2018). Even the EU highlights the importance of VD to address and reduce the scale-up funding gap in Europe (EIB, 2022). Simply stated, VD is a secured loan combined with an equity kicker in the form of warrant coverage (Hesse et al., 2016). While only a few studies investigate VD, the extant literature can be categorized into four main research streams: 1) characteristics of VD (Ibrahim, 2010), 2) business models of VD providers (Hesse et al., 2016; Iyer, 2020), 3) selection criteria of VD provider's to provide a loan (Chua et al., 2011; de Rassenfosse & Fischer, 2016; Lehnertz et al., 2022; Hardymond et al., 2005; Tykvová, 2017), and 4) role of patents in the VD lending relationship (Hesse & Lutz, 2016; Hochberg et al., 2018).

Overall, VD offers startups the opportunity to gather additional financial resources to either bridge liquidity needs in between equity rounds or their time until turning profitable. Additionally, VD can complement equity rounds to optimize a startup's capital structure (Ibrahim, 2010) because VD is an almost non-diluting funding source that lets founders and equity investors preserve their stakes in the startup. This makes VD a 'cheaper source' of financing compared to equity funding in the sense of dilution of existing equity stakes (Hesse et al., 2016).

However, startups with negative cash flows, no collateral, and no traditional means for repaying a loan do not make attractive lenders and are generally unattractive borrowers for traditional lenders (e.g., banks). Against this backdrop, it is important to highlight how VD providers refined their business model to provide loans to such high-risk borrowers. Established literature identified that VD providers apply unique selection criteria in their selection process to mitigate the risk associated with startups as borrowers (de Rassenfosse & Fischer, 2016). First, VD providers rely on a thorough

selection process based on the due diligence of involved VC investors. Second, VD providers are specialists in identifying and evaluating intangible assets (e.g., patents) that can serve as collateral for their loans (Hochberg et al., 2016). Third, VD providers select startups with other professional equity investors since VD providers rely on an implicit promise of involved equity investors to repay the VD loan out of their present and future equity investments (Ibrahim, 2010).

Despite research investigating the basics of VD being present, a deeper understanding of the effects of VD on startups is yet to be understood. Entrepreneurs are faced with a decision of whether to pursue VD in addition to or in lieu of another round of VC funding. This decision can potentially impact the future activities of a startup due to the commitment of capital resources to repay the debt. From the perspective of an entrepreneur, this can be viewed as a strategic decision (Mintzberg, et al., 1976; Eisenhardt & Zbaracki, 1992). In detail, little is known about the impact of VD on a startup's future performance concerning time to exit, the likelihood of attracting additional funding or experiencing a positive exit, and the potential IPO success. Prior research has shown that certain funding tools directly impact these development matrices (e.g., Croce et al., 2013; Cumming et al., 2005). Missing those insights for VD, entrepreneurs risk suboptimal conclusions in the financing decision of their startups.

In addition, the emergence of VD as a new market category could potentially disrupt the core VC business (Navis & Glynn, 2010). In this context, established markets need to understand the reasons behind the VD emergence and the boundaries of VD in order to address their potential disruption to save their market stakes (Wessel & Christensen, 2012). Finally, VD providers positioned themselves to solve scale-up funding gaps in the entrepreneurial finance landscape and governmental programs subsidize VD for this purpose (e.g., EIB, 2022; Vaekstfonden, 2019). With respect to established financial instruments for startup funding, the embeddedness of VD in the financial ecosystem and VD's potential and limitations need to be assessed. This helps startups, investors, public institutions, and other market players to focus their

monetary resources and attention to obtain the optimal financial service and price for their needs.

Against this background, my dissertation specifically answers the questions *1) how VD emerged as another source of startup financing in Europe and 2) the specific impact of VD on startup development.* In this manner, I employ qualitative and quantitative methods to 1) explore the underlying impacting mechanisms of VD and 2) empirically validate those findings in four self-contained chapters. My dissertation shows how VD was formed based on a Kirznerian entrepreneurial opportunity (Kirzner, 1997) due to an imbalanced market for startup financing. Venture debt providers have identified this imbalance and are helping to close financing gaps that have arisen. In addition, my dissertation shows how VD beneficially impacts the development of startups due to a positive certification effect (Booth & Smith, 1986).

In this context, my dissertation contributes to various literature streams. The most notable contributions of my dissertation can be categorized into contributions to 1) the scarce but growing VD literature, 2) the category emergence literature, and 3) the literature about the effect and importance of accessing debt as a startup. The overarching contributions are discussed in detail in chapter 7 which is summarizing my dissertation.

To the best of my knowledge, this is only the second dissertation investigating the rising phenomenon of VD. In his dissertation, Hesse (2016) investigates the business model of VD providers and the impact of the reputation of involved VCs on VD contracts. Contrasting, my dissertation focuses on the development of VD and the impact of VD on startups.

1.2. Research questions

1.2.1. The emergence of VD in Europe (Chapter 3)

First, my dissertation addresses the research topic of the emergence of VD in Europe. As discussed in the introduction the European startup economy struggles to

maintain its unicorn startups within Europe. My dissertation contributes to the existing literature by examining the unexplored case of the emergence of VD as a new market category in Europe.

Prior research investigating VD highlights the basic rationale and business model behind VD (Hesse et al., 2016; Ibrahim, 2010), the unique selection criteria of VD providers (de Rassenfosse & Fischer, 2016; Lehnertz et al., 2022), and the unique role of intellectual properties in VD decisions (Hochberg et al., 2014). However, whether VD is a needed financial instrument in the European ecosystem and whether VD can be a potential solution for the ongoing funding gaps in the European entrepreneurial finance landscape remains unexplored. The emergence of VD as a new market category could potentially disrupt the core business processes in the entrepreneurial finance landscape (Navis & Glynn, 2010). As an example, the high dependency of entrepreneurs on the VC market up to a potential exit scenario could diminish due to the rise of VD as an alternative funding option. In this context, established markets need to understand the reasons behind VD emergence and the boundaries of VD in order to understand their potential disruption through VD and to save their market stakes (Wessel & Christensen, 2012). Additionally, VD providers positioned themselves as potential solutions for the scale-up funding gaps in Europe and governmental programs subsidize VD for this purpose (e.g., EIB, 2022; Vaekstfonden, 2019).

In this context, my dissertation fills the void around the development of VD by addressing the following research question:

RQ3.1: *How and why did VD emerge in Europe?*

1.2.2. The impact of VD on startup development (Chapters 4, 5, and 6)

Second, my thesis addresses the research topic of the impact of VD on startup development. As outlined in the introductory section, the choice of entrepreneurs to

pursue or not pursue VD funding can have overarching consequences for startups. Involving VD can save equity stakes for entrepreneurs but comes with high-interest payment obligations. My dissertation aims to contribute to the existing literature by answering multiple research questions that address yet unexplored aspects of the impact of VD on startup development.

Extant literature describes debt as a common source of funding which can be an attractive option for startups because it allows them to access capital without giving up equity stakes in their company (Robb & Robinson, 2014). However, the use of debt as a source of funding can be a double-edged sword for startups. On the one hand, taking on debt can help a startup to grow and expand more quickly than it could with just equity financing since debt offers additional financial resources and can be accessed more flexibly (Chen et al., 2010). This can be especially beneficial for startups that have a proven track record and a solid business plan, as it can provide them with the capital they need to invest in new products, hire additional staff, or expand into new markets (Stiglitz & Weiss, 1981).

On the other hand, debt can also be a risk for startups. If a startup is not able to generate sufficient revenue to repay its debts, it may be forced to default on its loans, which can result in significant financial losses for the company and the company's stakeholders. In addition, carrying a large amount of debt can be a burden for startups, as it can limit their flexibility and ability to respond to changes in the market or the economy (Baxter, 1976). Next to the potential negative effects of debt, startups are also faced with rationed credit availability from the supplier side and have often no opportunity to access debt funding (Colombo & Grilli, 2007).

Generally, the involvement of debt directly affects startups in incentivizing them to engage in exploitation instead of exploration (Choi et al., 2016), providing additional monitoring of the startup and can enact change to meet interest obligations (Harris & Raviv, 1990). In contrast to other debt providers, VD providers follow a unique business approach in their selection strategy, behavior, and involvement in startup companies (Hesse et al., 2016). Thus, VD providers cannot be directly compared to

traditional lenders. Prior research investigating these questions only focused on single case studies and highlighted monitoring activities of VD providers similar to banks (Hardymond et al., 2004). However, the overarching impact of VD on startups yet to be examined. In this regard, my dissertation addresses the following research question:

RQ4.1: *By which mechanisms does VD influence startup development?*

Startup fundraising follows a highly competitive nature in that many companies are vying for the same pool of investor dollars. This can make it difficult for startups to stand out and differentiate themselves from their competitors, which can make it harder to secure funding and directly affects the success and survival of a startup (Hogan et al., 2017; Vanacker & Manigart, 2010). Thus, startups need to follow consistent strategic paths in their fundraising process. Hor et al. (2021) highlight the importance of the choice of financial instrument (e.g., equity, debt, mezzanine) for the success probability to secure future financial resource acquisition. However, little is known about the influence of VD on a startup's ability to acquire additional financial resources. Hence, my dissertation aims to answer the following research question:

RQ5.1: *How does VD influence the financial resource acquisition of startups?*

In addition, prior research has shown that the reputation of involved startup investors can highly impact the financial success of a startup (Krishnan et al., 2011; Lee et al., 2011). However, little is known about the influence of VD or the reputation of VD providers on a startup's ability to acquire additional financial resources. Thus, my dissertation aims to answer the following research question:

RQ5.2: *How does a VD provider's reputation influence the financial resource acquisition of startups?*

Empirical studies have shown that the involvement of specific investor types is associated with a higher performance of a startup (e.g., Gompers and Lerner, 2001,

Denis, 2004). However, a higher performance of a startup can either be attributed to better selection criteria by the investor ("picking winners") or can be a result of additional non-financial value-added by the investors ("building winners") (Baum & Silverman, 2004; Bertoni et al., 2011).

Prior research investigating how debt providers affect the performance of companies (Ross, 1977; Flannery, 1986; Harris & Raviv, 1990) indicates that debt can both hurt and boost competitive performance depending on the industry concentration and competitive position of the respective company (Campello, 2006). However, these studies did not consider startups and cannot simply be transferred to explain the effect of VD on startup development since VD is used in the special context of high-risk ventures and therefore has very different characteristics than conventional debt (Ibrahim, 2010). To extend the knowledge of the effect of VD on the performance of startups and whether these effects can be attributed to the selection or treatment of VD providers, my dissertation examines the following research questions:

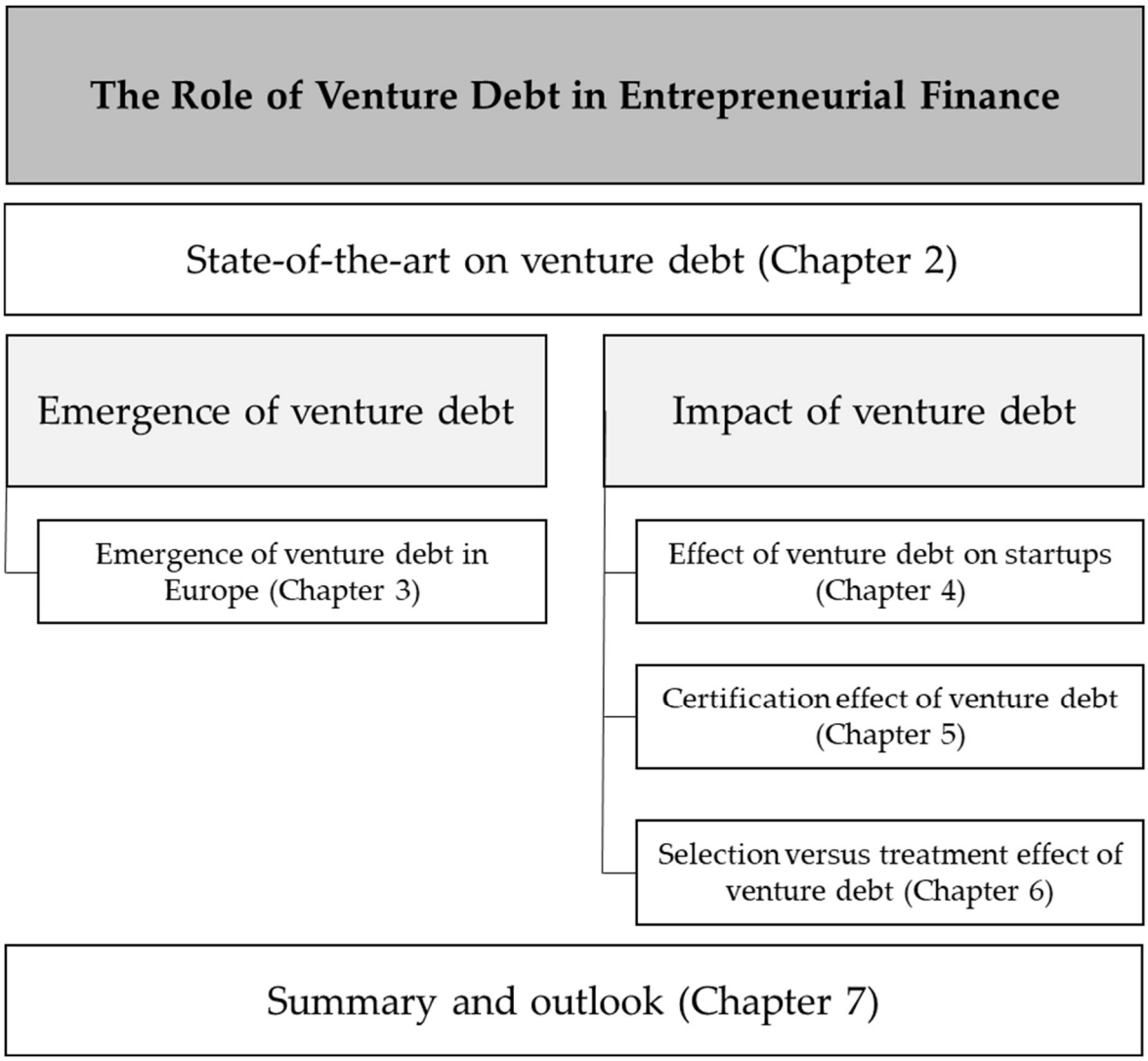
RQ6.1: *Do VD-backed startups develop better than their non-VD-backed counterparts?*
RQ6.2: *If this is the case, is this positive effect mainly attributable to the ability of VD providers to select more promising startups ("selection effect"), or is it a consequence of the support and value-added they offer to portfolio firms ("treatment effect")?*

1.3. Structure of the Dissertation

The dissertation comprises seven chapters. Chapter 2 provides the theoretical background on VD and a detailed definition of VD. In Chapter 3, the driving forces behind the emergence of VD in Europe are discussed. Chapter 4 focuses on the effects of VD on startup development from the standpoint of entrepreneurs and investors. In Chapter 5, the impact of VD based on the certification effect of VD on startups will be quantitatively assessed. Chapter 6 provides more details on the quantitative effect of VD on startups and examines whether the VD effect can be contributed to treatment or selection effects. Chapter 7 summarizes the key findings and discusses the main

theoretical and practical contributions. Figure 1-1 provides an overview of the structure of the dissertation.

Figure 1-1: Structure of the dissertation



More precisely, **Chapter 2** provides the 'groundwork' of the following analysis. It provides an overview of startup financing options and how VD fits into the startup financing landscape. In detail, a basic understanding and definition of VD are outlined, and VD is contrasted to other startup financings options such as VC and bank loans. Additionally, the chapter positions VD in light of other private debt investments strategies,

Chapter 3 examines how VD emerged in the European market as a new market category. While extant literature only focused on the emergence of categories mainly outside the entrepreneurial finance sector, this chapter analyzes the category emergence of a new financial instrument (VD) in the European entrepreneurial finance landscape. Based on qualitative research methods this chapter provides an overview of VD development in Europe over the past 25 years. It shows how market actors discovered VD as a Kirznerian entrepreneurial opportunity based on a disequilibrium state in the European entrepreneurial finance market.

Chapter 4 focuses on the basic influences of VD on startups. In contrast to prior literature, this chapter does not only focus on the unique selection criteria of VD providers but examines the direct influence of VD on the development of startups. Drawing from qualitative research methods, this chapter shows how VD influences startup development via 1) stronger financial discipline, 2) the freedom to operate, 3) the time to funding, 4) a certification effect, and 5) other value-adding effects. In general, I find that VD both positively and negatively affects startup development.

In **Chapter 5** the general effect of VD on the financial resource acquisition of startups is assessed using quantitative methods. Based on the competing qualitative arguments of chapter 4, this chapter focuses on the measurable effect of VD on startups in comparison to only VC-funded startups. This chapter concludes that VD has a positive certification effect that translates into a better financial resource acquisition of startups due to a higher likelihood of subsequent funding rounds and a higher likelihood of trade sales following VD funding rounds.

Chapter 6 deepens the understanding of the quantitative effect of VD on startups and investigates whether the positive effect of VD on startups can be attributed to a 'treatment' or a 'selection' effect. More specifically, does VD provide a direct treatment effect that facilitates better startup development, or do VD-funded startups show better development because VD providers select the better startups in the first place? Based on a thorough quantitative assessment and a comparison of VD-funded startups with only VC-funded startups, this chapter highlights that VD-funded startups

develop better based on both effects: VD partially provides a direct positive treatment effect on startups and VD providers select more promising startups.

Finally, **Chapter 7** concludes with a summary of the main results and contributions of my dissertation. Theoretical and practical implications are derived from the results and promising avenues for further research are outlined.

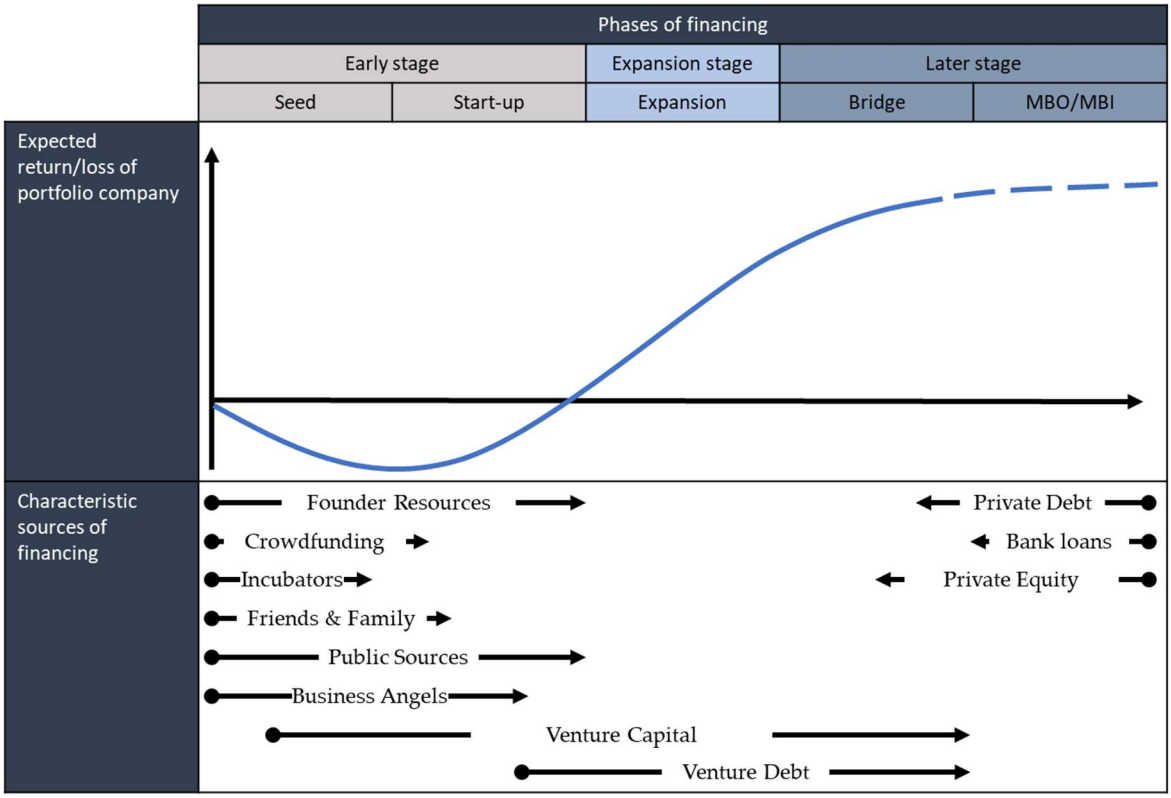
Chapter 2

Theoretical background on venture debt (VD)

The following theoretical chapter (Chapter 2) provides an overview of the financing option of startups and categorizes the standpoint of venture debt. The differences between venture debt and venture capital financing (Section 2.1), the differences between venture debt and bank loans (Section 2.2), and the overall categorization of venture debt among private debt investment strategies (Section 2.3) are discussed.

The financing decision of companies has an important influence on a company's performance, bankruptcy risk, scope of action, and numerous other aspects. Therefore, a large number of scholars have dedicated themselves to the research of a company's financing decision and have an ongoing discussion about the optimal finance decision-making of companies (e.g., Bradley et al., 1984, Haugen & Sembet, 1978; Schwartz & Aronson, 1967; Scott, 1977). Since startups are faced with the liabilities of newness and smallness, their scopes of action are limited (Bruderl & Schussler, 1990; Gimenez-Fernandez et al., 2020). For example, startups are not able to issue corporate bonds, can oftentimes not refinance them via positive cash flows, and struggle to obtain bank debt. Depending on the startup's track record, stage, and underlying assets, the startup can access increase its access to capital finance over its life cycle to a mature company (Berger & Udell, 1998). Figure 2-1 provides an overview of the typical sources of startup financing over the early stage, expansion stage, and later stage in the life of a startup.

Figure 2-1: Phases of startup financing



Source: Based on Berger & Udell (1998)

Traditionally, startups rely on the two primary sources of outside equity financing: VC and business angels until they reach a later stage where they can provide securities to access cheaper debt-based funding options (Denis, 2004). Since VD does neither fall into the traditional equity financing category nor the category of debt-based financing for mature companies, the questions arise: How does VD fit into a startup's financing lifecycle? How is VD different from other equity and debt-based financing options?

Ibrahim (2010:1171) describes VD as "loans to early-stage, rapid-growth startups that have no traditional means of paying it back". From a technical perspective, VD loans are traditional secured loans combined with an equity kicker in the form of warrant coverage (Hesse et al., 2016). Equity warrants carry the right to purchase equity at a set price within a given time framework and provide VD providers with valuation upside. A debt-based strategy can be surprising since rapid-growth startups usually do not show track records, positive cash flows, or tangible assets as securities. Thus, the very similar technical structure of VD to secured bank loans can be puzzling since the described attributes of rapid-growth startups appear to be a risk-averse banker's worst nightmare, and usually VCs focus on such startups as investment targets. Figure 2-1 illustrates how VD and VC invest in parallel over large portions of the startup lifecycle and how banks invest in later stages which are not targeted by VD and VCs. Further, in the phases where VD and VC are investing, startups are phased with few other alternative funding options. Therefore, it is necessary to develop a better understanding of the nuanced differences between VD to traditional bank loans and VC funding. Figure 2-2 offers a detailed overview of VD and these differences. First, I will discuss the differences between VD to VC, and second, the differences between VD and traditional bank loans.

Since VD is not only part of the entrepreneurial finance space but also part of the greater private debt space, I will compare VD to other private debt investment strategies last.

Figure 2-2: Venture debt (VD) characteristics

	Venture Capital	Venture Debt	Bank Loan
Balance Sheet	Equity	Debt (80% - 90%) + Equity (10% - 20%)	Debt
Cost / Payments	Equity Dilution Political Cost (Investor Involvement)	Interest Payment Equity Dilution	Interest Payment
Syndication	Regularly with VCs and VD	Regularly with VCs	Rarely with other lenders
Smart Capital	Active	Passive	Rarely
Requirements	Very Promising Business (-Idea) Growth Potential ~10x	Usually at least in Expansion Stage Intangible Assets as Securities Cash-Flows Growth Potential ~4x	Established Business Tangible Assets as Securities Reliable Cash-Flows
US Market Size (2022)	$ 238.3B (Pitchbook, 2023)	$ 31.8B (Pitchbook, 2023)	n.a.

Source: Own illustration

2.1. Differences between VD and venture capital (VC)

VCs are important intermediaries between startups and investors. VCs deploy money from external investors to high-risk, high-reward projects via purchasing equity or equity-linked stakes while the startups are still privately held (Gompers & Lerner, 2001). After their investment VCs stand on the side of the entrepreneurs and actively help to develop the startup. They do this by actively monitoring their portfolio companies and providing other non-financial value-adding practices to their portfolio companies (Bertoni et al., 2011). The other non-financial value-adding practices include helping to raise additional funds, strategic analyses, management recruiting, providing business advice, providing a corporate network, and being a coach and

mentor for the startup's CEO (e.g., Gorman & Sahlman, 1989; Kaplan & Strömberg, 2001; Lerner, 1995; Sapienza et al., 1996).

However, VC involvement comes with high costs for entrepreneurs. Due to the VC's purchase of equity stakes, entrepreneurs give up control and get diluted in their equity stakes (Janney & Dess, 2006). Equity dilution, especially over numerous financing rounds, can drive entrepreneurs into a minority stakeholder position over time and limits the entrepreneur's upside potential of their business idea. Second, VCs issue contracts that provide them with additional cash flow rights, board rights, voting rights, liquidation rights, and control rights (Kaplan & Strömberg, 2003). Thus, entrepreneurs are not only faced with limiting their financial upside but also with a political cost that constitutes itself with a lot of interference in the startup's daily business by the VCs.

In the end, VCs do not aim to hold on to their portfolio companies forever. VCs are commissioned to earn profits for their external investors and therefore want to exit their portfolio companies at some point in time. They do so by selling their equity stakes to other external investors. This can be achieved by an exit via IPO, trade sale, or leveraged buy-outs among other options.

Similar to VCs, VD providers oftentimes are also intermediaries between startups and other external investors with the commission to generate financial returns for their investors. In contrast to VCs, VD providers operate with a debt-based and not equity-based investment strategy. As already outlined before, VD is constructed as a secured loan that comes with some additional equity warrants. From a financial perspective, this makes VD providers almost completely negligible minority stakeholders of the startup. Since VD providers do not benefit much from a startup's equity valuation upside, the VD provider's most important concern is getting their principal investment reimbursed. This has several effects on the contrasting behavior of VD providers to VCs and implications for the startup and entrepreneurs: 1) the cost of the funding in itself and 2) the involvement of the investors in the daily activities of the startup.

First, the costs for the startup related to VD are limited to the interest payment and only a negligible equity dilution. Although the interest payments are very high compared to traditional bank loans, an equity dilution is a lot costlier for entrepreneurs. If a startup grows very rapidly, entrepreneurs lose a lot of return on their equity if they get diluted.

Imagine two similar promising high-growth startups. The first startup receives €1m in VC equity funding while the second startup receives €1m in VD funding to expand their businesses. The second startup receives 80% of the VD deal as a secured loan connected with a 10% annual interest payment. The other 20% of the VD deal is made of equity warrants. Let us further assume both startups increase their firm value tenfold over a period of 3 years and at the end of the third year both the VC and VD providers exit their respective portfolio companies. Assuming everything else is equal for both startups, which deal was cheaper for the startup and entrepreneur?

In the case of the first startup, the startup received €1m in equity financing and never had to repay anything. However, the VC investor benefitted by increasing tenfold his equity stake from €1m to €10m. Thus, the entrepreneur of the first startup is faced with €9m of opportunity costs since the €9m in increased equity valuation could have been his profit if he could have held on to the full equity stake.

In the case of the second startup, the startup received €1m of VD financing divided into €800k secured loan and €200k equity warrants. Similar to the first case, the equity part increased tenfold and results in a valuation of €2m after 3 years. During the 3 years, the second startup has to meet an annual 10% interest payment on the secured loan. This results in an annual €80k payment over three years which sums up to a total of €240k in interest payments. Additionally, the second startup has to repay its €800k loan after the third year. All in all, the total payments for the VD deal constitute €1.04m for the loan and €1.8m in opportunity cost for the entrepreneur due to the increased equity valuation of the startup.

To summarize, from the perspectives of the two entrepreneurs of the two startups, the entrepreneur of the first startup is faced with €9m in costs for his VC deal while

the entrepreneur of the second startup is faced with €2.84m in total costs for his VD deal. This example illustrates how a VC deal can be over 3 times costlier compared to a VD deal for an entrepreneur due to the dilution of equity. However, it should be noted that these numbers show a high variance depending on the length of the observed time period and the increase in firm valuation over this time. Simply stated, the higher the increase in firm valuation of a startup the higher the opportunity costs of an entrepreneur when diluting his equity. Thus, VD deals become relatively cheaper (more expensive) if a startup has a higher (lower) increase in its firm valuation compared to a 100% VC equity deal.

Next to the monetary benefits of VD in comparison to VC, VD differs from VC in terms of the investor's involvement. While VCs want to be actively involved in the daily business of the startup and shape the company according to their views, VD providers have a passive approach. In general, VD providers are primarily creditors without rights interfering with the daily activities of the startup. Due to their very limited equity stakes, VD providers are also not present on the board of directors. This leaves VD providers with very little power to actively engage in the daily business of the startup. Due to the VD's limited upside potential, VD providers would also not gain high benefits if they would try to steer the startup to a very successful path.

However, VD providers are very inclined to manage their downside risk and especially the default risk of their portfolio companies. They achieve this through contractual covenants, milestones, and intangible securities. VDs can limit their initial financial commitment and demand the fulfillment of certain covenants and milestones to open additional lines of VD credit to their portfolio company. These practices serve as general guardrails to guide portfolio companies and limit their potential actions to mitigate risky behavior. Additionally, VD providers can actively claim their securities if the startup violates contractual covenants and milestones. In such cases, VD providers actively engage with the startup and other investors to evaluate why a contractual violation was realized. After evaluation, VD providers are actively seeking solutions with all stakeholders and react flexibly with their claims and contractual

agreements to avoid defaulting on the startup if a realistic chance of survival of the startup is given.

All in all, VD providers differ from VCs in 1) the cost of capital and 2) their involvement. Due to a credit-based product and limited equity dilution of VD, VD deals are cheaper if the startup has promising growth and equity valuation expectations. Second, VDs have only limited power and limited aspirations to actively engage in the management of the startup. However, VD providers demand securities and other contractual covenants and set milestones for their portfolio companies. Thus, startups are faced with lower costs (monetary and political) but need to fulfill higher security demands in VD deals compared to VC deals.

2.2. Differences between VD and bank loans

Bank loans are structured debt contracts where a bank provides a loan to a borrower and the borrower is obliged to repay the loan and additional interest payments set by the contractual agreement. In this relationship, banks face the risk of not recovering their money if the borrower comes into financial distress and as a result defaults. Thus, banks employ a thorough selection process with the aim only to lend to credible borrowers. Banks typically employ standard financial statement criteria in the loan decision process (Cole et al., 2004). During their loan decision process, banks use credit scoring approaches by assigning a single quantitative score to a potential borrower and estimating the borrower's future loan performance (Feldman, 1997). Based on the value of the credit score, banks decide whether they are willing to lend to a certain borrower and under which conditions. For example, high-risk borrowers need to provide securities and pay higher interest rates (Morsman, 1986). The securities constitute typically physical assets that the bank can claim and liquidate in case of a borrower's default to reimburse the loan.

The application of credit scoring allows banks to monitor loans without actually meeting the borrower since credit scoring is vastly based on financial statement

metrics. The borrower's equity ratio, cash flows, and the presence of physical assets are example metrics that banks use for their credit scoring.

Banks differ in their technology of lending to startups fundamentally from the technology of lending to large established companies. Startup lending is very information-intensive and relationship-driven and requires tighter control and oversight (Berger & Udell, 1995). Although credit scoring can increase access to credit for startups (Frame et al., 2001), banks struggle to fully map and assess the startup with their scoring approach due to its information-intensive nature. As a consequence, banks reduce their volume of relatively costly SME loans via price or quantity rationing (Williamson, 1967).

Similar to bank loans, VD providers operate with secured loans. The only technical difference between VD and bank loans is the presence of additional equity warrants that give VD providers limited upside potential based on the valuation increase of the startup. Although VD and bank loans are technically very similar, VD providers are often ready to lend to startups in earlier stages when banks are not (see Figure 2-1). Ibrahim (2010) describes how this constitutes the underlying VD puzzle: Lenders cannot afford high default rates on their investments and therefore conventional wisdom holds that startups do not appear to be borrowing candidates and thus we should not see VD. How do VD providers solve this conundrum? VD providers have unique selection criteria which differ from traditional bank loans (de Rassenfosse & Fischer, 2016). In detail, VD providers are unique in their emphasis on 1) VC involvement, 2) intangible collateral, and 3) equity warrants in their selection process compared to bank loans.

First, traditional lenders (e.g., bank loans) place great importance on the ability of the lender to repay the loan via operating cash flows in their credit rating and investment selection (Carey & Hrycay, 2001). Since startups cannot provide positive cash flows, VD providers made out involved VCs as potential providers of additional capital to a startup which directly influences the startup's repayment capacity. VD providers focus in their selection process heavily on the credibility of involved VC

investors. The involvement of reputable VC investors with a lot of dry powder in their funds indicates the VC's ability to infuse a startup with more capital if needed. VD providers build upon this reputation and try to build relationships with these VCs. Since VCs benefit from VD providers due to increased returns by optimizing a startup's capital structure with debt, VCs and VD providers can act as complementary funding options with both parties benefitting. Thus, long-term relationships and mutual trust between VD providers and VCs are very important and are crucial for a VD provider's decision to invest in a startup. Based on this relationship and VC reputation, VD providers see the ability of involved VCs to provide additional funds to a startup if needed as an implicit promise to repay the loan. Consequently, VD providers select whether to lend or not to lend based on the involvement of VCs and not on operating cash flows compared to traditional bank loans.

Second, banks typically demand collateral to increase the borrower's motivation to avoid defaults and reduce the risk of the loan (Stulz & Johnson, 1985). In case of a default, the bank has the right to liquidize the collateral and recover its principal investment. For a traditional bank loan, the bank focuses on 1) the presence of collateral and 2) the possibility to sell the collateral on the secondary market (Williamson, 1988). Under these criteria, physical assets (e.g., machinery, buildings) are used by banks as collateral since they can be easily evaluated and liquidized. However, high-tech startups lack physical assets and only possess intangible resources that are highly firm-specific and difficult to evaluate. This negatively influences the possibility to sell these resources on the secondary market and banks avoid using them as collateral. Thus, banks do not choose to lend to companies without physical assets. Contrasting to banks, VD providers face these difficulties in evaluating intangible assets and focus on patents as collateral. Patents offer the ability to exclude others from using the underlying invention. The patent can either be sold together with the underlying technology or the exclusion right per se can be sold to potential competitors or non-practicing entities (de Rasssenfosse & Fischer, 2016). This saleability gives patents a liquidation value which is used by VD providers. Hochberg

et al. (2018) show that VD providers can evaluate the salability of patents and adapt their lending activity accordingly. This makes VD providers willing to lend to companies without physical assets.

Third, VD providers are focusing on deals with equity warrant coverage. Equity warrants carry the right to purchase equity stakes at a stated price until a stated date. VD providers use equity warrants to obtain a limited upside potential if the startup valuation increases. The background behind this selection criteria is the outlined conflicting character traits of startups and bankable companies. Lenders cannot carry a high number of defaulting borrowers and therefore focus on the risk-limiting behavior of borrowers. Although VD providers take intangible assets as collateral to secure their principal investment, the collateral only provides limited security due to restricted salability and volatile valuation. In order to align the objectives of both the startup and VD provider, VD providers seek equity warrants to benefit from the risk-taking behavior of startups (de Rassenfosse & Fischer, 2016). Equity warrants have 2 detailed effects: 1) VD providers can carry higher default rates in their portfolio due to equity compensations in well-developing startups and 2) VD providers are incentivized to work with startups in downturns and not claim their collateral too early.

All in all, VD providers differ from traditional banks and bank loans in 2 aspects 1) cost of capital and 2) security requirements. Similar to the VD VC relationship, bank loans are cheaper for entrepreneurs due to their non-diluting nature. Since VD deals always come with equity warrant coverage, entrepreneurs face opportunity costs when their startup has a high equity valuation growth rate. Second, VD providers operate differently from banks in their selection criteria and security requirements. Banks select according to their credit rating of the borrower whereas VD providers have a more complex approach and evaluate also other VC investors involved in a startup. Additionally, VD providers hedge some of their increased risks via equity warrants and not with a further increase of interest rate payments or security requirements.

2.3. Overview of VD compared to other debt-based investment strategies

Private institutions and individuals can act as private investors and invest their money into various investment opportunities with the aim to generate returns on their invested money. Against this background, private investors can choose to lend money to borrowers via a private debt contract to benefit from interest payments on their principal investment. In general, private debt constitutes loans handed out by different players than banks without the inclusion of the public capital market (BAI, 2020). Due to specially tailored accounting rules and specific contractual conditions in private debt contracts, numerous different segments can be defined according to different characteristics within the private debt space. In the private debt space, VD constitutes a private debt contract that is specifically tailored for lending to startup companies. This makes VD a specific financial instrument for private investors to invest in startups and generate returns with their investments.

Since investors are risk-averse individuals, investors want to be compensated when taking higher levels of risk in their investment with higher expected revenues (Black et al., 1972). Thus, investors evaluate their potential investments based on the risk/return metrics. As discussed above, lending to startup companies is connected with high default risk. Consequently, VD providers try to 1) limit the risk of their investment via collateral provided by the startup and 2) increase their potential return via equity warrants to achieve an attractive risk/return investment opportunity. However, VD is only one private debt investment strategy and private investors can choose to pursue other private debt strategies with more attractive risk/return metrics. Against this backdrop, VD is a financial instrument within a broader competition of other private debt financial instruments and the VD's attractiveness needs to be justified in comparison to other debt-based strategies.

Preqin (2018) defines Direct Lending, Distressed Debt, Mezzanine, Special Situations, and Venture Debt as different investment strategies within private debt.[1] Direct Lending categorizes private loans into well-performing enterprises and is identical to bank loans. Contrasting to bank loans, the lender is another non-bank entity. Direct Lending is often used to optimize a corporates capital structure and financing working capital.

Distressed Debt categorizes loans to corporates with liquidity and cash-flows constraints. Lenders face a high default risk of the borrower and often actively restructure the business of the borrower to secure future interest payments. Distressed Debt often develops out of Direct Lending agreements if borrowers face external shocks or mismanagement.

Mezzanine categorizes structured loans with debt and equity components. Mezzanine loans usually come with subordinated high-yield loans. In case of a default subordinated debt is served last by the liquidized corporate assets. Thus, mezzanine loans are connected with a high risk for the lender and lenders let themselves be compensated with profit participation in the form of equity kickers. Connected with this form of profit participation mezzanine loans oftentimes can be completely converted from debt into equity.

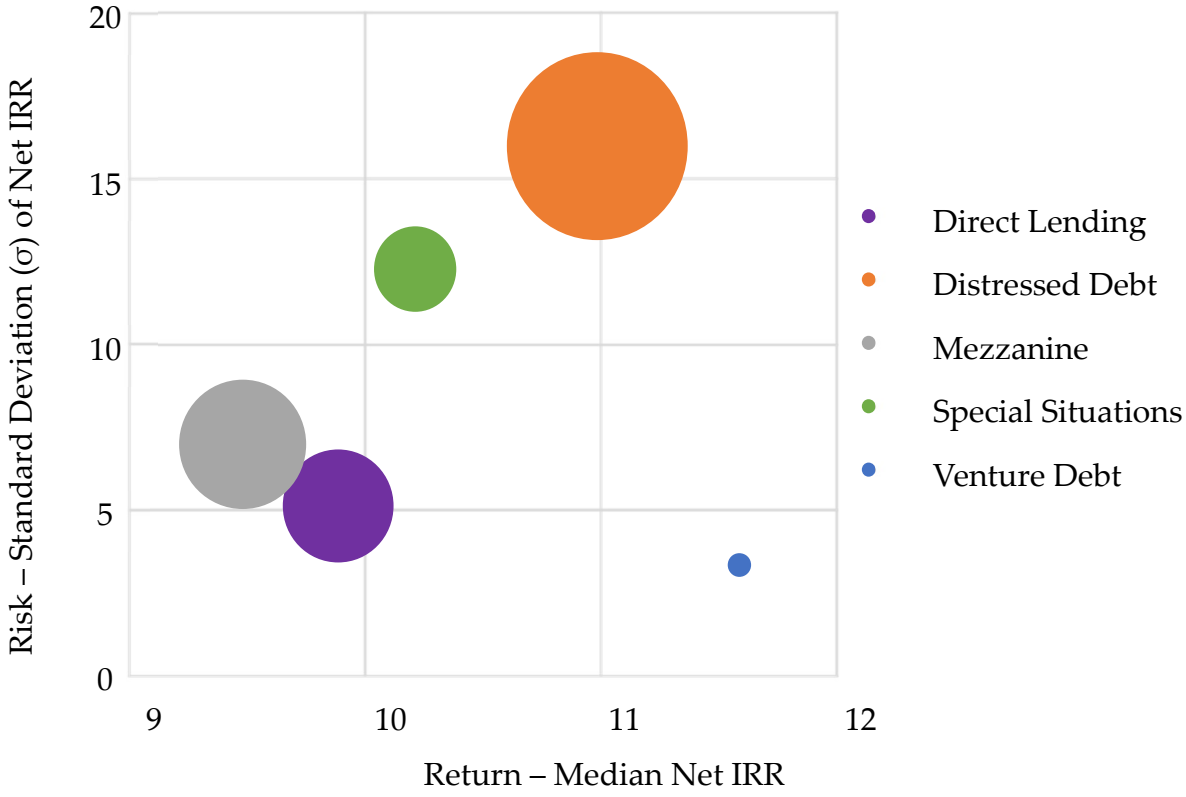
Special Situations categorizes loans to corporates in cases of high liquidity needs that lead to an overindebtedness or in particular long loan maturities. Special Situations loans are very case-sensitive and do not follow standardized processes due to their complex nature. This makes Special Situations loans very hard to evaluate and difficult to generalize their risk profile.

In contrast to other private debt investment strategies, VD focuses on investments in startup companies.

[1] Preqin (2018) additionally defines Buyout, Infrastructure, and Real Estate as private debt investment strategies. Those strategies are tied to public projects or special events (investment targets other than corporate businesses) and find no further consideration in my analysis.

Figure 2-3 provides an overview of the historic median net internal rate of return (IRR) and the standard deviation of the net IRR of private debt funds which focus on the mentioned investment strategies from 2005 - 2015. The circle size indicates the fund volumes in the respective private debt investment strategy during these 10 years. According to Preqin (2018), the global aggregated capital raised by the respective private debt investment strategies is Direct Lending ($7.8bn), Distressed Debt ($14.2bn), Mezzanine ($0.3bn), Special Situations ($2.2bn), and VD ($0.1bn) in the second quartal of 2018.

Figure 2-3: Private debt – risk/return by strategy (vintage 2005 – 2015 funds)



Source: Preqin (2018)

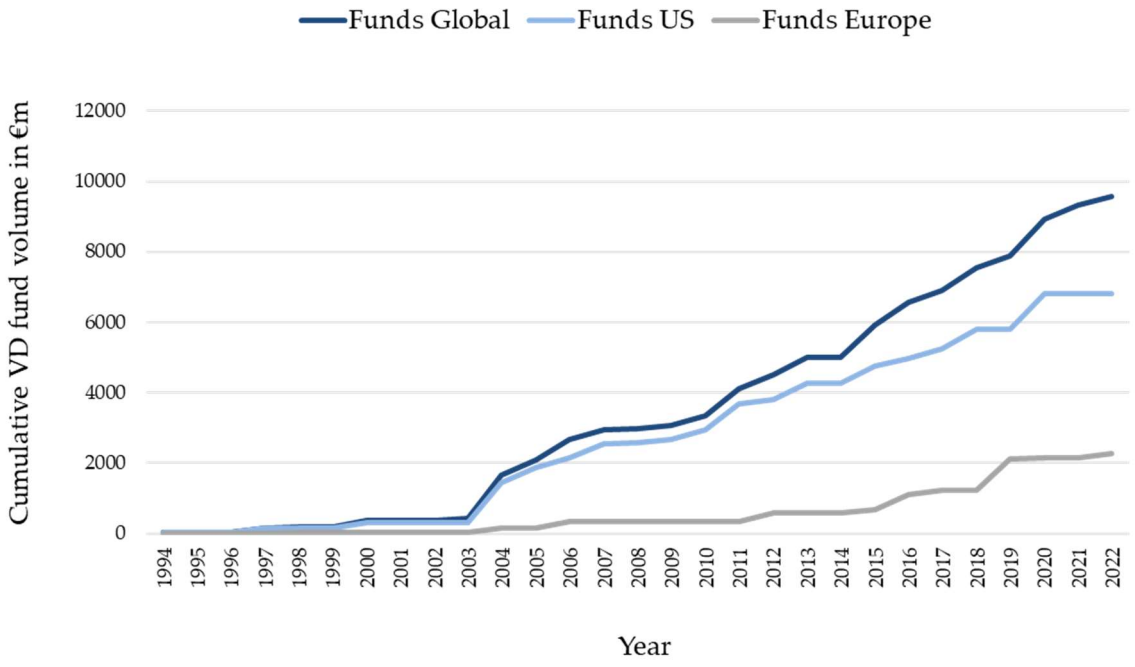
The figure shows the following risk/return metrics for the respective debt investment strategies: Direct Lending (9.8% Median IRR/ 6% σ), Distressed Debt (11% Median IRR/ 17% σ), Mezzanine (9.5% Median IRR/ 7% σ), Special Situations (10.2% Median IRR, 12% σ), and Venture Debt (11.6% Median IRR/ 4% σ).

Based on the basic principle of the demand for risk compensation with higher expected returns, most investment strategies show that a higher expected return (higher median net IRR) is connected with higher risk (σ). Surprisingly, the historic risk/return metric for VD does not fit into this basic framework. VD shows the highest median net IRR while simultaneously showing the lowest standard deviation of the net IRR. Thus, VD seems to be a superior investment strategy by any means compared to other debt-based investment strategies. What can be possible explanations behind this heuristic? Why are not more investors following a VD strategy if it seems to be superior to other debt-based investment strategies?

Two explanation approaches for these questions are 1) the still maturing VD market and 2) the VD's nature of being only a niche investment strategy.

First, VD was invented in the 1960s by banks in Silicon Valley (Stoykov, 2022) but only received stronger financial inflows in the early 2000s. Figure 2-4 provides an overview of the cumulative VD fund volume.

Figure 2-4: Cumulative VD fund volume (1994 - 2022)



Source: Own illustration based on PitchBook data

Against this background, VD constitutes an evergrowing and emerging market compared to other debt-based strategies that were established over the last centuries. Due to its relatively young age, the VD market is still evolving and the market has not evolved into a highly competitive system. This can provide VD players with the ability to exploit less-competitive market pricing of VD deals and generate higher returns compared to a fully matured competitive market (Porter, 1989).

Second, niche markets are "small, profitable homogeneous market segments which have been ignored or neglected by others." (Dalgic & Leeuw, 1994:42). These traits hold true for VD: the VD's market size is small compared to other debt strategies and other debt strategies neglect to invest into VD due to its limited market size compared with the necessity to be highly involved in VD deals to succeed compared to other debt-based investments. The literature awards niche markets with several benefits: higher growth possibilities, value creation, increased profits, increased market shares, and higher performance (Toften & Hammervoll, 2013). Consequently, VD profits from its niche status, and VD providers are able to generate higher risk-adjusted returns.

To summarize, VD shows higher returns and fewer risks compared to other deb-based investment strategies. However, the VD market makes up less than 1% of the global volume traded in debt-based investment strategies. Currently, the competitive pressure in the VD market seems to be low and results in high-risk-adjusted VD returns. Depending on future development, it is unclear whether these market conditions persist. VD is still a maturing market and the competitive forces have not fully developed, yet.

Chapter 3

An entrepreneurial opportunity for seasoned bankers? The emergence of venture debt in Europe.[2]

Venture debt is becoming more prominent in Europe as a tool to close the scale-up financing gap and mitigate the emigration of European startup unicorns to the US. However, little is known about the reasons for and the driving forces behind the emergence of venture debt as a new market category in Europe. Our qualitative interview study contributes to closing this gap by investigating how venture debt emerged and highlighting if venture debt is capable of addressing the scale-up financing gap in Europe. Based upon 28 semi-constructed interviews with startup founders, venture capitalists, and venture debt providers, we identify two main VD-specific aspects which fostered the emergence of venture debt in Europe: 1) the personality of venture debt providers and 2) the specific venture debt entrepreneurial opportunity in Europe. We show how the emergence of venture debt as a market category in Europe closes a disequilibrium state in the European entrepreneurial finance landscape and thus can be classified as a Kirznerian entrepreneurial opportunity.

[2] This chapter is based on Block et al. (2022)

3.1. Introduction

"Europe Births Tech Unicorns – Only To See Them Leave" (Pless, 2022) depicts one of the main pain points in the European startup ecosystem. Although the European Union (EU) offers several direct and indirect funding programs (e.g., European Regional Development Fund, Horizon Europe) to develop the European entrepreneurial finance landscape, startups seem to face uncovered funding gaps within Europe.

In the startup process of new ventures, there exist various equity and debt-based funding opportunities to grow a nascent business over its life cycle (Berger & Udell, 1998). If a startup experiences a need for funding but cannot find the money supply, the startup faces liquidity constraints due to the lack of funding opportunities (Honjo et al., 2014; Lam, 2010). One of the most pronounced funding gaps in recent years can be found in the scale-up phase where startups are reliant on equity and debt-based funding but face limited credit availability (Colombo & Gilli, 2007).

In Europe, the scale-up funding gap is especially vast, and European startups attract 54% less funding compared to US startups nine years after their foundation (Reypens et al., 2020). Thus, European economies see themselves spawning new unicorn startups (startups reaching a valuation of $1B) that emigrate to the US after struggling to find scale-up funding in Europe (e.g., Bucak, 2022; Pan Finance, 2022; Pless, 2022; Rist, 2022). Against this background, regional economies need to develop a working entrepreneurial finance landscape and address funding gaps to persist in the global competition for the attraction and development of the world's leading companies.

In recent years, venture debt (VD) providers became dominant to address the scale-up funding gap and established themselves at the intersection of venture capital (VC) and bank financing (Block et al., 2018) and also the EU highlights the importance of VD in its aim to address the scale-up funding gap in Europe (EIB, 2022). Simply stated, VD is a secured loan combined with an equity kicker in the form of warrant coverage (Hesse et al., 2016). VD offers startups the opportunity to gather additional financial

resources to bridge liquidity needs in between equity rounds or to bridge their time until turning profitable. Additionally, VD can complement equity rounds to optimize a startup's capital structure (Ibrahim, 2010).

However, startups with negative cash flows, no collateral, and no traditional means for repaying a loan do not make good lenders and are generally unattractive borrowers for lenders (e.g., banks) in the traditional sense. Thus, the mere existence of VD can be puzzling. Established literature identified that VD providers apply unique selection criteria in their selection process to mitigate the risk associated with startups as borrowers (de Rassenfosse & Fischer, 2016). First, VD providers apply a thorough selection process based on the due diligence of involved VC investors. Second, VD providers are specialists in identifying and evaluating intangible assets (e.g., patents) that can serve as collateral for their loans (Hochberg et al., 2016). Third, VD providers rely on an implicit promise of involved VC investors to repay the VD loan out of their present and future equity investments (Ibrahim, 2010).

Despite the research explaining the basic VD structure, a deeper understanding of the development of VD in Europe is yet to be understood. The emergence of VD as a new market category could potentially disrupt the core VC business (Navis & Glynn, 2010). In this context, established markets need to understand the reasons behind the VD emergence and the boundaries of VD in order to address their potential disruption to save their market stakes (Wessel & Christensen, 2012). Last, VD providers positioned themselves to solve scale-up funding gaps in the entrepreneurial finance landscape and governmental programs subsidize VD for this purpose (e.g., EIB, 2022; Vaekstfonden, 2019). With respect to established financial instruments for startup funding, the embeddedness of VD in the financial ecosystem and VD's potentials and limitations need to be assessed.

Against this background, this paper addresses the question *of how and why VD emerged as another source of startup financing in Europe.* We employ qualitative methods to examine the emergence of the VD market category. We show how VD was formed

based on a Kirznerian entrepreneurial opportunity (Kirzner, 1997) based on unanswered funding needs in the startup ecosystem in Europe.

3.2. Literature review

3.2.1. Prior research on VD

Despite the relative maturity of VD in practice, prior research on the topic remains scarce and the few relevant studies can be organized into two research streams: studies that describe VD as a financing tool and those that analyze the selection criteria of VD providers.

Simply stated, VD as a financing tool can be described as "loans to early-stage, rapid-growth startups that have no traditional means of paying it back" (Ibrahim, 2010:1171). More precisely, VD can be described as a specific type of loan characterized by a higher interest than traditional bank loans combined with an equity kicker in the form of warrant coverage (Hesse et al., 2016). The equity kicker is cashed out by the VD providers separately at a time of their choosing within the contractual constraints, whereas startups repay the VD loan over time or with the next equity round (Ibrahim, 2010; Hesse & Lutz, 2016).

In contrast to VCs who generate returns via an exit after a few years, VD providers depend on the interest payments and the repayment of their loans and are exposed to great risks given the high failure rates of startups. Thus, VD providers have been found to employ a thorough yet efficient selection process. More specifically, research has shown that VD providers have a strong preference for securities in the form of patents or other types of tangible and intangible assets (e.g., IT code, trademarks,…) (de Rassefosse & Fischer, 2016). The importance of intellectual property to secure a VD loan has been emphasized in various studies, with Fischer & Ringler (2014) finding that high-technology patents are often collateralized by VD providers and Hochberg et al. (2018) highlighting that the salability of patents further facilitates VD involvement. Additionally, VD relies heavily on already invested VCs as an implied

security for their investment. Ibrahim (2010) outlined how VDs see VC involvement as a substitute for cash flows since VCs can have the credible assurance to repay VD out of their present and future equity investments. In their recent work, Lehnertz et al. (2022) showed VD investors favor older startups with strongly committed VCs. It has also been argued that startups with patents are able to access VD at lower costs as this signal of quality results in a reduction of the credit spread and the number of equity warrants demanded (Hesse & Lutz, 2016). Even though we have some information about the requirements of VD, we know little about how and why this category emerged and developed over the last years.

3.2.2. Prior research on category emergence

Category emergence is discussed widely and with different perspectives in the literature. From a modern evolutionary perspective, economies are ever-changing constructs where new elements are always being introduced and old ones are disappearing (Nelson et al., 2018). This includes the emergence and disappearance of market categories.

At the heart of the emergence of new market categories and technologies are the entrepreneurial activities of individuals and communities (Mezias & Kuperman, 2001; Sine & Lee, 2009). Entrepreneurs follow ideas and opportunities to come up with new technologies and solutions that can resonate with the market. Following the classical entrepreneurship research literature, entrepreneurs can be classified as 'Schumpeterian' and 'Kirnerian' entrepreneurs.

'Schumpeterian' entrepreneurs are individuals that innovative and disrupt existing markets to create a disequilibrium in the market at irregular intervals (Schumpeter, 1954). Schumpeter (1934) portrays this type of entrepreneur as a leader who challenges conventional wisdom with a combination of creativity and proactivity.

'Kirznerian' entrepreneurs are characterized as individuals that discover opportunities in disequilibrium states (Kirzner, 1973). "[A] Kirznerian entrepreneur

considers opportunities as readily available, 'waiting to be grasped' at this moment, as if they 'exist' now" (de Jong & Marsili, 2015:22).

This identification and exploitation of entrepreneurial opportunities by 'Schumpeterian' and 'Kirznerian' entrepreneurs can grow into new businesses, attract new market players, and can lead to the emergence of new industries and new market categories over time.

Categories are a cognitive and normative interface that enables market exchanges among market players (Granqvist et al., 2013) and serve as a disciplinary mechanism that brings order to organizational interactions (Goldberg et al., 2016). Market categories consist of 1) clear boundaries that define the inclusion or exclusion of market players and 2) commonly link together market players within the category with a common identity (Mervis & Rosch, 1981). This means market players can use categories to define market spaces or market affiliations

New market categories can emerge based on newly introduced product attributes or a reinterpretation and recombination of existing product attributes. Durand & Khaire (2017:2) define category emergence as "the formation of categories that emerge from elements extraneous to an existing market. Categories emerge when the existing classification system and categorial structure of markets do not sufficiently account for material novelties sponsored by innovators." In general, new categories can be institutionalized through the sense-giving activities of relevant market players (Navis & Glynn, 2010).

The process of new category emergence can be split into a cognitive and a social process (Durand et al., 2017). The cognitive process focuses on the individual assessment of new categories by market actors and can be distinguished as three categorization models: 1) Prototypical, 2) causal, and 3) goal based. In the prototypical model, market actors rely on family resemblances of product features that one or more entities hold in common (Rosch & Mervis, 1975). The commonality between entities can form new category prototypes for actors if the commonalities cannot be attributed to an existing category (Duran & Paolella, 2013).

In the case of new and unique offerings, actors can struggle to categorize the offering based on product features (Paolella & Durand, 2015). In such cases, market actors follow a causal categorization process where they compare the relative value of each offer based on their own utility (Bowers, 2015). The causal model describes how this consideration process takes place and market actors form new categories based on the experienced value of each offer.

The goal-based model refers to market actors forming new categories based on the considerations for meeting their own goals and needs (Durand et al., 2017). In detail, market actors evaluate entities by their performance in fulfilling a specific goal and form a market category based on the associated performance to fulfill this goal.

In contrast to the cognitive process of category emergence, the social process of category emergence describes how market categories become socially accepted (Kennedy & Fiss, 2013). This process is dependent on the involved actors, the object, the context, and other elements (Durand et al., 2017). The social process is an ongoing iteration of market categories and influences the degree of agreement, understanding, and acceptance of market categories.

Prior literature shows that a high agreement and acceptance regarding a new category can be achieved via 1) consensus or 2) proof (Rhee et al., 2017): If an audience agrees upon the meaning of a category without deliberate coordination, a category forms based on the consensus of the audience. If an audience is very exclusive and only constitutes a few highly educated entities, a category can form based on sophisticated discourse and proof. Outsiders to the small audience generally accept the new formation because they lack the knowledge required to follow the discourse. Several case studies show how dominant market categories emerge based on market actors. Historians and critics played a crucial role in the emergence of modern Indian art (Khaire & Wadhwani, 2010), the hype of consumers of pulled oats paved the way for meat substitutes in Finland (Vaskelainen et al., 2022), and the overarching success of Airbnb sparked the category for sharing economy business models (Mikhalkina & Cabantous, 2015).

3.3. VD Emergence and development over time

The emergence of new categories is often associated with highly disruptive and fast-growing companies that challenge the status quo (Schumpeter, 1954). Large technology companies such as Microsoft and Tesla show how to create new market categories and overthrow the decade-present market leaders like Nokia or General Motors.

The history of VD, however, has a different story. Even though VD asserts itself as a distinct asset class within private debt, VD does not disrupt the existing entrepreneurial finance market in a way similar to the large technology players. VD is unique in its characteristics and has emerged as an alternative funding option in its very own distinct niche market.

Looking more closely at the history of VD, the first application of VD constitutes venture leasing contracts for the financing of the machinery of the nascent semiconductor industry in California in the 1960s and 1970s. Based on these leasing contracts, Silicon Valley Bank and a few other players developed VD in the 1980s: Lending to cashflow and often asset-light startups that were backed by reputable VC companies with a structured loan contract. Over the following decades, VD developed further and reached more and more publicity while spreading from California to the whole US.

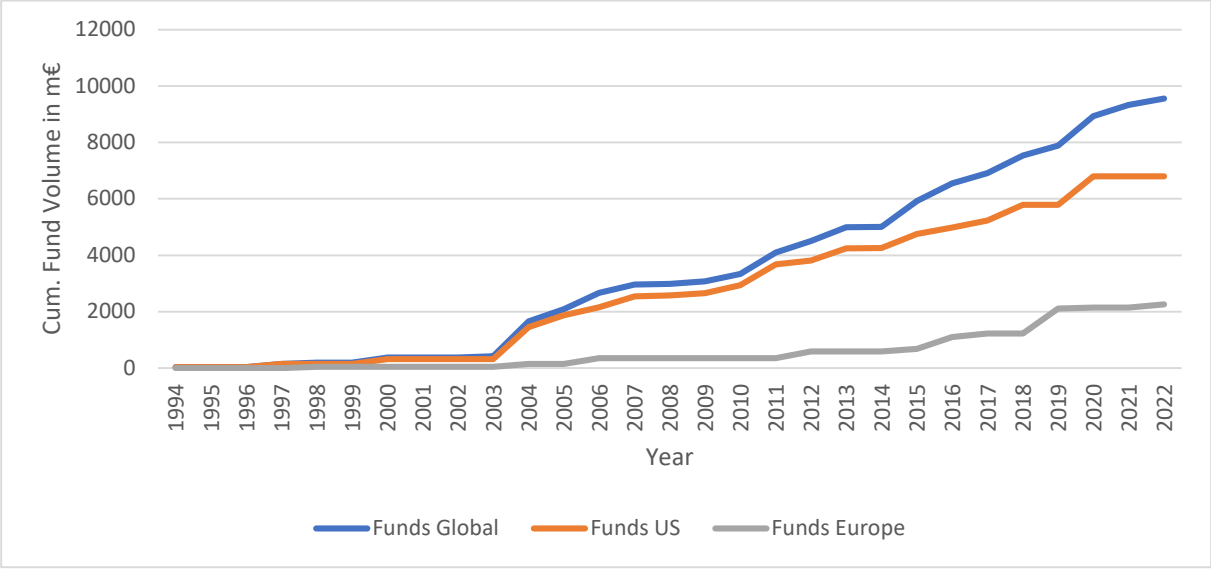
By 1998 VD was introduced in Europe by market players such as Kreos Capital. These VD funds lead the way to build the VD category in Europe by copying the US business model. Similar to the US, VD had a slow start in Europe with only a handful of market players. However, after the financial crisis in 2008, the market changed. As a result of the decreasing lending volume provided by banks, VD increased in popularity and the global VD volume as well as the completed deals increased. As a result, more VD players emerged and various new VD funds were funded in Europe.

With the evolving European VD market, more US players joined the European market with big players such as Silicon Valley Bank opening its first office in the UK in 2012.

By that time, European governmental actors noticed the potential of the VD category and started with supporting initiatives. For example, in 2016 the European Investment Fund and European Investment Bank started their ongoing activities in the European VD market. In addition, national institutions, like Vaekstfonden (Denmark) in 2015 or the KfW (Germany) in 2018 joined the VD market with governmental programs.

Additionally, the European VD ecosystem also contains several banks that are active in providing VD to startups. Currently, the European VD ecosystem encompasses over 30 players (funds and banks) with different backgrounds and geographical focuses.

Figure 3-1: Comulative VD fund volume



Source: Own illustration based on PitchBook data

Figure 3-1 provides an overview of the development of the global and regional VD fund volume over time and highlights the importance of VD as a funding source today. The global closed volume of VD funds constitutes around 9.6€bn. 71% of the volume

is provided by US funds, 24% by European funds, and 5% by funds located in the rest of the world.

3.4. Data and method

VD constitutes a combination of debt and equity that is not common in traditional sources of financing. This makes VD an exotic financing source. Quantitative data shows us that VD is growing rapidly over the last decade. However, the quantitative data cannot provide us with any explanations and reasons behind the genesis of VD. Therefore, we conducted an interview study to analyze how and why the VD market category emerged in Europe since most of this knowledge is preserved in the minds of the practitioners involved in the ecosystem. We identified 33 VD players located in Europe and contacted all of them via e-mail and LinkedIn. We aimed to interview one of the managing partners of the funds or in the case of banks the department head of the VD arm. We conducted interviews with 15 out of the 33 VD players. To be able to get a holistic view of the development and driving forces behind the emergence of the VD market, we approached European startups and VCs that received, syndicated, or have other experience with VD. As a result, we interviewed 8 startups that received VD funding and 5 VCs that already had experience with VD.

In order to reveal the driving forces that lead to the emergence of VD in Europe, we analyzed the interview material by using qualitative interpretative methods (Corbin & Strauss, 2008; Gioia et al., 2013; Leitch et al., 2010). We established initial categories using "open coding" (Corbin & Strauss, 2008) with the help of simple descriptive coding followed by analyzing relationships among the initial categories and assembling them into higher-order categories (Corley & Gioia, 2004). This work process for developing our framework involved a constant comparison between codes which resulted in the new creation, division, combination, and abolishment of codes.

Based on an iterative approach, the data was coded, analyzed, and discussed by two authors and their findings and interpretations were then discussed by the whole

research team. We made extensive use of coding matrixes to understand the driving forces of the emergence of VD in Europe. Table 3-1 provides an overview of our interview partners and **Fehler! Verweisquelle konnte nicht gefunden werden.** reports the results of our data coding and analysis.

Table 3-1: Overview of interviewees

Type	Profession	Education/ Schooling	Former Industry	Age category	VD experience	Length of the interview (in minutes)
VD1	Managing Partner	Business Administration, M.Sc.	Banking	50+	> 7 years	42:16
VD2	General Partner	Business Administration (MBA)	Banking, Private Equity, Consulting	40 – 50	> 10 years	40:16
VD3	Managing Director	Business Administration (MBA)	Engineer, Consulting, CFO	50+	> 15 years	49:11
VD4	Managing Partner	Business Administration, M.Sc.	Banking, Private Equity, Startup Founder	30 – 40	> 6 years	53:10
VD5	General Partner	Business Administration (MBA)	Private Equity	50+	> 20 years	47:04
VD6	Senior Portfolio Manager	Business Administration, B.Sc.	Banking	30 – 40	> 3 years	42:11
VD7	Managing Partner	Business Administration (MBA)	Corporate, Banking	50+	> 15 years	45:17
VD8	Managing Partner	Business Administration (MBA)	Corporate, Venture Capital, Familly Office	50+	> 6 years	30:41
VD9	Team Lead Venture Debt	Business Administration (MBA)	Banking	30 – 40	> 4 years	51:56
VD10	Co-General Manager	Business Administration (MBA)	Banking, Startup Founder	40 – 50	> 5 years	58:41

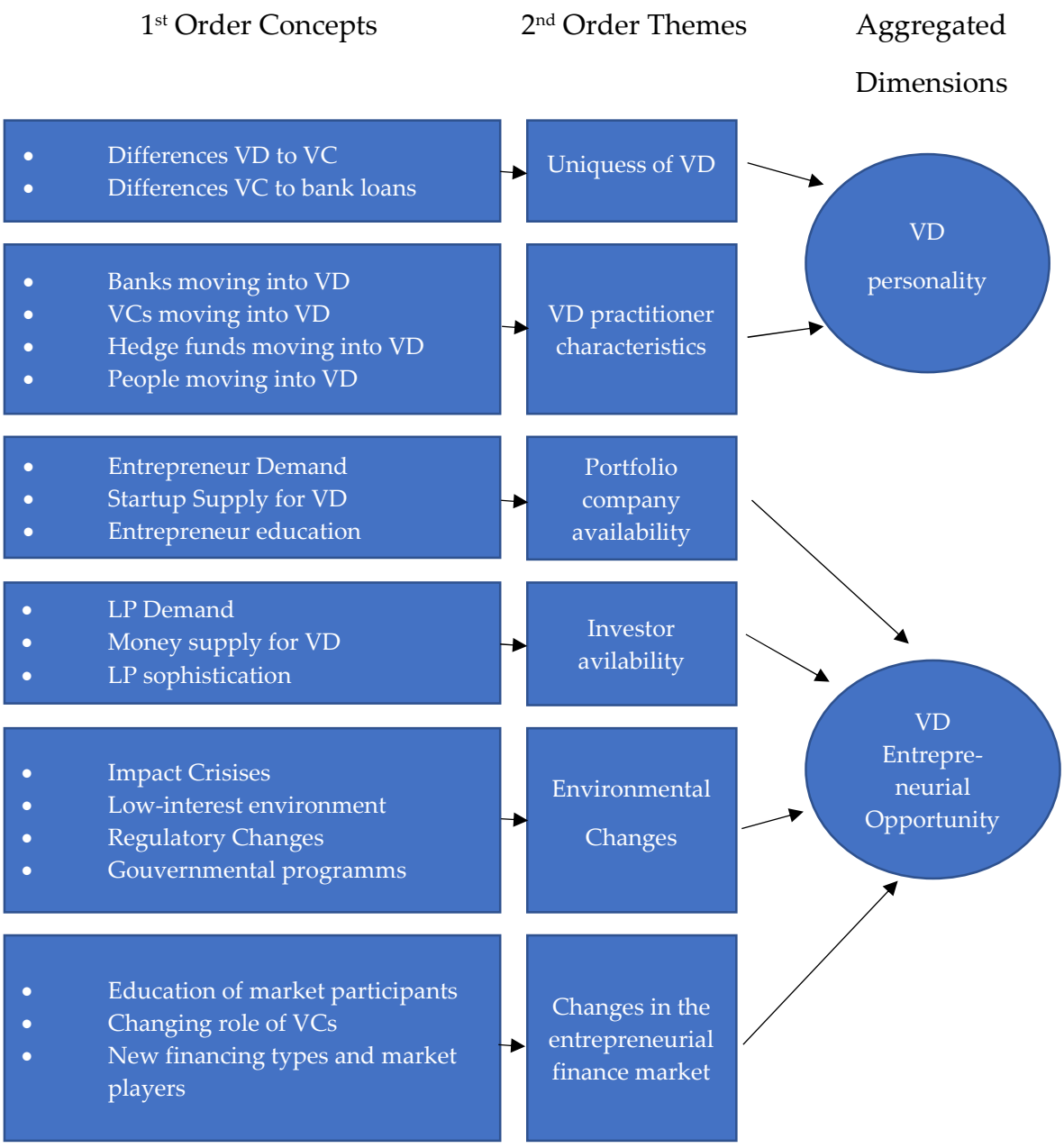
Type	Profession	Education/ Schooling	Former Industry	Age category	VD experience	Length of the interview (in minutes)
VD11	Managing Partner	Industrial Engineering, M.Sc.	Banking, Federal Ministry of Finance	50+	> 4 years	58:12
VD12	Executive Director	Business Administration, M.Sc.	Banking	40 – 50	> 4 years	53:12
VD13	Investment Director	Business Administration, M.Sc.	Banking	40 – 50	> 2 years	42:19
VD14	Investment Officer	Business Administration, M.Sc.	Consulting, Corporate Finance	40 – 50	> 5 years	43:20
VD15	Managing Director	Business Administration, M.Sc.	Consulting, Corporate Finance	40 – 50	> 5 years	43:47
E1	CFO	Business Administration, B.Arts		30 – 40	n.a.	45:02
E2	CFO	Business Administration, B.Sc; Engineering, B.Sc.		30 – 40	n.a.	45:30
E3	CFO	Business Administration (MBA); Mathematics, B.Sc.		40 – 50	n.a.	44:07
E4	CFO	Business Administration, M.Sc.		40 – 50	n.a.	54:42
E5	CEO	Business Administration (MBA); Law, B.Sc.		50+	n.a.	30:40
E6	CEO	Business Administration, (MBA); Engineering, M.Sc.		30 – 40	n.a.	31:22
E7	CEO	Business Administration, (MBA)		30 – 40	n.a.	44:17

Type	Profession	Education/ Schooling	Former Industry	Age category	VD experience	Length of the interview (in minutes)
E8	CEO	Electrical Engineering, M.Sc.		30 – 40	n.a.	32:57
VC1	Partner	Business Administration, (MBA); Physics, PhD		50+	n.a.	26:06
VC2	Partner	Business Administration, M.Sc.; Law, M.Sc.		50+	n.a.	28:17
VC3	Investment Director	Chemical Engineering, PhD		50+	n.a.	41:23
VC4	Partner	Business Administration, (MBA); Air Transport Management, M.Sc.		40 – 50	n.a.	27:03
VC5	Partner	Business Administration, M.Sc.		50+	n.a.	28:22

3.5. Findings

Based on our research question (why VD emerged in Europe?), our data reveals two major insights. First, the responses indicate how the people working in VD are very different from traditional sources of financing (e.g., VC and bank loans). Second, all the respondents depicted various influences in the European entrepreneurial finance landscape that highlight the entrepreneurial opportunity of VD. We conclude that both findings, the unique „VD personality“ and the „VD entrepreneurial opportunity“ can explain how VD emerged in Europe. Figure 3-2 outlines our framework which we discuss in the following subsections.

Figure 3-2: Discursive themes



3.5.1. VD personality

25 of our respondents described the uniqueness of VD as a financing instrument and 16 of our respondents described more specifically the characteristics of VD practitioners. Related to the unique characteristics of VD, respondents highlighted the structure of VD constituting secured debt together with equity warrants. They explained how this unique structure makes VD different from other financing options like VC and bank loans. Furthermore, they emphasized how this unique structure of

VD needs to be mirrored by the mindset of the VD practitioners as the following quote illustrates:

> "To do VD you need a combination of two skill sets: One is credit. […] And then you have to have also an equity mind. […] When you look at a deal from a credit perspective, when I look at this, I don't want to lose money. And when you look at it from an equity point of view, how much money can I make if it goes well? And in VD you need both. First, not to lose money. And second, to earn money if it goes well with your equity kicker." (VD2)

Respondents explained which people and personas enter the VD space. On the other hand, respondents also discussed other institutions (e.g., banks, hedge funds) which tried to enter the VD but were not able to adapt to the VD mindset. As individuals working in VCs and hedge funds dream of building up the next unicorn with active involvement in the companies, this mindset is unfitting to the characteristics of VD. Therefore, respondents see individuals which worked for traditional banks as more fitting for the VD mindset since bankers typically do not try to actively shape companies. However, the necessity in VD to rate intangible securities and to evaluate the upside potential of equity is contradictory to traditional banking. Besides these differences, our interviews revealed that most of our VD respondents have a professional background in banking. They explained that VD offered them the opportunity to support entrepreneurial activities which are not possible to realize in corporate banking. Furthermore, VD offered them the chance to apply their knowledge in the area of secured debt and apply it to the entrepreneurial finance space.

3.5.2. VD entrepreneurial opportunity

All but one of our respondents (27 out of 28) mentioned that the VD market offered an entrepreneurial opportunity. In line with Davidsson (2015), the answers of respondents outline various "external enablers" of the entrepreneurial opportunity. Both the money supply side, as well as entrepreneurs, experienced a gap in their financing options. According to our respondents, the money supply side searches for

interesting high-yield debt-based products where they can deploy their money without the fear of default. On the other side, entrepreneurs are looking for an alternative debt-based financing option for complementing or substituting VC funding. More specifically, entrepreneurs value their equity stakes and do not want to dilute themselves with every financing round. This aspect was supported by additional external enablers in the changing entrepreneurial finance landscape and other macroeconomic environmental changes. Respondents emphasized the increased education and financial literacy of all market participants in Europe. In other words, market participants are more educated about the existing and emerging financing instruments in the market. This change enabled VD to be understood and accepted among the market participants.

From a macroeconomic perspective, respondents highlighted that the development of bank loans and the policy used by banks to provide loans changed significantly due to regulatory changes, in particular with Basel III. The requirements introduced by Basel III make it very hard for banks to finance asset-light startups. In addition, respondents emphasized the huge impact of government programs to facilitate VD within Europe. The European Investment Bank became one of the largest VD players and national mandates sparked VD within other public institutions (e.g., KfW, Vaekstfonden) to support the VD ecosystem.

The findings of our interviews suggest that the emergence of the VD category is driven by an unanswered funding demand from startups in Europe partially resulting from stricter banking regulations. This funding gap could also not be covered by other existing financial instruments and called for the emergence of a new market category that addresses the funding gap. VD providers realized this unique opportunity and constructed a debt-based financial instrument based on the US-based VD role models.

3.6. Discussion

Drawing on the broader literature on category emergence (e.g., Durand & Khaire, 2017) and modern evolutionary economics (Nelson et al., 2018), and, we evaluated how and why VD emerged in Europe. We find that the European VD emergence is driven by 1) individuals with a specific VD personality and 2) the entrepreneurial opportunity that arose to establish VD in Europe.

Our interviews suggest that VD emerged out of a Kirznerian entrepreneurial opportunity. The entrepreneurial finance market was disrupted by new financing options, new players, and a changing role of VCs and banks. During the start of the century, the professional entrepreneurial finance market constitutes of mostly VCs, business angels, and banks. The emergence of crowdfunding, ICOs, and new regulations changed the market. VCs changed their focus to certain industries within the broader market and do not dictate the development of the startup as strongly as in the past (Lerner & Nanda, 2020). Banks are not able to finance cash-flow and asset-light companies and other financing options focus on financing the early stages of a company. This left a financing gap for startups, especially in the scale-up phase. This disequilibrium was discovered by individuals as an entrepreneurial opportunity and they implemented VD in Europe to fill this financing gap. These individuals constitute mostly seasoned bankers who are familiar with debt-based products but are restricted by regulation to invest in promising, innovative startups. The personal history of our VD interviewees also shows they are highly experienced in the field. 10 out of 14 worked in the banking sector and started working in VD during their 40ies. Since Kirznerian opportunities build incrementally upon or replicate existing product concepts (Shane, 2003), VD was the ideal opportunity for bankers to apply their knowledge and provide new possibilities. At the same time, VD fits their mindset as it provides a relatively low-risk opportunity (in particular in comparison with VC) as bankers are educated to control the risk of their entrepreneurial activities (Sarasvathy et al., 1998).

This emergence story is further amplified by an evolutionary economic perspective. VD was not developed only out of the European ecosystem but was influenced by the US VD industry (Hassink et al., 2019). Our interviews and the story of the first VD players in Europe highlight that European players copied the American business model and adapted it to the European market. Only after the first European players built and developed the European VD market, large US players (e.g., SVB) followed into the European market. This development illustrates how the ideas and business practices of foreign industries can be adapted and implemented by local players without the active involvement of foreign market players.

Using the category emergence framework and our interviews it is not trivial to determine in which process stage the VD market in Europe is today. Even though VD in Europe exists for over two decades, our interviews depict a pattern that VD as a product is still evolving. This is highlighted for example by the new initiative of VDs to offer debt in tranches to their portfolio companies. This means that companies can draw tranches on a contractual maximal volume to better fit their liquidity needs. Additionally, VD's market legitimacy varies between market players, and especially seasoned VC funds are very conservative in their view of VD's application.

Interviewees also emphasized an increasing category identity in the European VD market. VD players work together to lobby public institutions to receive more beneficial treatment of the category or to condemn market participants that adopted business practices that hurt the reputation of the whole VD market.

These findings suggest that VD has not gained full legitimacy as a market category in Europe. Navis & Glynn (2010) argue that a market category achieves full legitimacy when firms within the category emphasize their differences and stop emphasizing a shared meaning of the market category as a whole. Our findings reveal that VD providers are still trying to form a shared representation of the VD market to educate market participants about the product. However, with the harmful behavior of individual VD providers, a higher focus on the differences between VD providers is emerging.

Additionally, the lacking legitimacy of VD as a market category is mirrored by our identification of interview partners, as well as our interview acquisition process. These processes highlight that VD is still not prominent in the whole European startup financing world, and a lot of market participants, are still uninformed about the product. As a consequence, based on our research it can be concluded that currently, the VD category has not reached full legitimacy and is not dominant enough to close the scale-up financing gap. This result is substantiated by the recent paper of Quas et al. (2022) who show that Europe still struggles with the scale-up financing gap, even though VD could be one of the most prominent solutions.

From a category emergence perspective, we conclude that VD is currently situated in the transition from a nascent market to a legitimate respected market category. We base this assessment on the findings on how VD is very well developed as a product and accepted among the market VD participants that are educated about VD and share a common identity as the VD category as a whole. However, VD still needs to develop further in its life cycle. In particular the focus on the differences between market players needs to be further developed so that VD reaches the legitimacy threshold to become a legitimate market category. If VD develops further on its current trajectory it has the potential to make a permanent change in the entrepreneurial finance landscape and be helpful to solve the ongoing scale-up financing gap in Europe.

3.7. Conclusion

We investigated how and why VD emerged in the entrepreneurial finance landscape in Europe. Our findings reveal two VD-specific aspects which fostered the emergence of VD in Europe: 1) the VD personality and 2) the specific VD entrepreneurial opportunity in Europe. With our research, we contribute to research at the intersection of category emergence and entrepreneurial finance for the special case of VD.

First, we contribute to the scarce VD literature and develop a better understanding of the driving forces of VD in Europe. The existing VD literature examines the reasons for VD from a theoretical perspective (Ibrahim, 2010), how the VD business model works (Hesse et al., 2016), and how VD is used in its practical application (Hardymon et al., 2004). However, we are the first to draw from the vast experience of players in the entrepreneurial finance market to depict the forces that drove VD to its current position in Europe. We find the unique interaction of a specific VD personality and entrepreneurial opportunity that drove the development of VD in Europe. We show how seasoned bankers are well-equipped to pursue and drive VD due to their skill-sets and knowledge about debt-based products. However, the "regular" banker might not pursue an entrepreneurial opportunity based on their risk aversion (Sarasvathy, 1998) or their higher age (Curran & Blackburn, 2001; Kautonen et al., 2011). However, bankers who are dissatisfied with the limited room to engage in new and innovative industries and companies seem to be attracted by the opportunities provided by VD and engaged in developing the VD ecosystem.

Second, we connect the specific case of VD emergence to the broader category emergence literature. Category emergence is often discussed together with the development of novel technologies and categorial features that are hard to classify in existing category systems (Durand & Khaire, 2017). Hence, the emergence of new categories is often connected with the destruction and disruption of existing markets. The disruptive nature of new market categories and the further evolvement of the market can be connected to the classical Schumpeterian approach (Schumpeter, 1954). However, Kirznerian category emergencies remain rare even though Kirznerian entrepreneurial opportunities should be well represented in the ecosystem (de Jong & Marsili, 2015). The special case of VD emergence highlights that the rise of a new market category does not always disrupt existing markets, in our case the entrepreneurial finance market. VD rather exploits the disequilibrium in the market and addresses a lack of alternative financing options for expansion, bridging, and other special purposes. Therefore, the emergence of VD can be compared with a

vertical disintegration of the market (Jacobides, 2005). VCs and banks moved out of the space that VD now occupies due to a lack of incentives or new regulations. Thus, we see the rise of VD as mostly a complementary product to the market. However, we also see some rivalry at the intersection of VD with other financing options.

Chapter 4

How does venture debt impact startup development? A qualitative study

Venture debt is becoming an important source of financing, in particular for later-stage startups. Yet, we know little about its effects on a venture's development. Our qualitative study contributes to closing this gap by investigating how venture debt influences startups. Based upon 28 qualitative interviews with startup founders, venture capitalists, and venture debt providers, we identify several effects. We find that venture debt both positively and negatively influences the development of startups.

4.1. Introduction

Venture debt (VD) is a financial instrument consisting of a secured loan and equity warrants (Ibrahim, 2010) and becomes an increasingly important phenomenon in the entrepreneurial finance landscape. Prior research investigated the business model of VD (e.g., Hesse et al., 2016), the concept of VD (Ibrahim, 2010), the selection criteria of VD providers (e.g., de Rassenfosse & Fischer, 2016), and the role of patents in the VD provider's selection process (e.g, Hochberg et al., 2018). However, startups faced with the decision of pursuing VD funding or using other sources of funding cannot fall back on established research on the potential consequences and impact of VD on their development.

Against this backdrop, this study aims to delve deeper into the consequences of VD in order to contribute to and extend the scope of the emerging literature that focuses primarily on the role of VD within the broader context of entrepreneurial finance and the assessment of potential deals. We use a qualitative approach to examine the underlying mechanism of the impact of VD on startups. Therefore, the central research question that underpins our study is: By which mechanisms does VD influence the development of startups?

We conducted 28 qualitative interviews with startup founders, VCs, and VD providers to examine the concepts behind the VD impact (Gioia et al., 2013). We identified stronger (financial) discipline, freedom to operate, time to funding, certification effects, and other value-adding practices as key concepts that explain the influence of VD on startup development. Surprisingly, we find mixed views on the direction (positive or negative) of the impact of some of these concepts on startup development.

4.2. Data and method

4.2.1. Data

Our qualitative study aims to better understand the market behavior and characteristics of VD providers. In order to capture a broad and holistic picture of the VD landscape, we conducted 28 semi-structured interviews with the key market actors. Specifically, we interviewed 15 VD fund managers, 5 VC fund managers, and 8 entrepreneurs that had received both VD and VC funding, which enabled us to triangulate our findings and let us identify similarities and differences between different groups of market participants (Denzin, 1978). We continued the interviews until the emerging categories and relationships tended to converge and the answers became repetitive (Glaser & Strauss, 1967) and theoretical saturation was reached (Eisenhardt, 1989).

Stakeholders qualified to discuss the VD process were identified by using two distinct strategies. First, we utilized the Crunchbase database to identify VD funding rounds, the associated VD funds, and the startups that had received VD funding as well as VC funds that had experience with VD providers. Each potential informant was contacted via email to request an interview. Second, we employed snowball sampling by asking our initial informants for additional contacts and personal recommendations of individuals with knowledge of VD. All interviews lasted between 25 and 60 minutes and were conducted via web meetings using either Microsoft Teams or Zoom. Every interview was recorded and transcribed and conducted by two researchers; one author participated in every interview whereas the second interviewer varied among co-authors. All interviewees were promised that their personal and their respective organization's identities would be kept confidential and therefore each respondent is referred to using alpha—numeric pseudonyms (Siegel et al., 2003). Table 4-1 summarizes the main characteristics of our 28 interviewees.

Table 4-1: Interviewee characteristics

Type	Profession	Education/ Schooling	Age category	VD experience	Length of the interview (in minutes)
VD1	Managing Partner	Business Administration, M.Sc.	50+	> 7 years	42:16
VD2	General Partner	Business Administration (MBA)	40 – 50	> 10 years	40:16
VD3	Managing Director	Business Administration (MBA)	50+	> 15 years	49:11
VD4	Managing Partner	Business Administration, M.Sc.	30 – 40	> 6 years	53:10
VD5	General Partner	Business Administration (MBA)	50+	> 20 years	47:04
VD6	Senior Portfolio Manager	Business Administration, B.Sc.	30 – 40	> 3 years	42:11
VD7	Managing Partner	Business Administration (MBA)	50+	> 15 years	45:17
VD8	Managing Partner	Business Administration (MBA)	50+	> 6 years	30:41
VD9	Team Lead Venture Debt	Business Administration (MBA)	30 – 40	> 4 years	51:56
VD10	Co-General Manager	Business Administration (MBA)	40 – 50	> 5 years	58:41
VD11	Managing Partner	Industrial Engineering, M.Sc.	50+	> 4 years	58:12
VD12	Executive Director	Business Administration, M.Sc.	40 – 50	> 4 years	53:12
VD13	Investment Director	Business Administration, M.Sc.	40 – 50	> 2 years	42:19
VD14	Investment Officer	Business Administration, M.Sc.	40 – 50	> 5 years	43:20
VD15	Managing Director	Business Administration, M.Sc.	40 – 50	> 5 years	43:47
E1	CFO	Business Administration, B.Arts	30 – 40	n.a.	45:02
E2	CFO	Business Administration, B.Sc; Engineering, B.Sc.	30 – 40	n.a.	45:30

Type	Profession	Education/ Schooling	Age category	VD experience	Length of the interview (in minutes)
E3	CFO	Business Administration (MBA); Mathematics, B.Sc.	40 – 50	n.a.	44:07
E4	CFO	Business Administration, M.Sc.	40 – 50	n.a.	54:42
E5	CEO	Business Administration (MBA); Law, B.Sc.	50+	n.a.	30:40
E6	CEO	Business Administration, (MBA); Engineering, M.Sc.	30 – 40	n.a.	31:22
E7	CEO	Business Administration, (MBA)	30 – 40	n.a.	44:17
E8	CEO	Electrical Engineering, M.Sc.	30 – 40	n.a.	32:57
VC1	Partner	Business Administration, (MBA); Physics, PhD	50+	n.a.	26:06
VC2	Partner	Business Administration, M.Sc.; Law, M.Sc.	50+	n.a.	28:17
VC3	Investment Director	Chemical Engineering, PhD	50+	n.a.	41:23
VC4	Partner	Business Administration, (MBA); Air Transport Management, M.Sc.	40 – 50	n.a.	27:03
VC5	Partner	Business Administration, M.Sc.	50+	n.a.	28:22

4.2.2. Interview process and data analysis

We conducted semi-structured interviews with open-ended questions to ensure the free expression of opinions and experiences from our interviewees. Our interview guideline was developed by gathering information from prior VD and VC research as well as market information including data and market reports from the databases Prequin, Pitchbook, and Crunchbase. This approach allowed us to identify characteristics, market developments, possible motives for VD, and the relationship between startups and VD/VC providers. In order to confirm that our respondents were in fact knowledgeable about the topic, we started each interview by asking the interviewees about their professional backgrounds, how they had learned about VD and what, in their opinion, makes VD an interesting financing tool. We continued with more specific and structured questions (Spradley, 1979) regarding their motives for engaging in VD and their opinions about the influence of VD on startups. We closed the interviews with detailed questions regarding the evolution of the entrepreneurial finance landscape, the funding environment overall, and VD more specifically.

The interviews were recorded and later transcribed by one of the authors. We used the software program MaxQDA to code and categorize our data. Our initial coding scheme was based on the researchers' prior knowledge acquired through the relevant literature and the market developments (Miles & Huberman, 1994) and then this initial coding scheme was expanded and adjusted while working with the data to cover all relevant aspects mentioned by the interviewees (Strauss & Corbin, 1998). We subsequently combined similar codes and deleted others that were found not to be informative for the emerging concepts (Gioia et al., 2013). Overall, we developed the final coding scheme with an iterative, inductive, and ongoing process. We aggregated the codes into a meaningful system of higher-dimensional categories (Miles & Huberman, 1994).

Once the coding structure was developed, the first coding was done by one of the authors. To ensure the reliability of our results, one of the co-authors coded around

30% of the interviews and the coding of the two coders were compared. After resolving inconsistencies and adapting the coding scheme, all interviews were coded again with the revised coding scheme and checked for consistency. The subsequent coding and analysis of all interviews were based on this final coding scheme. Our analysis resulted in five main categories 1) stronger discipline, 2) freedom to operate, 3) time to funding, 4) certification effect, and 5) value-adding effects. We further distinguished between positive and negative effects, which will be outlined in the following section.

4.3. Results

a) Positive effects of VD on startups

The identified positive effects of our interviews are summarized in Table 4-2.

Table 4-2: Positive effects of VD on startups

Categories in the Qualitative Study, Definitions, Examples, Frequencies				
Category	Definition of the Category	Argument	Example Quote	Frequency (N=28)
Positive Effects on Startups				
1. Stronger Discipline	Influence of VD on the discipline of entrepreneurs regarding deliverables (i.e., reports, interest payments, …)	VD providers place a strong emphasis on financial controls, compelling startups to follow reporting and accounting guidelines as well as monetary discipline.	"[…] the ones [VDs] we had to deal with, I think they already attached importance to a certain discipline when it comes to financial accounting and then he also imposed certain conditions that they [startups] have to report e.g. monthly in a format that maybe goes beyond what we typically expect now e.g. as a VC, but I think that's a good lesson also for the founders to apply a discipline there."	7

Categories in the Qualitative Study, Definitions, Examples, Frequencies				
Category	Definition of the Category	Argument	Example Quote	Frequency (N=28)
Positive Effects on Startups				
2. Freedom to Operate	Influence of VD on the management freedom of entrepreneurs (i.e., company development, decision making, control over equity, …)	Startups with VD have higher flexibility and more independence when pursuing VC rounds, IPOs, etc.	"We [VD] are less dilutive, of course, and we don't have the second cost of equity which is the political cost. When you put a VC fund in a company, then you have a new board member and a new shareholder agreement and that is a completely different board game. Somebody you have to answer to and somebody who has influence. … if you want to ignore [our] advice, you are free to do so […] "	22
3. Time to Funding	Speed of realization of a VD round (compared to VC)	VD has a light DD process and no onerous negotiations about valuation. VD rounds can be realized much faster.	"But once the negotiation process is complete, which can be two days or sometimes a year, then our funding is very fast. Our due diligence is maybe four weeks. Documentation is probably four to six weeks. And we often start the documentation about two weeks into the due diligence. So, it could be easily done in 8 weeks."	8
4. Certification effect	Certification effect of VD on outsiders	VD involvement signals startup quality to outsiders and the startup can attract more funding, new investors, etc.	"There is kind of an association with debt as negative. I read TechCrunch, […] and raising debt is like for losers. Oh, they went with debt that means they cannot raise equity. No, it's the opposite. Raising debt is for smart guys, because it's less dilutive."	13

Categories in the Qualitative Study, Definitions, Examples, Frequencies				
Category	Definition of the Category	Argument	Example Quote	Frequency (N=28)
Positive Effects on Startups				
5. Value-adding effects	Value-adding effects of VD on startups (e.g., expertise, networks, …)	VD providers can have value-adding effects depending on their level of involvement.	"The reason why we [VD fund] have been relatively successful is that we know how to solve [bad] situations. You get into death valley, you better work with us and not anybody else because we will not dissolve, we provide more capital, we will restructure, we will work with the board, we will find a way to make it work."	15

Stronger (financial) discipline

Seven of our respondents (25%) described how VD can positively affect startups by requiring more financial discipline. Both VD providers and VCs argued that a loan forces the startup's management to improve their liquidity management to be able to ensure regular interest payments. In line with previous research on financial reporting (Ball et al., 2008), VD providers and VCs mentioned that regular reports are more important for debt providers than for equity investors as debt providers typically do not have a seat on the board. Furthermore, VD providers emphasized the importance for the startup to manage the level of debt with discipline. VD1 had a particularly strong view on this:

"Yea, I guess the other thing that we try to do, […] is some control over the quantum of debt relative to the size of the company. […] But if you put 50 million of debt into a 10 million revenue company, and that debt is amortizing and secured. Which venture debt is." (VD1)

Overall, the respondents reasoned that fulfilling the requirements of debt providers is an important learning experience for the management team, which prepares them for the next stage of development as their startups mature and grow.

Freedom to operate

Most importantly, the majority of the interviewees (22; ~ 79%) stated that VD involvement offers startups a great amount of freedom to operate compared to other funding options. This freedom has direct implications on how entrepreneurs can shape the startup to their vision and influence its strategy (Baum et al., 1998; Cortes & Herrmann, 2021; Elenkov et al., 2005). More specifically, our respondents reported that VD can affect the freedom to operate in three distinct ways: 1) less equity dilution, 2) more operational flexibility, and 3) fewer investors with board presence.

VD providers, VCs, and entrepreneurs highlighted that less equity dilution is very important, in particular for equity-sensitive entrepreneurs who want to retain controlling stakes of their startup. This seems to be particularly important for entrepreneurs with high managerial capabilities but who are in need of external financing (Hellmann, 1998), as they can be restricted by equity investors. As VD5 stated: "*For entrepreneurs who are sensitive to dilution is to say: […] You will get the same amount of capital as you want but with less dilution.*" Entrepreneurs added to this argument by emphasizing the control they maintain with VD as well as the independence they gain from their existing VC investors which can keep their portfolio companies on a tight leash (Tian, 2011). In line with this argument, E6 pointed out that with greater VD investment the control over financing decisions increases while the dilution decreases.

Overall, all respondents agreed that VD increases the startup's freedom to operate because VD funding is seen as an add-on or complementary financing round to VC. Consequently, some of our interviewees explained how they can adapt their liquidity to the "optimal level" with the help of VD. Entrepreneurs also reported how the flexible covenant structure and the opportunity to access VD in tranches can increase the flexibility of the startup. In this regard, E5 pointed out, how beneficial VD can be in delaying the next equity round until the startup can reach a higher valuation: *"You care more about postponing the round as much as possible so that you can get the higher valuation and get less diluted."*

In addition, respondents reported that VD providers are very different from other risk capital investors with regard to involvement and board presence. VD providers explained that they – in contrast to VCs (Cumming et al., 2010; Fried et al., 1998) – are not interested in having an ongoing active role in the startup, especially on the board, due to the time, effort, and industry expertise needed to fulfill such a role. More specifically, they are not willing to commit to this time investment since their upside potential is very limited given their minority equity stakes. Entrepreneurs highlighted that their boards are already well structured and effective and that additional board members would only slow down their activities. Consequently, entrepreneurs do not see the need for VD providers on their boards, as pointed out by E3:

"Its definitely my experience that the VC providers are much more active. […] I mean the debt providers they also move closer when we're not performing great, I think. But in the end of the day they don't have much input on the business. I had discussions with him [my VD] but he is very aware and tells us "I'm not trying to interfere with anything but let me hear a little bit about how things are developing and if we should look for some new debt for you guys." (E 3)

Time to funding

A positive effect regarding time to funding was mentioned by eight of our respondents (~ 29%). The time between applying for and receiving the funding can be crucial for startups (Hsu, 2007) as the shorter the time to funding, the less likely the startup is to run into liquidity problems. Furthermore, if the startup knows that the time to funding is relatively short, it can opt for a more flexible funding cycle. Respondents noted that VD funding typically is completed much faster than an equity financing round, for a variety of reasons. First, VD providers have comparably lighter due diligence requirements as they rely considerably on the due diligence of existing VC investors (Ibrahim, 2010). Second, VD providers focus less on the startup's valuation (compared to VC investors), which avoids long discussions on the valuation of the startup (Mason & Harrison, 1996). Third, entrepreneurs highlighted that VD rounds need much less preparation in general and less coordination with their board to be realized. As E3 pointed out: *"I think, overall the execution is much easier on the debt side"* and

further *"I mean, on the debt side there is of course lots of documentation […]. But I would say the preparation work is larger for an equity round so there is the execution that makes debt more attractive."*

Certification effect

A positive certification effect of VD for startups, which is commonly associated with the involvement of VC investors (Guerini & Quas, 2016; Lee & Wahal, 2004; Megginson & Weiss, 1991), was mentioned by 13 of our respondents (~ 46%). This positive effect of VD was associated with the specific selection criteria of VD providers with regard to business model requirements, securities, and stability, which corresponds with the selection criteria identified by de Rassenfosse & Fischer (2016). Specifically, some of the interviewees stated that attracting funding from VD providers certifies the credibility of a startup's business model. However, our VC respondents noted that this certification is not yet universally recognized and is only meaningful if the startup attracted VD funding from one of the reputable VD actors in the ecosystem. As VC2 noted: *"Its [VD reputation] improving all the time, they are more professional, there are more players and they have a reputation which is the most important factor."*

Value-adding effects

Additional value-adding effects of VD providers on their startups were described by 15 of our respondents (~ 54%). In this category, respondents mentioned that VD providers offer their network to the startup, help to optimize its capital structure, and adapt their behavior when the startup goes through difficult phases to make sure the startup does not go bankrupt. Some VD providers emphasized that their active work together with the startup's board in difficult times is what distinguishes effective value-adding VD providers from the rest, as VD4 pointed out:

"If you come from the traditional lending space, you will shut down the business and the business will never be able to get to the top. The reason why we have been relatively successful is that we know how to solve that situation. If you get into death valley, you better work with us and not anybody else because we will not dissolve, we provide more capital, we will restructure, we will work with the board, we will find a way to make it work." (VD 4)

Overall, our qualitative evidence suggests that VD providers can have a positive effect on startups, but in different ways than equity investors (Cumming et al., 2005; Croce et al., 2013). In particular, VD offers startups increased flexibility in their funding cycle, and entrepreneurs can remain in control of their startups due to the less-diluting nature of VD.

b) Negative effects of VD on startups

While several positive effects resulting from VD involvement exist, the analysis of our interviews also revealed a number of negative effects within three of the five aforementioned categories, which are summarized in Table 4-3 and discussed below.

Table 4-3: Negative effects of VD on startups

Categories in the Qualitative Study, Definitions, Examples, Frequencies				
Category	Definition of the Category	Argument	Example Quote	Frequency (N=28)
Negative Effects on Startups				
1. Stronger Discipline	Influence of VD on the discipline of entrepreneurs regarding deliverables (i.e., reports, interest payments, …)	No arguments found		0
2. Freedom to Operate	Influence of VD on the management freedom of entrepreneurs (i.e., company development, decision making, control over equity, …)	VD contracts have strong requirements and interest payments that decrease the room for manoeuvre of the startup.	"VD can help to extend the runway. However, clearly you know you start paying back pretty quickly that VD and it eats into your cash flow again as well, right? And when you come into a distress situation then venture debt can be quite destructive. That´s for me the main downside of venture debt."	6

Categories in the Qualitative Study, Definitions, Examples, Frequencies

Category	Definition of the Category	Argument	Example Quote	Frequency (N=28)
Negative Effects on Startups				
3. Time to Funding	Speed of realization of a VD round (compared to VC)	VD contracts come with a lot of security pledges and bureaucracy that slows down the process and increases the time to close a funding round.	"So I see a lot of disadvantages in terms of there have to be contracts drawn up, there has to be a pledge all the time. It's a lot of paperwork"	4
4. Certification Effect	Certification effect of VD on outsiders	The involvement of VD providers increases the inherent risk for new outside investors since VD providers can drive startups bankrupt if their behavior is self-interested.	"I know stories of people [VDs] who said: 'Okay, I default you and I want to get my money out and I don't care what the others do then.' So it can get really nasty!"	11
5. Value-adding effects	Value-adding practices of VD on startups (e.g., expertise, networks, …)	No arguments found		0

Freedom to operate

Even though the positive opinion about VD on the freedom to operate seems to be predominant, six of our respondents (~21%) described situations wherein VD funding can also have a negative effect on the freedom to operate for the startup. Since VD is a debt contract, a startup that receives VD needs to meet regular interest payments, contract obligations, and reporting duties – all of which can further exacerbate the stressful working environment and fluctuating cash flows typically associated with startups. In addition, the risk that investors claim their physical and intellectual property as securities were mentioned by those respondents. Overall, respondents described how these VD-related obligations can keep the management occupied and tie up a startup's scarce resources. This aspect fuels the risk of failure of a startup and are critically viewed by VC investors, as articulated by VC1:

"VD people, you know, give you a whole set of governance and things like that and then, when the time comes, they call you on that. […] If your project is delayed by even three months you are not meeting those governance rules. So that is where the difficulties start with VD that is not adapted to the 'venture part' – they provide debt only but they are not 'venture' enough." (VC 1)

Time to funding

A negative effect of VD on time to funding was mentioned by four of our respondents (~14%). Although VD providers are less focused on due diligence and valuation negotiations (as they typically rely on the current VC investors), some respondents described the bureaucratic requirements due to the risk evaluation process as a major reason for funding delays. In particular, entrepreneurs complained about the amount of paperwork, legal pledges, and appointments with notaries required to obtain VD. The resulting delays can eradicate the potential advantages of the VD funding process and can even have negative effects on the startup. As VD12 pointed out:

"The fewest dealt with this complex, contractual construct of VD contracts, which are 100-200 pages guaranteed and enormous legal costs, notary costs mostly. And also the other special termination rights, such as the material-adverse-clause […] which are inherent in these contracts. They can make life very difficult for the

customer and if you do not deal with them properly in advance, VD can also be a disadvantage, so you might say you would have preferred to take the equity."

However, it is important to note that these concerns were only mentioned by German startups and a specific German VD fund. Thus, this negative effect with respect to timing may be unique to and the result of the German legal environment.

Certification effect

In contrast to the 11 respondents attesting that VD provides a positive certification effect, ten respondents (~39%) mentioned that VD can also have a negative certification effect for startups. This view, which was shared by VC investors and entrepreneurs alike, was also supported by the experience of VD providers reporting that they have to deal with many negative perceptions of VD in the market. In particular, respondents described how VD involvement can increase the (perceived) risk of failure of a startup. The underlying reasons for this perceived risk include the "loan-to-own" mentality of selected VD providers, the risk of default for the startup when VD providers claim the loan securities, and, more generally, the interest and repayment obligations resulting in liquidity constraints for the startups. These concerns were summarized by VD10: *"A prime example in Germany, also on the VD side, is the behavior of the [VD] fund with [company 1] and [company 2], where the fund was the decisive factor that the companies have gone bankrupt."* VD10 further explained that even though this behavior is not typical for VD providers, these single cases can cause a widespread negative market perception of VD.

4.4. Summary

Overall, the insights and experiences of our respondents highlight various characteristics of VD that may have negative influences on startups. Specifically, the negative certification of VD due to a negative reputation of VD generally is one of the main concerns mentioned by our respondents. The bureaucracy that delays access to VD funding, other legal restrictions, and the counterparty risk of the VD provider's behavior can also lead to additional negative effects of VD for startups.

In sum, our qualitative analysis suggests two competing hypotheses and cannot provide a clear answer as to whether VD has a positive or a negative effect on startup development. VD7 highlighted this by referring to the basic assumptions of Modigliani & Miller (1958):

"Does adding this capital [VD] to your balance sheet make your company riskier? And if that makes the company riskier, does that make your equity more expensive? That is the thesis for me because it gets right to one of the cornerstone theories of modern finance. I ask whether in this case the theory holds true? It appears that it doesn't." (VD 7)

To get a deeper understanding of how VD impacts startups and to answer these questions, we examine the quantitative effect of VD on startups in the following chapters. This way, we will be able to determine whether the positive or negative effects of VD on startup development persist.

Chapter 5

Does venture debt facilitate the financial resource acquisition of high-growth ventures? A certification perspective[3]

Venture debt is increasingly becoming an important source of entrepreneurial finance, in particular for later-stage, high-growth, ventures. Yet, we know little about its effects on a venture's development. Our study contributes to closing this gap by investigating if, and if so how, venture debt provides a certification effect to high-growth ventures, which ultimately influences their strategic trajectory and outcomes. Using a sample of 41,568 startups and 79,664 funding rounds, we find that venture debt increases the likelihood of acquiring additional external financial resources via subsequent funding and trade sales. In addition, high-reputable VD providers increase the likelihood of acquiring additional financial resources via IPOs.

[3] This chapter is based on Block et al. (2022)

5.1. Introduction

Research shows that debt, provided by both insiders and outsiders, plays an important role in small business finance. Estimates are that up to 75-90%, (Cassar, 2004; Cole & Sokolyk, 2018) of young ventures take up some form of debt in their venture lifecycle and that even the few high-growth ventures that ultimately attract external private equity funding still have as much as 25% of outside debt in its capital structure (Robb & Robinson, 2014). Due to their nature, early-stage ventures often have limited track records and information asymmetries between the founders and external investors are high, which can lead to difficulties for startups to access external debt (Stiglitz & Weiss, 1981, Wright, Lumpkin, Zott, & Agarwal, 2016). Venture capital (VC) as high-risk equity capital has filled this void and has led to the gestation of some of the most innovative new ventures over the last decades. To summarize, until more recently, the common perspective in entrepreneurial finance was that outside debt financing (e.g., in the form of a bank loan) was an attractive financing option for selected young, but not-so-innovative and fast-growing ventures, while VC was the preferred option for innovative new ventures with disruptive products/services and high-growth potential.

This view, however, is changing and needs to be updated to better reflect the current market dynamics and the evolution of the entrepreneurial finance landscape. With the advent and growing popularity of venture debt (VD) lending, innovative and fast-growing startups now have an attractive outside funding option that may complement or even be an alternative to traditional sources of funding. VD lies at the intersection of VC and traditional debt and is clearly different from traditional debt financing. A VD contract is structured as a secured loan that involves additional equity warrants. The distinct differences between VD and traditional debt financing are 1) the use of intangible assets as securities and 2) the implicit and not contractually specified promise of already involved VC investors to repay the VD loan (Ibrahim, 2010). VD

established itself as a reliable external debt source and is becoming commonplace across regions and a wide range of industries as the number of VD deals has tripled over the last decade and the global aggregated deal volume reached $28 bn in 2019 (Stanford, Warfel, & Midkiff, 2021). However, while VD has increasingly captured the attention of entrepreneurs and institutional investors alike since being introduced in the 1970s, the scholarly examination of this source of funding remains scant. Those few VD studies that exist have mostly analyzed the profiles of ventures that have received VD. Research has shown that the companies that receive VD have already successfully engaged other institutional investors (de Rassenfosse & Fischer, 2016). While the VD selection process typically occurs at a point in a startup's lifecycle stage similar to that of a late-stage VC investor, a VD provider may be even more selective given their less active role in the venture (i.e., no board seat, no voting rights, etc.) as well as the expectation of generating a return on investment through amortized payments in the near term. A large research gap exists about the consequences of VD for startups. While prior research has analyzed to a great deal the implications of VC for a startup's future funding pattern (e.g. the likelihood to conduct an IPO or a trade sale), we know little about the role of VD in the startup's funding pattern. The central research questions that underpin our study are: How does VD influence the financial resource acquisition of startups? How does a VD provider's reputation influence the financial resource acquisition of startups?

Our study takes a certification perspective and theorizes that VD as a financing instrument entails a certification value and increases the chances of a high-growth potential venture attracting additional financial resources. From the perspective of the entrepreneur, the decision to pursue VD in addition to or in lieu of another round of VC funding can be viewed as a strategic decision (Mintzberg, Raisinghani & Théoret, 1976; Eisenhardt & Zbaracki, 1992) owing to the potential impact on the company's subsequent activities and the commitment of capital resources to repay the debt. We further argue that these suggested certification effects not the same for all providers of VD. Building on the VC reputation literature (Krishnan et al., 2011; Lee et al., 2011), we

posit that the positive certification effects are mostly coming from a highly select and reputable group of VD providers.

To answer our research questions we use an explorative quantitative research setting using objective certification effects of our financial instrument (VD) and the subjective certification of a VD provider's reputation as the theoretical fundament explaining the mechanism. Using a sample of 40,314 startups, our results show that venture debt increases the likelihood of financial resource acquisition via follow-up funding, and trade sales while an increased VD provider's reputation increases the likelihood of financial resource acquisition via IPO.

With these results, we contribute to the young but growing literature on VD in two ways. First, we show that VD as a financing instrument has a positive certification value. Startups that obtained VD financing show a higher likelihood of acquiring additional financial resources via follow-up funding rounds and trade sales. Second, we show that the group of VD providers is very heterogenous and that this heterogeneity has implications for the startup's ability to attract additional financial resources via IPOing.

Our study also has practical implications for entrepreneurs. Even though there is evidence that VD may complement VC funding, we do not know whether VD provides the same positive certification effects commonly associated with VC-backing (Megginson & Weiss, 1991; Lee & Wahal, 2004). More importantly, little is known about VD's impact on a startup's performance compared to their non-VD-backed counterparts in terms of the time to exit, the likelihood of a positive exit, and the prospect of a successful IPO. Lacking these insights, entrepreneurs run the risk of incurring debt service without gaining the potential longer-term performance benefits that may be assumed.

Our research has practical implications. External debt provides significant diversification benefits for startups (Chen et al., 2010) and incentives startups to engage in exploitation instead of exploration (Choi et al., 2016). Additionally, the

likelihood of startup survival and profitability increases with the startup's use of business debt (Cole & Sokolyk, 2018).

5.2. Background on VD

5.2.1. Overview of VD and differences to other financing instruments

Despite its relative maturity in practice, dating back to the 1980s with the launch of Silicon Valley Bank, prior research on VD remains scarce. Simply stated, VD as a financing tool can be described as "loans to early-stage, rapid-growth startups that have no traditional means of paying it back" (Ibrahim, 2010:1171). More precisely, VD can be described as a specific type of loan characterized by a higher interest than traditional bank loans combined with an equity kicker in the form of warrant coverage (Hesse et al., 2016). The equity kicker is cashed out by the VD providers separately at a time of their choosing within the contractual constraints, while startups repay the VD loan over time or with the proceeds from the next equity round (Ibrahim, 2010).

In contrast to VCs who generate returns via an exit after a few years, VD providers depend on the interest payments and the repayment of their loans and are exposed to great risks given the high failure rates of startups.

This makes VD providers specialists in providing individual structured loans to rapid-growth, high-tech startups. On the surface, VD loans are very similar to traditional bank loans on a company's balance sheet. Therefore, one might ask the question, how VD loans and VD providers are different from traditional banks?

VD differs from traditional banks in two distinct ways: 1) VD providers oftentimes operate with funds or within special dedicated venture-debt arms and 2) the target group for and the nature of VD loans is different from other sources of debt financing.

First, numerous large VD players (e.g., TriplePoint Capital, Hercules Capital. Kreos Capital) use VD funds as their investment vehicle. The funds are structured similarly

to VC funds where the fund takes the role of the general partner who manages the capital of the fund and searches for suitable investment targets. The capital is supplied by limited partners who constitute institutional and private investors. Therefore, VD funds aim to maximize the limited partner's returns while controlling for default risk. Additionally, various banks (e.g., Silicon Valley Bank, Comerica, European Investment Bank) focus almost exclusively on or have dedicated arms for their VD business. Banks struggle with covering VD deals in their regular business units since the target group and nature are markedly different from traditional bank loans which we outline below.

Second, VD targets startups that typically have negative cash flows, no tangible collateral, and no recourse. This means that VD providers face equity risk for a debt return (Hesse et al., 2016). Consequently, the VD recipients would rarely, if ever, receive a loan by traditional credit rating models and outline why VD differs from traditional bank debt. On the other side, VD providers aim for full repayment of their loans and are not providing convertible debt structures to companies. Thus, VD providers can't substitute their increased risk with higher (equity) profits beyond their equity warrants. Why do VD providers engage anyway in lending to non-creditworthy recipients by traditional credit rating models?

The business model of VD providers relies heavily on building "symbiotic" relationships with VCs. VD providers reduce their risk-taking by an implicit promise of the involved VCs to continue funding the startup or to repay the loan from their own funds (Ibrahim, 2010; Lehnertz et al., 2022). Important to note is that this promise does not come with any contractual obligations for the VCs. Therefore, VD providers' main efforts constitute relationship management with VCs and auditing whether the VCs can make credible promises. Thus, the nature of VD and how VD providers work is unique to most other providers – especially in the debt environment.

Figure 5-1 summarizes the differences between VD and VC and bank loans.

Figure 5-1: Overview venture debt

	Venture Capital	Venture Debt	Bank Loan
Balance Sheet	Equity	Debt + Equity (80% - 90%) (10% - 20%)	Debt
Cost / Payments	Equity Dilution Political Cost	Interest Payment Equity Dilution	Interest Payment
Syndication	Regularly with VCs and VD	Regularly with VCs	Rarely with other lenders
Smart Capital	Active	Passive	Rarely
Requirements	Very promising Business (-Idea) Growth Potential ~10x	Usually at least in Expansion Stage Intangible Assets as Securities Cash-Flows Growth Potential ~4x	Established Business Tangible Assets as Securities Reliable Cash-Flows
US Market Size (2022)	$ 238.3B (Pitchbook, 2023)	$ 31.8B (Pitchbook, 2023)	n.a.

5.2.2. Relevant literature on VD

Despite its relative maturity in practice, prior research on VD remains scarce and the few relevant studies can be organized within two main research streams: (i) studies that describe VD as a financing tool and (ii) those that analyze the selection criteria of VD providers.

Since we already discussed VD as a financing tool and the related literature above, we want to focus here on the second stream which analyzes the selection criteria.

In contrast to VCs who generate returns via an exit after a few years, VD providers depend on the interest payments and the repayment of their loans and are exposed to great risks given the high failure rates of startups. Thus, VD providers have been found to employ a thorough yet efficient selection process. More specifically, research has shown that VD providers have a strong preference for securities (in the form of patents), warrants, and VC involvement when selecting portfolio companies (de Rassefosse & Fischer, 2016). The importance of intellectual property to secure a VD

loan has been emphasized in various studies, with Fischer & Ringler (2014) finding that high-technology patents are often collateralized by VD providers and Hochberg et al. (2018) highlighting that the salability of patents further facilitates VD involvement. It has also been shown that startups with patents are able to access VD at lower costs as this signal of quality results in a reduction of the credit spread and the number of equity warrants demanded (Hesse & Lutz, 2016).

With regard to the likelihood of startups receiving VD, Lehnertz et al. (2022) found that a startup's age, strongly committed existing investors, and being active in certain industries have a positive effect. Tykvová (2017) reported similar findings with the startup's age and the reputation of the VCs already invested in the startup having positive effects on the likelihood of a startup receiving VD. Interestingly, they also find that VD funding is negatively related to a successful startup exit. However, Iyer (2020) found a positive effect of VD on the valuation of the startup in subsequent funding rounds.

While the extant literature does provide limited insights with respect to selected outcomes of VD-backed startups, the effects of VD on startups are thus far not well understood. Our study delves into this research gap and aims to answer the question of how VD influences a startup's ability to acquire new financial resources.

5.3. Theory and hypotheses

5.3.1. Theoretical background: Certification theory in entrepreneurship

High-growth ventures are often faced with negative cash flows and rely on external finance sources to proceed and survive until their business model turns profitable later in their life cycle. To secure new funding rounds, startups need to be able to attract new investors and convince involved investors to provide new capital inflows.

The relationship between the startup and investors constitutes a principal-agent problem where the 'agent' (the startup) aims to convince the 'principal' (the investors) to provide funding. Since startups are characterized by a lack of information and liability of newness (Rao et al., 2008; Zimmerman and Zeitz, 2002), external investors are faced with high information asymmetries. The investors ('the principals') have to base their decision (to invest or not to invest) based on the information presented to them by the startup ('the agent'). In this relationship, the 'agent' could lie to the 'principal' which could result in a harmful decision for the 'principal' (Grossman & Hart, 1992). Thus, the 'principal' needs to rely on an affirmation of the truthfulness of the information presented by the 'agent'. The affirmation can be achieved by the ability of the 'agent' to verify their presented information (Bull & Watson, 2004; Deneckere & Severinov, 2008). This mandates a coherent explanation of the presented information with additional information. However, the 'agent' could find himself not being able to disclose additional information due to non-disclosure agreements or costs related to producing such information. Even in the case of successful affirmation by the 'agent', the 'principal' can find himself struggling to evaluate the presented information.

In these cases, middlemen between the 'agent' and the 'principal' can 1) gain additional information as the affirmation of the 'agent's' truthfulness which cannot be presented directly to the 'principal' and 2) the middlemen can evaluate the information based on their expert skills (Biglaiser, 1993; Biglaiser & Friedman, 1994). This gives middlemen the ability to certify the truthfulness and the quality of the 'agent' and help the 'principal' to make the right decision. In this case, the 'principal' can actively seek a third-party certification by a middleman and use it for his inspection.

Contrasting, 'agents' can actively pursue certification via a middleman to signal their quality if they lack the ability to convey credibly their quality to 'principals' (Stahl & Strausz, 2017). If so, the 'agent' takes on the role of a 'signaler' who is inclined to send a signal to a 'receiver'. This constitutes a special case where the underlying certification effect by a middleman (covered by certification theory) is used for signaling purposes (covered by signaling theory). Further key signaling constructs

involve e.g., the signal cost and the observability of the signal (Connelly et al., 2011). In our context, signaling is unfitting since there is no indication of whether startups actively use VD for signaling purposes. Additionally, startups often decide to engage in VD funding due to lower funding costs and according to signaling theory credible signals need to involve transaction costs associated with the signal.

Within the framework of startup funding, evaluating a startup's quality is a complex task that is crucial for outstanding early-stage startup investors (Baum & Silverman, 2004). Since startups are privately held entities without a long track record the publicly available information is scarce and informational asymmetries between startups and investors are high. Especially in the case of research-oriented high-tech startups where the owners are among the few experts in their field, the communication between a startup and an external investor can be difficult due to challenges in disclosing and evaluating information (Ang, 1992).

Thus, the involvement of specific third parties inside a startup can certify a startup's quality and result in reducing information asymmetries with other external investors (Booth & Smith, 1985; Dranove & Jin, 2010). This certification of a startup's quality can lead to a reduction of information asymmetries and startups can better access external sources of finance (Cassar, 2004; Coleman et al., 2016; Courtney et al., 2017; Nofsinger et al., 2011).

5.3.2. Hypotheses

Certification effects of VD as an instrument

In general, the inclusion of debt in the capital structure can serve as a certification of a startup's quality. By incorporating debt, the startup can bind itself to pursue high NPV projects to meet the lender's interest repayments (Crutchley & Jensen, 1996; Jensen, 1986; Ross, 1977). Since the lender has the power to force the startup into default, the incorporation of debt constitutes credible information to the marketplace. Additionally, debt providers are monitoring the startup and can enact change to meet

interest obligations (Harris & Raviv, 1990). This can be especially relevant in the startup context where companies need to transition from exploring their business opportunities to exploiting their established business plan to turn profitable. Choi et al. (2016) show how the presence of debt is a vital instrument in directing innovation along the optimal trajectory and forces companies to engage in exploiting their innovation. In a more recent study, Epure & Guasch (2020) find that equity investors also value the involvement of debt in the startup context, see it as a certification of the startup, and are more likely to invest in startups with debt in the capital structure.

Since VD providers act as pure debt investors who emphasize getting their principal investment reimbursed and do not work with convertible loans or other equity-like transactions, we hypothesize:

> *Hypothesis 1: Venture debt serves as a credible certification of a startup's quality which improves the startup's access to external financial resources via a higher probability of subsequent funding rounds, a higher probability of IPOing, and a higher probability of getting bought via trade sale.*

Certification effects associated with the provider of VD

While the involvement of VD, the financial instrument, itself can serve as a tool for certification of a startup's quality, also the high reputation of an involved investor can have a subjective certification effect. The subjective certification via an involved investor's reputation is independent of the objective certification via the underlying instrument. If a highly reputable investor is involved in a startup, external stakeholders pay more attention to the investor's name and the used financial instrument might go unnoticed. Additionally, VD is still a maturing industry connected with a lot of uncertainty in the market. Thus, external stakeholders might focus in particular on the track record of VD providers to further mitigate counterparty risks when investing in a startup. In that case, reputational benefits are important to build trust and signal deal quality. Low reputable VD investors might invoke their security rights, not in arrangement with other involved investors and as a result, drive

a promising startup into bankruptcy and deal a lot of collateral damage among other involved investors. This makes a good VD reputation and the track record of a VD provider in successfully exiting startups without invoking security rights very trustworthy. The involvement of such a highly reputable VD investor leads to a further reduction of information asymmetries by certifying the underlying quality of the product or startup (Dranove & Jin, 2010; Kreps & Wilson, 1982; Milgrom & Roberts, 1982; Shapiro, 1983). And in turn, the certification via a highly reputable VD provider also results in the increased access of a startup to external investors due to lower informational asymmetries.

It has been found in the startup context, the reputation of involved VC investors is crucial to future financial resource acquisition. Some scholars even highlighted that "it is far more important whose money you get than how much you get or how much your pay for it" (Bygrave & Timmons, 1992, p.208). This goes as far as entrepreneurs accepting less favorable valuations to get high-reputational VCs on board their startups (Hsu, 2005). Why is this the case? Scholars found that the involvement of high-reputable VCs is connected with a higher startup valuation (Davila et al., 2003), and in turn, startups can raise more financial resources on better terms Additionally, high-reputable VC investors face the risk of losing their reputation. Therefore, startups with high-reputable investors face better governance structures and control mechanisms to protect the investor's reputation (Krishnan et al., 2011; Petkova et al., 2014). These practices further increase a startup's certified quality and its access to external financial resources.

For the special case of financial resource acquisition via IPOs scholars have found strong reputational effects. First, VC presence in itself certifies a higher startup quality and leads to a higher initial valuation (Megginson & Weiss, 1991). However, the reputation of the involved VC investors further pushes the valuations, execution speed, and long-term performance of such startups (Krishnan et al., 2001; Nahata, 2008; Stuart et al., 1999). The effect of the reputation of involved business partners in IPOs does not end with VC investors. The reputation of the underwriter who conducts

the IPO together with the IPOing company directly influences the success of a company's IPO (Booth & Smith, 1986; Carter et al., 1998; Carter & Manaster, 1990) as well. Therefore, it is beneficial for startups to get further certified by highly reputable underwriters to avoid underpricing and gather the maximum financial resources via an IPO.

Since the reputation of the involved investors further amplified the certification of a startup's quality, we argue this holds also up in the special case of high-reputable VD involvement. Thus, we hypothesize:

> *Hypothesis 2: The involvement of higher reputable venture debt providers serves as an additional certification of a startup's quality which improves the startup's access to external financial resources via a higher probability of subsequent funding rounds, a higher probability of IPOing, and a higher probability of getting bought via trade sale.*

5.4. Data, variables and method

5.4.1. Data Sources

We use Crunchbase as the primary data source in our quantitative study. Crunchbase is commonly used in studies examining aspects of entrepreneurial finance (e.g., Block & Sandner, 2009; Ter Wal et al., 2016; Werth & Boeert 2011), and describes itself as the leading destination for company insights from early-stage startups to the Fortune 1000. It collects its data by using crowdsourcing and news aggregation techniques and provides funding round-level data on each financing event, including the announcement date, investors, funding amount, and funding stage (Series A, B, C, etc.). Additionally, other startup information is available, such as the founding date of the startup, industry, number of founders, headquarter location, and exit outcomes (IPO and trade sale).

Although Crunchbase provides an investor classification and the type of financing for each funding round, we found that the quality of the available data in the context

of VD is not adequate. To overcome this issue, we first exported an overview of all investors listed on Crunchbase with at least 10 financing rounds classified as "Debt Financing". This resulted in 86 investors. Second, for those 86 investors, we manually screened their websites and looked at their deals in Crunchbase, Preqin, and Pitchbook to verify whether they can be classified as VD providers. This resulted in a final sample of 61 VD providers.

Our unit of analysis are funding rounds, hence we started with all 338,189 funding rounds reported on Crunchbase but only kept funding rounds from 2009 onwards (34,649 funding rounds deleted) to exclude potential effects caused by the economic crisis. In addition, we only focus on the US market because VD is most mature in the US. Hence, we dropped funding rounds from all other countries (157,044 funding rounds deleted). Thereafter, we classified all funding rounds with the participation of one or more of the 61 identified VD providers as VD funding rounds. For the evaluation of the impact of VD involvement on startup development, we use VC-backed startups *without* VD involvement. Therefore, we also kept all other VC funding rounds independent of VD participation and deleted all other funding rounds reported on Crunchbase and all funding rounds happening after a VD funding round (38,587 funding rounds deleted). Afterward, we deleted 1,889 funding rounds that happened after an exit event. 9,036 funding rounds had missing investors and 15,824 funding rounds did not report the company's founders and were deleted. Last, we deleted all funding rounds with a following bankruptcy event (1,496 deleted). Our final sample contains 40,314 VC-backed startups: 1,392 of these startups were also VD-backed, and 38,922 did not receive VD funding. On the funding round level, our data contains 79,664 funding rounds, where 1,392 funding rounds have VD participation and the remaining 78,272 are funding rounds solely provided by VCs.

5.4.2. Variables

Dependent variables

To measure whether VD funding provides a certification effect on a startup's financial resource acquisition we use the dependent multi-item variable *Next Event*. The variable consists of a set of possible events (*IPO*, *Trade Sale*, F*ollow-up Funding*, and *Nothing*) following a respective funding round. *Next Event* is coded *IPO* when an IPO event occurred after the funding round took place. *Next Event* is coded as *Trade Sale, Follow-up Funding,* and *Nothing* when a trade sale event, a follow-up funding event, or nothing followed after the respective funding round.

Independent variable

VD: To measure the effect of VD, the dummy variable VD-backed is coded as 1 at the point of time when a startup received VD funding for the first time. The variable is coded as missing for all subsequent funding rounds after the initial VD funding. The variable is coded as 0 for all rounds before a VD funding occurred and for all funding rounds from startups that never received VD funding.

VD-Reputation: Following approved measures for reputation in the startup context (e.g., Gompers, 1996; Krishnan et al., 2011; Nahata, 2008), we construct a VD reputation index based on a rolling 5-year normalized average. We use VD provider age, number of IPOs of portfolio companies, number of trade sales of portfolio companies, number of bankruptcies of portfolio companies, number of participated funding rounds, and the average size of funding rounds for each VD provider in a given year. We calculate a Z-score for each of the variables taking a 5-year rolling average and normalizing them over all VD providers in a given year. The final reputation index for a given VD provider in a given year constitutes the sum of the six Z-scores (the score for bankruptcies is subtracted).

Control variables

We included several control variables that can affect both the startup's development outcome and the selection by VD providers. *Patents* have been identified as a signal of quality to outside investors (Long, 2002), which could improve their development outcomes. They have also been found to be important for VD providers when assessing startups (de Rassenfosse & Fischer, 2016). The patents are captured as a dummy variable coded as 1 if the startups filed patents before the focal funding round.[4]

Since the presence of VC investors can positively influence a startup's development (Brander et al., 2002) and the involvement of VC investors has been found to be an important selection criterion for VD providers (Ibrahim, 2010), we included *VC* and *Funding Round Syndication* as control variables. *VC* is a dummy variable that is coded 1 if a startup received funding from a VC investor before the focal funding round. *Funding Round Syndication* captures the number of different types of investors involved in the funding round. In line with the findings of Tykvová (2017), several of our interviewees mentioned that not only the presence of VC investors but also their reputation is an important selection criterion. Thus, we also included the reputation of VCs as a control variable. *VC-Reputation* is a dummy variable that captures whether one of the VC investors involved before the focal funding round is one of the largest VC investors according to FundComb's list[5].

In addition, we included a number of additional variables that might also play a role in a VD provider's selection and could affect a startup's development outcome: The cumulative USD inflow received by the startup before year t (*Amount of Prior Funding),* the logarithmic age of a startup at the time of funding (*Venture Age (ln)*), and the *Number of Funding Rounds* a startup had before the focal funding round.

[4] We extracted the INPADOC-patent family from the database PATSTAT and matched the patents to the companies in our dataset with Damerau Levenshtein distance meassures.

[5] Retrieved from https://fundcomb.com/lists/largest/startup-capital, accessed 18.04.2022.

Finally, we included dummies for *Year*, *Venture Industry*[6], *Venture State*[7] and the *Number of Founders*.

5.4.3. Method

Our unit of analysis are funding rounds and we analyze the events following a respective funding round. For the analysis of our independent variable *VD* on our dependent variable *Next Event*, we use a multinomial logistic regression model to assess the ability of financial resource acquisition of VD and non-VD-backed startups. Since the events after a funding round are competing, this allows us to capture the effect of *VD* simultaneously on all possible outcome events.

For the analysis of our independent variable *VD-Reputation* on our dependent variable *Next Event*, we use a multinomial logistic regression model on a data sub-sample of only funding rounds with VD-involvement to assess the influence of VD reputation on a startup's ability of financial resource acquisition.

5.5. Results

5.5.1. Descriptive results

Table 5-1 provides an overview of the descriptive statistics of our dataset, including the type of event ('IPO', 'Trade Sale', 'Follow-up Funding', and 'Nothing') following the respective funding rounds.

[6] Crunchbase offers 46 industry categories that we clustered into 19 categories listed in Table 3.

[7] The variable contains the states with the most VD providers: California, Illinois, Massachusetts, New York, Texas, and 'other states'.

Table 5-1: Descriptive statistics

Type of next event	VD-backed (N=1,392) (1)	Non-VD-backed (N=78,272) (2)	Difference (2) – (1)
IPO	2%	1%	-1%***
Trade sale	10%	6%	-4%***
Follow-up funding	60%	57%	-4%***
No event ("nothing")	28%	37%	9%***

Note: This table reports the descriptive statistics for the events following the funding rounds with VD and non-VD participation. All funding rounds are obtained from the database Crunchbase.
** Significance at 10% level, ** Significance at 5% level , *** Significance at 1% level*

The descriptive statistics show that VD-backed and non-VD-backed startups have clear differences in the type of events following respective funding rounds. *IPO* events can be found for 1.76% and 0.73% of VD and non-VD funding rounds respectively. VD funding rounds are followed by a *Trade Sale*-event in 9.71% of cases while non-VD rounds are only followed in 5.60% of cases by a *Trade Sale*-event. 59.57% of VD-funding rounds are followed by *Follow-up Funding*-events in contrast to 55.63% of non-VD funding rounds. The percentage of *Nothing* (no event) following VD-funding rounds is 28.37%and 36.18% for non-VD-funding rounds. These statistics give a first indication of the differences in financial resource acquisition of VD-backed and non-VD-backed ventures. Overall, VD-backed ventures show a more positive outcome in terms of financial resource acquisition with more, trade sale, and funding events and fewer *Nothing*-events compared to non-VD-backed startups.

Table 5-2 provides an overview of all of our VD providers, their VD-Reputation index for the year 2020, and the number of their deals in our dataset.

Table 5-2: Overview of VD providers

VD Provider	Pure VD*	Headquarter	Founded Date	Number of Deals	VD Reputation (2020)
Goldman Sachs		NYC, NY, US	1869	257	9.98
MMV Capital Partners		Toronto, Canada	1998	13	8.71
GE Capital		Norwalk, Connecticut, US	1932	39	5.91

VD Provider	Pure VD*	Headquarter	Founded Date	Number of Deals	VD Reputation (2020)
Silicon Valley Bank		Santa Clara, California, US	1983	387	5.73
JP Morgan Chase		NYC, NY, US	2000	59	4.46
Comerica Incorporated		Dallas, Texas, US	1849	49	3.90
Clydesdale Bank		Glasgow, Scotland, UK	1838	3	3.86
Lighter Capital	X	Seattle, Washington, US	2010	315	3.78
PNC Bank		Pittsburgh, Pennsylvania, US	1845	14	3.22
Deutsche Bank		Frankfurt am Main, Germany	1870	24	3.15
Wells Fargo		San Francisco, California, US	1852	36	3.12
SunTrust Bank		Atlanta, Georgia, US	1891	20	1.58
Wells Fargo Capital Finance		Santa Monica, California, US	2002	11	1.19
Western Technology Investment	X	Silicon Valley, California, US	1980	168	1.11
City National Bank		Los Angeles, California, US	1954	23	0.74
Oxford Finance LLC	X	Alexandria, Virginia, US	2002	71	0.72
Rabobank		Utrecht, The Netherlands	1972	7	0.71
CRG L.P.		Greater Houston Area, US	2003	31	0.42
Columbia Partners Private Capital		Bethesda, Maryland, US	2004	16	0.40
Square 1 Bank		Durham, North Carolina, US	2005	92	0.17
Barclays		London, UK	1690	29	0.09
Bank of America		Charlotte, North Carolina, US	1998	26	-0.08
BDC Venture Capital		Montreal, Quebec, Canada	1975	18	-0.27
Viola Credit	X	Herzliya, Israel	2000	22	-0.27
Moscow Seed Fund		Moscow, Russia	2005	4	-0.39
TriplePoint Capital		Menlo Park, California, US	2006	57	-0.41
Agility Capital	X	Santa Barbara, California, US	2000	59	-0.49
Bridge Bank		San Jose, California, US	2001	39	-0.49
BOOST&Co	X	London, UK	2011	3	-0.51
Trinity Capital Investment	X	Chandler, Arizona, US	2008	74	-0.60
ORIX Ventures		Hartford, Connecticut, US	2001	22	-0.69
Horizon Technology Finance	X	Farmington, Connecticut, US	2004	42	-0.72
Monroe Capital		Chicago, Illinois	2004	22	-0.80
Bpifrance		Paris, France	2012	28	-0.86
Overseas Private Investment Corporation		Washington, D.C., US	1971	6	-0.87
Kreos Capital	X	London, UK	1998	12	-0.93
Broadview Ventures		Boston, Massachusetts, US	2008	35	-0.94
Harbert European Growth Capital		Birmingham, UK	2013	14	-1.09
International Finance Corporation		Washington, D.C., US	1956	23	-1.24
European Investment Bank (EIB)		Luxembourg, Luxembourg	1958	7	-1.28
Business Finland		Helsinki, Finland	1983	9	-1.35
SaaS Capital	X	Cincinnati, Ohio, US	2007	28	-1.41
Flow Capital	X	Toronto, Ontario, Canada	1993	16	-1.51
InnoVen Capital	X	Mumbai, Maharashtra, India	2014	6	-1.54
FMO		The Hague, The Netherlands	1970	1	-1.79
The FSE Group		Camberley, UK	2002	11	-1.84
North Carolina Biotechnology Center		Alexander, North Carolina, US	1984	14	-1.84

VD Provider	Pure VD*	Headquarter	Founded Date	Number of Deals	VD Reputation (2020)
Runway Growth Capital	X	California City, California, US	2015	17	-1.84
Recurring Capital Partners	X	Austin, Texas, US	2016	22	-1.95
TIMIA Capital	X	Vancouver, Canada	2015	12	-1.98
Super G Capital	X	Newport Beach, California, US	2008	15	-2.01
ENISA		Athens, Greece	2004	2	-2.06
WindSail Capital Group	X	Boston, Massachusetts, US	2013	22	-2.12
Foundation for Technological Innovation	X	Lausanne, Switzerland	1994	1	-2.34
Feenix Venture Partners	X	New York, NY, US	2017	12	-2.55
Espresso Capital	X	Toronto, Ontario, Canada	2009	8	-2.55
FW Capital		Liverpool, UK	2010	1	-2.65
Trifecta Capital Advisors	X	New Delhi, Delhi, India	2013	2	-2.69
Northern Powerhouse Investment Fund		Sheffield, UK	2014	1	-2.74
BlackSoil		Mumbai, Maharashtra, India	2010	1	-2.78
Hercules Capital	X	Palo Alto, California, US	2003	1	-6.01

**Pure VD investors are only active in VD and have no other businesses (e.g., VC, banking, …) next to it.*

The summary shows 21 VD providers (34.42%) with a positive reputation index for the year 2020 and a skew toward highly reputable investors. The reputation index maximum is 9.98 and the minimum is -6.01. Additionally, the VD investors are involved in 1 and up to 387 different deals in our final dataset. The top 10 VD providers involved in most deals account for 64.69% of the total deals of VD providers.

5.5.2. Regression results

Table 5-3 reports the results of the multinomial logistic regression of the effect of our independent variable *VD* on our dependent variable.

The results highlight that being VD-funded has a significant effect in two out of our three possible outcome events: *VD* has a positive effect on *Trade Sale*, and *Follow-up Funding*. The results of our analysis suggest that the involvement of a VD provider has a positive influence on a startup's ability for acquiring new financial resources.

In a nutshell, our models provide support for Hypothesis 1 that VD has a positive effect on a startup's financial resource acquisition via trade sales and subsequent funding rounds.

Most of our control variables are highly significant. *Patents*, *VC-Reputation*, *Number of Funding Rounds*, *Funding Round Syndication*, and *Number of Founders* show the same

directions as *VD*. *VC* shows a negative coefficient on *IPO* and a positive on *Trade Sale* and *Follow-up Funding*. *The* coefficient for *Venture Age* shows a positive sign for *IPO* and *Trade Sale* while being negative for *Follow-up Funding*.

Table 5-3: Hypothesis 1 mlogit regression

Dependent variable	IPO	Trade Sale	Follow-up Funding	Nothing
Hypothesis 1				
VD (dummy)	0.23 (0.24)	0.35 (0.11)***	0.19 (0.07)***	
Controls				
VC (dummy)	-0.94 (0.18)***	0.38 (0.06)***	0.30 (0.03)***	
VC-Reputation (dummy)	0.61 (0.11)***	0.55 (0.05)***	0.16 (0.03)***	
Venture Age (ln)	0.71 (0.07)***	0.40 (0.03)***	-0.18 (0.01)***	
Patents (dummy)	0.37 (0.10)***	0.17 (0.04)***	0.31 (0.02)***	
Amount of Prior Funding (ln)	0.11 (0.01)***	-0.00 (0.00)	0.00 (0.00)*	
Number of Funding Rounds	0.13 (0.03)***	0.04 (0.02)**	0.07 (0.01)***	(base outcome)
Funding Round Syndication	0.19 (0.01)***	0.12 (0.01)***	0.11 (0.00)***	
Number of Founders	0.29 (0.04)***	0.19 (0.02)***	0.25 (0.01)***	
Year (dummies)	Yes	Yes	Yes	
Venture State (dummies)	Yes	Yes	Yes	
Venture Industry (dummies)	Yes	Yes	Yes	
N (Funding Rounds)	79,664			

Note: The entries are unstandardized βs with standard errors in brackets.

** Significance at 10% level, ** Significance at 5% level , *** Significance at 1% level*

Table 5-4 reports the results of the multinomial logistic regression of the effect of our independent variable *VD-reputation* on our dependent variable for the sub-sample of only funding rounds with VD involvement.

Table 5-4: Hypothesis 2 mlogit regression

Dependent variable	IPO	Trade Sale	Follow-up Funding	Nothing
Hypothesis 2				
VD Reputation	0.17 (0.06)***	0.03 (0.03)	0.02 (0.02)	
Controls				
VC (dummy)	0.00 (1.30)	0.89 (0.39)**	0.42 (0.26)	
VC-Reputation (dummy)	-0.11 (0.75)	0.33 (0.31)	0.18 (0.20)	
Venture Age (ln)	0.43 (0.49)	0.18 (0.17)	-0.32 (0.12)***	
Patents (dummy)	-0.10 (0.69)	0.25 (0.25)	0.33 (0.17)*	
Amount of Prior Funding (ln)	0.15 (0.08)*	-0.03 (0.02)	0.00 (0.02)	(base outcome)
Number of Funding Rounds	-0.09 (0.23)	0.03 (0.10)	0.11 (0.06)*	
Funding Round Syndication	0.13 (0.10)	-0.01 (0.04)	0.01 (0.02)	
Number of Founders	-0.56 (0.40)	0.06 (0.11)	0.11 (0.07)	
Year (dummies)	Yes	Yes	Yes	
Venture State (dummies)	Yes	Yes	Yes	
Venture Industry (dummies)	Yes	Yes	Yes	
N (Funding Rounds)	1,392			

Note: The entries are unstandardized βs with standard errors in brackets.
** Significance at 10% level, ** Significance at 5% level , *** Significance at 1% level*

The results of our sub-group analysis suggest that *VD-Reputation* increases the likelihood of IPOs for VD-backed startups. *VD-Reputation* does not show a significant

influence on the other dependent variables *Trade Sale* and *Follow-up Funding*. Interestingly, the effect occurs for the outcome event that remained insignificant for the analysis of the full sample.

Thus, our models provide support for Hypothesis 2 and the positive impact of *VD-Reputation* on a startup's ability to acquire financial resources via IPOs.

Only some of our control variables only show significant influences. *VC* shows a positive and significant sign on *Trade Sale*. *Amount of Prior Funding* is positive and significant for the outcome *IPO*. In the case of the outcome event, *Follow-up Funding Venture Age* shows a negative and significant sign while *Patents* and *Number of Funding Rounds* show positive and significant signs.

Looking at both models together, VD increases the ability of a startup to acquire more financial resources in every aspect. However, the differences are that VD involvement in general increases financial resource acquisition via trade sales and follow-up funding. The VD provider's reputation does not influence these effects. However, in the special case of IPOs, the reputation of involved VD providers has a strong positive influence. These results suggest that it is more important that you get VD in contrast to from whom you get VD.

5.5.3. Robustness checks

Based on our results we conducted different robustness checks to evaluate whether our results persist in different settings and models. First, we constructed the dependent dummy variables *IPO, Trade Sale,* and *Follow-up Funding*. The variables are coded as 1 if an IPO, trade sale, or subsequent funding event occurs after the respective funding round. The variables are coded 0 if no event happens after the funding round. Table 5-5**Fehler! Verweisquelle konnte nicht gefunden werden.** reports the results for the effect of *VD* in the full sample and *VD-Reputation* in the sub-sample on those variables.

Table 5-5: Robustness probit regressions

	Hypothesis 1			Hypothesis 2		
Dependent variable	IPO (dummy)	Trade Sale (dummy)	Follow-up Funding (dummy)	IPO (dummy)	Trade Sale (dummy)	Follow-up Funding (dummy)
Model	(1)	(2)	(3)	(4)	(5)	(6)
Hypothesis 1						
VD (dummy)	0.15 (0.13)	0.21 (0.07)***	0.10 (0.04)**			
Hypothesis 2						
VD Reputation				0.23 (0.08)***	0.01 (0.02)	0.01 (0.01)
Controls						
VC (dummy)	-0.65 (0.10)***	0.21 (0.03)***	0.18 (0.02)***	0.41 (1.18)	0.84 (0.27)***	0.25 (0.15)*
VC-Reputation (dummy)	0.27 (0.06)***	0.38 (0.03)***	0.09 (0.02)***	-0.24 (0.51)	0.30 (0.23)	0.11 (0.12)
Venture Age (ln)	0.33 (0.03)***	0.23 (0.01)***	-0.11 (0.01)***	0.96 (0.35)***	0.13 (0.23)	-0.17 (0.07)**
Patents (dummy)	0.17 (0.05)***	0.11 (0.03)***	0.18 (0.01)***	0.04 (0.43)	0.22 (0.17)	0.17 (0.10)*
Amount of Prior Funding (ln)	0.06 (0.01)***	0.00 (0.00)	0.00 (0.00)**	0.14 (0.07)*	-0.02 (0.01)	0.00 (0.01)
Number of Funding Rounds	0.07 (0.02)***	0.02 (0.01)*	0.04 (0.01)***	-0.06 (0.18)	-0.04 (0.07)	0.07 (0.04)*
Funding Round Syndication	0.08 (0.01)***	0.07 (0.00)***	0.06 (0.00)***	-0.03 (0.08)	-0.01 (0.03)	0.01 (0.01)
Number of Founders	0.08 (0.02)***	0.12 (0.01)***	0.14 (0.01)***	-1.14 (0.40)***	0.05 (0.07)	0.06 (0.04)
Year (dummies)	Yes	Yes	Yes	Yes	Yes	Yes
Venture State (dummies)	Yes	Yes	Yes	Yes	Yes	Yes
Venture Industry (dummies)	Yes	Yes	Yes	No	Yes	Yes
Observations (N)	29,853	33,839	74,462	324	527	1,235

Note: The entries are unstandardized βs with standard errors in brackets.
** Significance at 10% level, ** Significance at 5% level , *** Significance at 1% level*

The effects show the same results as in our main analysis.

Second, we apply a parametric hazard analysis on the events of *IPO, Trade Sale,* and *Follow-up Funding*. We use the days after a respective funding round and the following event to determine the speed of realization of such an event depending on *VD* and *VD-Reputation*. Table 5-6 reports the results of our analyses.

Table 5-6: Robustness parametric hazard regressions

	Hypothesis 1			Hypothesis 2		
Dependent variable	IPO	Trade Sale	Follow-up Funding	IPO	Trade Sale	Follow-up Funding
Model	(1)	(2)	(3)	(4)	(5)	(6)
Hypothesis 1						
VD (dummy)	-0.26 (0.22)	-0.26 (0.09)***	-0.11 (0.04)***			
Hypothesis 2						
VD Reputation				-0.16 (0.05)***	-0.00 (0.02)	-0.01 (0.01)
Controls						
VC (dummy)	1.18 (0.18)***	-0.32 (0.05)***	-0.24 (0.02)***	0.46 (1.26)	-0.83 (0.32)**	-0.33 (0.14)**
VC-Reputation (dummy)	-0.58 (0.11)***	-0.46 (0.04)***	-0.07 (0.02)***	0.25 (0.65)	-0.16 (0.25)	-0.04 (0.10)
Venture Age (ln)	-0.66 (0.07)***	-0.37 (0.02)***	0.18 (0.01)***	-0.62 (0.49)	-0.19 (0.14)	0.25 (0.06)***
Patents (dummy)	-0.24 (0.09)**	-0.08 (0.04)**	-0.23 (0.01)***	1.02 (0.71)	-0.17 (0.20)	-0.20 (0.08)**
Amount of Prior Funding (ln)	-0.13 (0.01)***	0.00 (0.00)	-0.00 (0.00)***	-0.17 (0.08)**	0.02 (0.02)	-0.01 (0.01)
Number of Funding Rounds	-0.11 (0.03)***	-0.05 (0.02)***	-0.07 (0.01)***	-0.17 (0.20)	0.01 (0.09)	-0.10 (0.03)***
Funding Round Syndication	-0.10 (0.01)***	-0.06 (0.00)***	-0.05 (0.00)***	-0.04 (0.09)	0.02 (0.04)	-0.00 (0.01)
Number of Founders	-0.16 (0.04)***	-0.11 (0.14)***	-0.16 (0.00)***	0.57 (0.36)	0.03 (0.09)	-0.05 (0.03)
Year (dummies)	Yes	Yes	Yes	Yes	Yes	Yes
Venture State (dummies)	Yes	Yes	Yes	Yes	Yes	Yes
Venture Industry (dummies)	Yes	Yes	Yes	Yes	Yes	Yes
Observations (N)	79,664	79,664	79,664	1,392	1,392	1,392

Note: The entries are unstandardized βs with standard errors in brackets.
** Significance at 10% level, ** Significance at 5% level , *** Significance at 1% level*

The results show that *VD* shortens the time to a *Trade Sale* and *Follow-up Funding events* in the full sample while *VD-Reputation* shortens the time for an *IPO* event in the sub-sample.

Overall our robustness tests show persisting effects of our variables.

5.6. Summary, discussion and outlook

5.6.1. Summary of main findings and contributions

The aim of our study was to examine how VD affects the ability for financial resource acquisition of a startup. Based on a certification and reputation perspective we developed two main hypotheses 1) VD involvement awards a startup with a certification of quality which results in better access to financial resources and 2) this certification is further amplified by the reputation of the VD provider. We specified that these hypotheses should increase a startup's financial resource acquisition via IPOs, trade sales, and follow-up funding rounds. We investigated our hypotheses through a quantitative study. Overall, our results support largely a positive impact of VD on the financial resource acquisition of startups: Startups with VD involvement experience a higher likelihood of trade sales and follow-up funding rounds compared to only VC-funded startups. Furthermore, a higher reputation of VD providers in VD-funded startups increases the IPO likelihood of the startup. The effects indicate that VD involvement in general increases a startup's ability for financial resource acquisition. Interestingly, the results show that the financial instrument, VD itself, and the reputation of the VD provider have different effects.

With these findings, our study contributes to the discussion about the effect and importance of accessing debt as a startup (Chen et al., 2010; Cole & Sokolyk, 2018; Rob & Robinson, 2014). The literature shows that startups can rely heavily on debt for their further development. Epure & Guasch (2020) show that the involvement of professional debt in early-stage startups can serve as a reliable signal for external equity investors. With our study, we show further insights into how these effects interact in the special case of VD. Since VD is a non-traditional source of business debt connected with a unique business model and lending philosophy it is worthwhile to investigate VD separately. We displayed the superior ability of a startup to attract new financial resources via trade sales and follow-up funding when VD was used in prior

funding rounds. This indicates a strong certification power of VD and very positive signals for outside investors when VD is involved in the funding history of a startup.

Second, we contribute to the literature on reputable investors and other stakeholders. Prior literature has shown how venture investors contribute to a startup's development via value-adding practices (e.g., Dushnitsky & Lenox, 2006) and the role of other stakeholders (e.g., underwriters) in the success of financial resource acquisition of startups (Corwin & Schultz, 2005). Building upon the established research on the reputation effect of VC investors (e.g., Krishnan et al., 2001; Nahata, 2008; Stuart et al., 1999) and other stakeholders (e.g., Booth & Smith, 1986; Carter et al., 1998; Carter & Manaster, 1990) we exhibit the reputational certification effect in the special case of VD. We also find a positive reputational certification effect in our results, however, not as pronounced as the general VD effect. Interestingly, reputation only affects a startup's financial resource acquisition via IPO. Thus, startups need only consider the high reputation of their VD providers when they want to pursue an IPO event in the future.

Finally, we contribute to the small but growing VD literature (e.g., Ibrahim, 2010; Fischer & Ringler, 2014; de Rassenfosse & Fischer, 2016; Tykvová, 2017; Hochberg et al., 2018) by moving beyond the issue of deal selection and investigating the consequences of VD funding for startup development. We show that several arguments point to a positive certification effect of VD on a startup's quality. We empirically examined the effect of VD and find supporting positive effects of VD on a startup's financial resource acquisition.

5.6.2. Interpretation and reflection of findings using interviews with practitioners

After our empirical analysis, we conducted 28 interviews with VD providers, VC investors, and entrepreneurs. With this approach, we aim to better understand the certification mechanism and discuss alternative explanation approaches from the point of view of practitioners.

The interviews confirmed our findings of VD having a positive certification effect for startups and our respondents mentioned how the association of VD with strict selection criteria concerning business model requirements, securities, and stability, positively certifies the quality of a startup obtaining VD. This corresponds with the selection criteria identified by de Rassenfosse & Fischer (2016). Thus, interviewees attested to VD funding being more difficult to attract for startups compared to VC funding and therefore providing additional positive certification beyond the certification of VC involvement. In particular, the certification for other external debt providers is strongly pronounced by VD involvement since respondents described startups with VD providers are being attributed by being nearly bankable and therefore attractive for the broader debt market for more mature companies. However, our VC respondents noted that this certification is not yet universally recognized and is only meaningful if the startup attracted VD funding from one of the reputable VD actors in the ecosystem. As a VC noted: *"Its [VD reputation] improving all the time, they are more professional, there are more players and they have a reputation which is the most important factor."*

However, the positive certification effect was not universally seen. Some respondents attested VD has a negative certification effect for startups. This view, which was shared by VC investors and entrepreneurs alike, was also supported by the experience of VD providers reporting that they have to deal with many negative perceptions of VD in the market. In particular, respondents described how VD involvement can increase the (perceived) risk of failure of a startup. The underlying reasons for this perceived risk include the "loan-to-own" mentality of selected VD providers, the risk of default for the startup when VD providers claim the loan securities, and, more generally, the interest and repayment obligations resulting in liquidity constraints for the startups. These concerns were summarized by a VD provider: *"A prime example in Germany, also on the VD side, is the behavior of the [VD] fund with [Company 1] and [Company 2], where the fund was the decisive factor that the companies have gone bankrupt."* The VD provider further explained that even though this behavior

is not typical for VD providers, these single cases can cause a widespread negative market perception of VD.

Additionally, we used the interviews to explore other alternative directions for interpreting our results. Overall, the interviews implicated possible positive effects of VD on startups via 1) more freedom to operate for entrepreneurs and 2) other value-adding effects of VD providers.

First, VD involvement offers startups a great amount of freedom to operate compared to other funding options. This freedom has direct implications on how entrepreneurs can shape the startup to their vision and influence its strategy (Baum et al., 1998; Cortes & Herrmann, 2021; Elenkov et al., 2005). More specifically, VD can affect the freedom to operate in four distinct ways: 1) less equity dilution, 2) more operational flexibility, 3) fewer investors with board presence, and 4) faster time to funding. Less equity dilution leaves entrepreneurs with more control over the company's equity and a stronger say in the decisions of the board of directors. VD offers more operational flexibility due to the light due diligence process and easier contractual closing since not necessarily all equity investors need to agree to a VD deal. Moreover, VD providers hold very little equity and are not present on the board of directors. The absence of an additional party on the board of directors makes the decision process more efficient. Last, VD funding typically is completed much faster than an equity financing round, for a variety of reasons. The time between applying for and receiving the funding can be crucial for startups (Hsu, 2007) as the shorter the time to funding, the less likely the startup is to run into liquidity problems. Furthermore, if the startup knows that the time to funding is relatively short, it can opt for a more flexible funding cycle. The increased flexibility in the funding rounds helps startups to optimize their funding to their liquidity needs and to access the capital market during attractive times. This optimization can help startups to increase the size of their funding rounds and their access to financial resources. Therefore, entrepreneurs could be able to better progress on the development of their startup and shape a better success story around it if they experience greater freedom to operate.

This can help to convince new outside investors to invest in the startup and open up new external financial resources.

Second, respondents mentioned other value-adding effects of VD providers. In this category, respondents mentioned that VD providers offer their network to the startup, help to optimize its capital structure and adapt their behavior when the startup goes through difficult phases to make sure the startup does not go bankrupt. This active support of VD providers can lead to new financial resources for the startup.

5.6.3. Practical implications

The results of our study offer practical implications for entrepreneurs and VD providers. First, our study indicates that VD seems to be an attractive funding source for selected startups, as VD providers typically do not interfere with the daily business of the startup but have a certification effect. This certification leads to a better ability to acquire new financial resources as a startup. Additionally, startups can use our results to better understand if and under which conditions it is worth pursuing VD funding, especially when highly reputable VD providers are offering a lot of certification impact. VD providers can use our results to better understand and articulate the certification impact of their funding on startups. This can help VD providers to educate market participants about the product and to overcome a general reservation against debt-based products in the startup context.

5.7. Limitations and future research

Despite its many insights and contributions, our study also has limitations. First, the specification of VD providers remains a challenge in our startup development analysis. Due to limitations in our dataset, we needed to classify VD providers manually according to the information provided on their website and the prior deals we found in various databases. Second, some investors are not only active in VD but also provide other types of financing, such as VC or traditional bank loan financing,

without the specific characteristics of VD investments. In these cases, we were not able to differentiate whether such an investor acts as a VD provider, as another type of debt provider, or investor in a funding round since the financing tools are not disclosed in the Crunchbase database. Third, we need to be careful with a causal interpretation of our results as we cannot completely rule out selection effects. VD providers have demanding selection criteria and successful entrepreneurs may self-select into VD to avoid dilution and keep higher equity stakes for themselves.

Overall, VD research is still in its infancy and is therefore a field that provides various avenues for future research. Building upon our study, there is room to further dive into the selection and treatment debate of VD on startup development. We have observed that data quality regarding VD is improving. If this development continues, it will be possible to provide an even deeper and more causal analysis of the effects of VD on startup development and startup performance.

Additionally, we investigated the impact of VD focusing on finance-related metrics of a startup. However, startup financing (in particular VC) can also impact other non-financial metrics of a startup. Established literature shows that the involvement of VCs can positively affect a startup's innovation output (Bertoni et al., 2011; Kortum & Lerner, 2001). In addition, recent research has shown that a positive connection between different types of entrepreneurial finance and the development of sustainability-oriented startups exists (Bocken, 2015; Hegeman & Sorheim, 2021).

Since startups typically are constrained with regard to outside debt funding (Colombo et al., 2007), they often have to rely heavily on VC funding. This reliance bears the risk of startups being exploited by the behavior of their VCs. It is well known that VCs favor IPOs as the exit route of their investment (Brau et al., 2003; Cumming & MacIntosh, 2003; Sethuram et al., 2021). A (fast) IPO exit, however, might not be in the best interest of the startup and the pressure exercised by VCs and their short-terminism might even have negative consequences for a startup's development. Future research could investigate whether the growing importance of VD offers the opportunity for startups to avoid such potential conflicts of interest. With VD as an

alternative and complementary source of financing, startups may have the opportunity to emancipate themselves to a certain degree from VCs and their (often short-term) goals.

With regard to the choice of financing instruments, the pecking order theory postulates that companies prefer internal financing over external debt over external equity (Frank & Goyal, 2003; Myers & Majluf, 1984). Since high-growth startups often rely heavily on VC financing and are constrained with regard to external debt financing, the question arises as to how VD can be sorted in the pecking order theory. Theoretically, startups should prefer VD over new external VC financing. However, it remains unclear whether this actually holds true. As these questions show clearly that more research is needed to further define the role of VD in a changing entrepreneurial finance landscape, new empirical insights are needed to understand the role of VD for startups seeking financing.

Chapter 6

Venture debt providers: Picking winners or making winners?[8]

Venture debt (VD) financing is a growing phenomenon of increasing importance in the entrepreneurial finance landscape. Although research interest in VD has recently increased, the impact of VD on startup development is unresolved thus far. We tap into this research gap by empirically examining how VD influences startup development and disentangle whether this influence can be credited to the treatment effect (making winners) or to the selection effect (picking winners) of VD providers. To capture startup success, we investigate the positive events "subsequent funding round", "trade sale", and "IPO" following VD funding rounds. We find that VD providers seem to select more promising portfolio companies but also have a direct positive treatment effect on a startup's development.

[8] This chapter is based on Krause et al., (2021)

6.1. Introduction

Venture debt (VD) is a type of startup financing that is becoming increasingly important in the entrepreneurial finance landscape. This is reflected in the number of VD deals, which has tripled over the last decade and reached an aggregated deal value of approximately $28 bn worldwide in 2019 (Stanford et al., 2021). Although the first VD was recorded in the 1970s, scholars have given surprisingly little attention to this phenomenon.

In particular, thus far, little is known about the influence of VD on a startup's development. This question is important to answer because prior research has argued that startup investors not only provide financial support but also provide nonfinancial value-added (Mason, 2013; Large & Muegge, 2008). We add to this discussion by investigating how VD-backed startups develop after their VD funding rounds and, more specifically, disentangle the selection and treatment effect of VD providers.

The scarce literature investigating VD focuses on the characteristics of VD (Ibrahim, 2010), the business models of VD providers (Hesse et al., 2016; Iyer, 2020), and the selection criteria for a VD provider's decision to invest in a startup (Hardymond et al., 2005; Chua et al., 2011; de Rassenfosse & Fischer, 2016; Tykvová, 2017). Hesse et al. (2016) characterize VD as a specific type of loan that is typically an individually structured financing instrument targeted toward the specific needs of high-growth startups and returned through an equally amortized payment of the loan principal plus interest.

Due to these specific characteristics, the VD provider's selection process differs from that of other investors (Ibrahim, 2010). Research focusing on this question found that several startup characteristics are important in the VD provider's selection process: the involvement of other investors such as venture capital (VC) investors (de Rassenfosse & Fischer, 2016), the reputation of an involved VC (Tykvová, 2017), the presence of equity warrants and patents (de Rassenfosse & Fischer, 2016), the deployability of patents (Hochberg et al., 2018), and family involvement (Chua et al., 2011). However,

it remains unclear how VD providers and their selection of startups are linked to the startups' development. Prior research investigating the debt strategies of companies and how they affect their performance (Ross, 1977; Flannery, 1986; Harris & Raviv, 1990) did not consider startups. Ultimately, the results indicate that debt can both hurt and boost competitive performance depending on the industry concentration and competitive position of the respective company (Campello, 2006). In addition, these studies cannot simply be transferred to explain the effect of VD on startup development since VD is used in the special context of high-risk ventures and therefore has very different characteristics than conventional debt.

Therefore, to the best of our knowledge, our study is the first to address how VD affects startups by examining the following research questions. First, do VD-backed startups develop better than their non-VD-backed counterparts? Second, if this is the case, is this positive effect mainly attributable to the ability of VD providers to select more promising startups ("selection effect"), or is it a consequence of the support and value-added they offer to portfolio firms ("treatment effect")? In other words, do VD providers have a positive treatment effect on portfolio firms beyond the selection effect?

To answer our research questions, we empirically analyze the impact of VD investments on the development of startups. Our data set is based on the database "Crunchbase" and comprises 2,950 US-based funding rounds of 1,431 VD-funded companies by 64 VD providers since 2009. We compare these funding rounds with 79,066 funding rounds of solely VC-backed startups. As a proxy to measure the development of the startups, we consider the different events that can follow the respective funding round: Subsequent funding, trade sales, IPOs, and those without any events recorded ("nothing"). We use these events as dependent variables and apply a two-step Heckman and counterfactual model.

The results of our study reveal that startups that received funding from VD providers more often experience subsequent funding rounds, trade sales, and IPOs. This positive effect of VD on a startup's development is partially explained by the

selection of VD providers. In other words, although we find that VD providers seem to select better portfolio companies, we still find a positive significant relationship between VD and a startup's development that cannot be explained by the selection of VD providers. Therefore, it seems that VD providers do provide an additional positive treatment effect and that the positive effect on the development of VD-backed startups is not solely based on better selection by VD providers.

With our study, we provide several theoretical contributions. First, we contribute to the growing VD literature (e.g., Ibrahim, 2010; Fischer & Ringler, 2014; de Rassenfosse & Fischer, 2016; Tykvová, 2017; Hochberg et al., 2018) by investigating which influence VD funding has on a startup's development. We show that VD-funded companies seem to develop better than non-VD-funded companies. Second, we add to the discussion about disentangling selection from the treatment effects of financing options for startups (e.g., Aerts et al., 2007; Bertoni et al., 2011; Lee & Zhang, 2011; Croce et al., 2013; González-Uribe & Leatherbee, 2018; Bonini et al., 2019). Our study contributes to this line of research by examining VD as an alternative funding option for startups and shows that better startup development can contribute to both the selection and the treatment of VD providers. Third, we contribute to the broader line of research dealing with capital structure and the signaling effects of debt funding (Ross, 1977; Flannery, 1986; Harris & Raviv, 1990). We find empirical evidence that is consistent with the debt literature and show that high-quality startups are preferred by debt providers, in our case VD providers.

In addition, we can derive practical implications from our study. We show that VD providers seem to offer direct value-adding treatment to startups. Thus, entrepreneurs not only have financial motives to include VD funding in their startup but also to generate additional value for their startup and to improve their startup's development.

6.2. Literature review

6.2.1. Value-adding impact of VC and VD providers

Prior research argued that VD is built on an implicit contract between VC and VD providers as a complementary funding option in between rounds to extend the startup's runway (Ibrahim, 2010). However, as de Rassenfosse & Fischer (2016) pointed out, startups that receive VD are in a phase between initial equity financing options provided by the startup team, family and friends, and angel investors before access to public equity and debt markets is available. Based on this view, VD would be a direct substitute for VC, as this is the phase where VC investors typically also start to provide funding to startups. Although equity is argued to be the most appropriate funding option for startups in that phase (Berger & Udell, 1998), it has also been shown that startups already rely heavily on debt (Cassar, 2004).

Since VD and VC differ not only fundamentally in their effect on the capital structure of startups but also in how they handle the relationships with and add value to their portfolio firms (Ibrahim, 2010), it is important to investigate the effects of VD and VC investors on startups.

We begin by summarizing the findings of prior research investigating the selection criteria of VD providers and the value-added services that VC and VD providers offer that may influence a startup's development.

Selection effect of VD providers

VC and VD providers have fundamentally different business models that reflect the risk-return profile of their activities. Whereas VC investors provide equity investments and do not receive interest payments and repayment of their investment, VD providers' engagement and risk are reduced over time. These differences are expected to affect the selection criteria used by both types of investors. The literature on VC investors is very rich, and prior research has shown that they focus strongly on specific startup characteristics in their selection process, such as the top management team,

patents, and economic potential (e.g., Baum & Silverman, 2004; Block et al., 2019; Hsu et al., 2014; Moritz et al., 2021). In contrast, research on VD is scarce. However, a small number of studies have investigated the selection criteria that influence the selection process of VD providers.

Table 6-1 provides an overview of the selection criteria identified.

Table 6-1: Literature overview of VD selection criteria

Title of article	Authors and year	Source	Positive Signals identified
Family involvement and new venture debt financing	Chua et al., 2011	Journal of Business Venturing	Family involvement increases access to VD.
Venture debt financing: Determinants of the lending decision	de Rassenfosse & Fischer, 2016	Strategic Entrepreneurship Journal	Patents as collateral are as important as tangible assets; warrants increase chances to receive VD; VC backing as a substitute for a startup's positive cash flows.
When and Why Do Venture-Capital-Backed Companies Obtain Venture Lending?	Tykvová, 2017	Journal of Financial and Quantitative Analysis	Investment by (reputable) VC investors and higher liquidation value increases access to VD.
Patent Collateral, Investor Commitment, and the Market for Venture Lending	Hochberg et al, 2018	Journal of Financial Economics	Salability of patents and credible commitment of equity investors increases access to VD.

Note: This table reports the VD literature that examined VD provider-specific selection criteria

Although VD providers are not as risk-averse as traditional banks and seek some upside potential with equity kickers (de Rassenfosse & Fischer, 2016), their main concern relies on not losing their principal investment and receiving an adequate risk-adjusted rate of return, which has been found to be between 8% and 21% (Hesse et al., 2016). Therefore, VD providers seek some form of security for their invested capital. As startups today are often asset-light companies, VD providers often accept patents or other types of intellectual property that can be redeployed to alternative users in case of default (de Rassenfosse & Fischer, 2016; Hochberg et al., 2018). Another source of implied security for the VD provider can be the involvement of a VC investor (Ibrahim, 2010). This can be explained by the fact that the most likely source of cash for a startup that already received VC is another equity round at a significantly higher

valuation. A new equity round at a higher valuation of the startup makes equity more attractive, as it becomes cheaper and puts less pressure on the liquidity of the startup (Ibrahim, 2010). Hence, it is likely that the cash inflow would result in a repayment of the VD provider (de Rassenfosse & Fischer, 2016; Tykvová, 2017; Hochberg et al., 2018). Therefore, Ibrahim (2010) argues that VC and VD providers engage in an implicit contract in which the VC investor conveys with its involvement that the loan will be repaid.

However, not only do securities play a crucial role for VD providers but also the market, products, and competitive positioning of the startup (Iyer, 2020). VD providers prefer companies in which the road to the break-even point and profitability is foreseeable, which implies a high probability that startups can repay the loan with future cash flows. Therefore, VD providers typically do not invest in the very early stages of a startup and often come in after a VC investor has already invested (Hesse et al., 2016).

Chua et al. (2011) also found that family involvement has a positive effect on a startup's access to VD. The authors argued that companies with family involvement are less aggressive in pursuing growth and high-risk strategies (Berrone et al., 2012; Gómez-Mejía et al., 2007), which is in line with the interests of VD providers.

To summarize, the risk-return profile between VC and VD providers differs significantly. VC investors take much more risk and focus on the upside potential of their portfolio companies. Taking up this risk requires compensation with an appropriate return on equity, which has been found to be between 15% and 31% (Ljungqvist & Richardson, 2003). In contrast, VD providers have a strong focus on avoiding the downside risk that comes with startup investments and aim for stable positive outcomes. Therefore, the selection criteria identified for VD providers, such as the presence of intellectual property, presence of VC investors, company age, later funding stage or more cumulative prior funding, can be used as securities and/or are indicators for a positive future development of the startup.

Consequently, we hypothesize:

H1: VD-funded startups develop more positively because VD providers are more likely to select more promising startups in the first place (selecting winners).

Venture capital and its value-adding impact

Over the last decades, VC investors have been praised for their positive impact on startup development (Lerner & Nanda, 2020). As equity investors, VC investors want to be actively involved in the development of a startup and claim to offer value-adding services beyond financing ('smart money') to their portfolio companies (Sapienza, 1992; Mason 2013). Therefore, VC investors can add value for startups with financial and business advice, as mentors and confidants to CEOs, and by opening their network of other firms and professionals to the startup (Sapienza et al., 1996). Furthermore, VC investors also show their presence in the startup through strong monitoring processes (Gorman & Sahlman, 1989). Typically, they do not offer entrepreneurs the complete amount of money that is needed in one transaction but offer a staging investment process directly connected to the startup's development (Gompers, 1995). Therefore, VC-backed startups typically depend strongly on their VC investor after their initial investment and additionally have to tolerate the active involvement of their VC investor.

Overall, prior research has identified a positive effect of VC investors on startups' performance and growth (e.g., Jain & Kini, 1995; Audretsch & Lehmann, 2004; Alemany & Marti, 2005; Engel & Keilbach, 2007; Puri & Zarutskie, 2012). However, most of this research does not investigate whether this positive effect must be attributed to the selection process of VC investors or to their value-adding impact. Bertoni et al. (2011) first disentangled this relationship between the ability of VC investors to select better startups versus building better startups due to their value-adding effect. The authors confirm that VC investors indeed have direct value-adding treatment effects that improve startup development. They attribute this effect to two dimensions: first, the value-adding services provided by VC investors (Sapienza et al., 1996), and second, the positive signaling effect that a startup sends with its affiliation

with a (reputable) external equity provider (Plummer et al., 2016). In line with this finding, Lerner & Nanda (2020) highlighted these positive effects by showing that, annually, only 0.5 percent of US-based startups are backed by VC investors but represent nearly half of the entrepreneurial companies that go public every year.

Venture debt and its value-adding impact

VD is structured in a way that VD providers operate with debt. In addition, equity kickers such as warrants are incremental features of VD (de Rassenfosse & Fischer, 2016). The debt position is similar to traditional bank loans, as VD providers obtain common interest payments on the loan, and it has to be repaid on a schedule. However, VD is different from traditional bank loans, as startups are still high-risk companies. In this phase, information asymmetry between the VD provider and the entrepreneurs is particularly high, as startups do not have long track records, are often not yet profitable, and rely heavily on future refinancing tools (Hardymon et al., 2004; Ibrahim, 2010; Hesse et al., 2016). Therefore, VD providers typically ask for securities that can either be classic tangible assets (which are often not available for (tech) startups) or intangible such as patents or other intellectual property. As these securities are typically imperative for the startup, entrepreneurs have strong incentives to repay the loan. In addition, VD providers often provide loans after a VC investor has already invested in the startup (Hochberg et al., 2018). Hence, VD providers rely on the due diligence process done by the VC investor and understand the VC investor's involvement as an implied security for their loan (Ibrahim, 2010). Consequently, VD providers often do not actively monitor their portfolio companies as VC investors do (Ibrahim, 2010). Nevertheless, in specific cases, such as the Silicon Valley Bank as one of the largest and oldest VD players in the market, at least a minimum degree of monitoring is done by observing the startup's day-to-day activities on their bank accounts and its cash-burn rates (Hardymon et al. 2004). Although equity kickers are an incremental part of VD, the equity portion is too small to offer significant upside potential and can be understood as an additional incentive for VD providers (Hesse et

al., 2016). As a result, in most cases, VD providers do not want to become actively involved in the daily business of entrepreneurs (de Rassenfosse & Fischer, 2016).

Based on these findings, the question arises whether VD providers can even have a positive treatment effect on the startup's development if they are not actively involved in their portfolio companies. However, it could be argued that VD providers do not have the same level of "political cost" for the startup, as the entrepreneurial team has more freedom in its decision-making processes without the interference of the capital provider. This allows entrepreneurs to work more independently and develop their businesses with fewer restrictions.

In addition, prior research found that the involvement of third parties such as VC investors and debt providers can be a tool for startups to signal their value to outsiders (Ross, 1977; Janney & Folta, 2006). These signals can have a positive effect on the likelihood of receiving additional external capital (Plummer et al., 2016). Hence, it can be argued that the involvement of a VD provider can also function as a signal of quality. However, the signaling effects of VD and VC are likely to differ. VC investor involvement has been found to signal the high quality of a startup with high future growth prospects (de Rassenfosse & Fischer, 2016). However, VC investors provide high-risk capital and only expect a small portion of their portfolio companies to become profitable or even to survive (Zider, 1998). This makes VC-funded companies on average very promising, but they come with a high risk that the expected positive outcome will not be achieved. Hence, we argue that the signaling effect of VC involvement is limited. In contrast, the involvement of VD providers does not necessarily signal exorbitant future growth prospects, but it can serve as a signal of quality. VD providers only invest in companies from which they expect a high probability of debt repayment and the risk-adjusted return is acceptable (Ibrahim, 2010). Based on these arguments, we expect that the involvement of a VD provider adds a stronger quality signal.

Thus, we hypothesize:

H2a (treatment effect): VD-funded startups develop more positively than VC-funded startups due to a positive treatment effect of VD providers. (building winners).

However, prior research has argued that the involvement and monitoring activities of VC investors provide added value for startups beyond financing (Barry et al., 1990). As discussed above, when startups are funded by VD instead of VC, they do not experience the same level of involvement and monitoring from their investors. Hence, it can be concluded that VD providers do not provide comparable, positive value-adding effects for startup development. In other words, startups with VC involvement should develop more positively than those with VD involvement.

Thus, a competing hypothesis to H2a would be:

H2b (treatment effect): VD-funded startups develop less positively than VC-funded startups due to a negative treatment effect of VD providers.

6.3. Data and sample selection

6.3.1. Data and variables

The main data source used in this study is the database Crunchbase. Crunchbase describes itself as the leading destination for company insights from early-stage startups to the Fortune 1000. Crunchbase collects its data using crowdsourcing and news aggregation. Crunchbase provides funding round-level data on each financing event, including the announcement date, investors, funding amount, and stage of financing (Series A, B, C, etc.). Additionally, other startup information is available, such as the founding date of the startup, industry, number of founders, headquarters location, and exit outcomes (IPO and trade sale).

Although Crunchbase also provides an investor classification and type of financing for each funding round, we found that the quality of these data in the context of VD is not adequate. To overcome this issue, we first exported an overview of all investors listed on Crunchbase with at least 10 financing rounds classified as “Debt Financing”. This resulted in 86 investors. Second, for those 86 investors, we manually screened

their websites and looked at their deals in Crunchbase, Preqin, and Pitchbook to verify whether those investors can be classified as VD providers. This resulted in our final sample of 64 investors that we classified as VD providers.

Next, we used all 338,188 funding rounds reported on Crunchbase and only kept funding rounds from 2009 onward (34,747 deleted) to exclude potential effects caused by the economic crisis. In addition, we only focus on the US market because VD is the most mature in this market and is not directly comparable to other markets. Hence, we dropped funding rounds from other countries (157,137 deleted). Thereafter, we classified all funding rounds with the participation of one or more of the 64 identified VD providers as VD funding rounds and deleted all other funding rounds with no VD participation. Since we are comparing rounds with VD participation to VC funding rounds, we also kept all other VC funding rounds independent of VD participation. Additionally, we deleted observations with missing variables needed to answer our research questions (16,572) as well as bankruptcy as the next event (1,516). Our final sample contains 41,568 different startups. A total of 1,431 of these startups were VD-backed, and 40,137 experienced no VD funding round. As a result, our sample contains a total of 83,532 funding rounds, where 2,950 funding rounds have VD participation and the remaining 79,066 are funding rounds solely provided by VC investors. Table 6-2 provides an overview of our final data set, including the type of event following the respective funding rounds. For our model, we clustered the type of next event to construct our dependent variable, which will be discussed in the following section.

Table 6-2: Data sample

Type of next event	VD-backed	Non-VD-backed	N
Follow-up funding	1,724	44,370	46,094
IPO	74	882	956
Trade sale	331	4,961	5,292
No event ("nothing")	821	28,853	29,674
N	2,950	79,066	83,532

Note: This table reports the descriptive statistics for the events following the funding rounds with VD and non-VD participation. All funding rounds are obtained from the database Crunchbase.

Dependent variables:

Success: The variable Success is coded as a dummy variable where the funding rounds without a following event are coded as 0. The other types of events, including follow-up funding, IPO, and trade sales, are coded as 1. This allows us to differentiate between favorable startup development outcomes and no outcomes.

Subsequent funding: The variable Subsequent funding is coded as a dummy variable where the funding rounds with follow-up funding are coded as 1. The events without a following event are coded as 0.

Trade sale: The variable Trade sale is coded as a dummy variable where the funding rounds with a following trade sale are coded as 1. All other following events without a following event are coded as 0.

IPO: The variable IPO is coded as a dummy variable where the funding rounds with a following IPO are coded as 1. All other following events without a following event are coded as 0.

Independent variable:

VD-backed: This dummy variable is coded as 1 at the point of time when a startup received VD funding for the first time. The variable is coded as 0 for all rounds before VD funding and for all funding rounds of startups that never received VD funding.

Control variables:

We included several control variables that can affect both the startup's development outcome and the selection of VD providers. *Patents* have been identified to signal quality to outside investors (Long, 2002), which could improve their development outcomes. Furthermore, patents have been found to be important for VD providers (de Rassenfosse & Fischer, 2016). The patents are captured as a dummy variable that is coded 1 when a startup has patents. [9]

[9] We extracted the INPADOC-patent family from the database PATSTAT and matched the patents to the companies in our dataset with Damerau Levenshtein distance meassures.

Since the presence of VC investors can positively affect a startup's development (Brander et al., 2002) and VC investors have been found to be an important selection criterion for VD providers (Ibrahim, 2010), we included *VCinv*, *VCBest*, and *Syndication* as variables. *VCinv* is a dummy variable that is coded 1 if a startup received funding from a VC investor. *VCBest* is a dummy variable that captures whether one of those VC investors was one of the largest VC investors according to FundComb's list[10], and *Syndication* captures the number of different types of investors involved in the funding round.

In addition, we included a number of additional variables that might also play a role in VD providers' selections and could affect a startup's development outcome: The cumulative dollar inflow received by the startup before year t (*prior funding*), the logarithmic age of a startup at the time of funding, the *Stage* of a startup coded as an ordinal variable with the stages 'Seed', 'Series A', …, 'Series J'[11], and the number of *Funding Rounds* a startup had before year t.

Additionally, we included a control variable for the VD market with *VD deal value* that captures the logarithmic aggregated deal value of the VD market lagged by one year[12].

Finally, we included some standard control variables: *Year*, *Industry*[13], and *State*[14] as indicator variables, *# Founders* to control for the number of founders, and *Gender* to control for the gender heterogeneity of the founding team.

[10] Retrieved from https://fundcomb.com/lists/largest/startup-capital, accessed 17.01.2021.

[11] VD funding rounds do not necessarily get assigned a stage by Crunchbase if there is no VC participation. For those cases, the stage of the VD funding rounds is assigned to the stage of the previous VC funding round.

[12] The information for *VD deal value* was extracted from the database Preqin.

[13] Crunchbase offers 46 industry categories that we clustered into 19 categories listed in Table 6-3.

[14] The variable contains the states with the most VD investors: California, Illinois, Massachusetts, New York, Texas, and 'other states'

6.3.2. Summary statistics and univariate analysis

The summary statistics of the startups at the firm level are illustrated in Table 6-3.

Table 6-3: Descriptive statistics (observation unit: firm-level)

	VD-backed	Only VC-backed
Average year startup founded	2007.4	2011.5
Average year of first investment	2013.0	2014.7
Startup age in years (at first investment)	5.96	3.45
Proportion of startups with at least one patent	0.39	0.23
Rounds of investment		
≤2	0.37	0.76
3-4	0.30	0.17
>4	0.33	0.07
Industries (multiple classifications possible)		
Advertising	0.15	0.09
Artificial Intelligence	0.06	0.06
Biotechnology	0.11	0.10
Consumer Goods	0.23	0.31
Consumer Services	0.16	0.18
Data and Analytics	0.16	0.14
Education	0.04	0.04
Energy	0.04	0.03
Engineering	0.22	0.22
Financial Services	0.13	0.10
Hardware	0.17	0.15
Health Care	0.23	0.22
Information Technology	0.25	0.19
Media	0.14	0.17
Professional Services	0.37	0.32
Real Estate	0.04	0.04
Software	0.50	0.42
Transportation	0.04	0.05
Other	0.07	0.09
State		
California	0.42	0.38
Illinois	0.03	0.03
Massachusetts	0.06	0.06
New York	0.13	0.13
Texas	0.04	0.05
Other	0.31	0.35
# Founders	2.07	1.92
IPO	0.06	0.02
Trade sale	0.26	0.14
Success (IPO, trade sale, or subsequent funding)	0.88	0.58
Observations (N)	1,431	40,137

Note: This table reports the descriptive statistics for the sample of startups backed by VD and VC investors at the firm-level observational unit. All companies are obtained through the database Crunchbase. Patent data are supplemented via PATSTAT.

Of the 41,568 firms in our sample, 1,431 (3.44%) are VD-backed. The average VD-backed startup was founded in 2007 and received its first VD round approximately six years later. Additionally, VD-funded startups more often have patents present and do more funding rounds in general. The industry and state distributions of VD- and VC-funded companies are similar and do not show significant differences. However, the number of IPOs, trade sales, and successes of VD-funded startups are higher than those of VC-funded startups.

6.4. Methodology and results

To test the impact of VD participation on startup development outcomes, we follow Dutta & Folta (2016) and Croce et al. (2013). First, we apply a probit regression model. With the inclusion of all our control variables, we should be able to control various selection aspects of VD providers. Even though a general probit model is not able to completely control for selection effects, it allows us to obtain a baseline analysis for our following analysis. In the next step, we use a two-step Heckman approach with the following counterfactual analysis to disentangle selection from treatment effects.

6.4.1. Baseline probit estimation

For our baseline model, we apply the following general probit estimation to assess the startup development outcome of VD and non-VD-backed startups:

$$Y_{i,t}^{*} = \beta\left(VD\text{–}backed_{i,t}\right) + \gamma' X_{i,t} + \mu_t\left(Year(t)\right) + \varepsilon_{i,t}$$
$$Y_{i,t} = 1(Y_{i,t}^{*} > 0)$$

where i represents the startups and t represents time. $Y_{i,t}^{*}$ is the dummy dependent variable (success), $VD\text{–}backed_{i,t}$ is equal to 1 if startup i is VD-backed in year t, and 0 otherwise. In vector X, the following control variables are included: the logarithmic number of patents filed by startup i before year t, the logarithmic amount of cumulative funding that startup i received before year t (prior funding), the

logarithmic startup age, the startup stage, the number of funding rounds startup i received before year t, the number of investors involved in the funding round at year t (syndication), the dummy variable if a VC investor was involved in startup i before year t, the dummy variable if one of the largest VC investors was involved in startup i before year t, location dummies, number of founders, the logarithmic aggregated deal value of the VD market lagged by one year (VD deal value), the gender heterogeneity of the founding team of startup i, and industry dummies. Year(t) captures year fixed effects.

Table 6-4: Baseline analysis: Probit regression

Dependent variable	Success
	(1)
VD-backed	0.11*** (0.03)
Patents	0.06*** (0.01)
Prior Funding	0.00 (0.00)
Age	-0.06*** (0.01)
Stage	0.06*** (0.01)
# Funding rounds	-0.03*** (0.01)
Syndication	0.06*** (0.00)
VCinv	0.16*** (0.02)
VCBest	0.15*** (0.02)
# Founders	0.17*** (0.17)
VD Deal Value	-0.36*** (0.03)
Gender	-0.14*** (0.04)
Year	Yes
State	Yes
Industry	Yes
Observations (N)	82,016
χ^2	8680.65***

Note: This table reports the regression results of the probit baseline estimation. The dependent variable is the dummy variable of positive startup development outcomes. The variable is equal to 1 if a positive event (IPO, trade sale, subsequent funding) follows the VD funding round and equal to 0 if nothing followed (yet). The main independent variable is the dummy variable VDTreatment equal to 1 for the years a startup is VD-backed.
** Significance at 10% level, ** Significance at 5% level , *** Significance at 1% level*

Table 6-4 illustrates our baseline probit regression with a successful startup development outcome as the dependent variable. The coefficient of the VD-backed

dummy is positive and significant, suggesting that there is a positive effect of the VD provider's treatment on the startup development outcome. This effect becomes visible even though we control for both prior VC involvement (VCinv) and prior involvement of one of the largest VC investors (VCBest). We see that both of those terms are positive and significant. This suggests that prior VC involvement also has a positive impact on a startup's development and that the largest VC investors can foster those outcomes even better.

However, one of the concerns with this baseline estimation is that the positive effect of VD providers could be attributed to the fact that they choose better startups in contrast to VC investors. Even though we already controlled for a number of VD-specific selection criteria (i.e., patents, prior funding, age, stage, syndication, VC involvement), it remains unclear whether our selection variables captured all aspects of VD-specific selection criteria or whether there are still unobserved selection effects that could influence the results of our analysis. To address this issue, we control i for selection effects n the next step to isolate whether the positive effect of VD providers on the positive startup development outcome can be ultimately attributed to the treatment effect of VD providers or to unobserved selection effects.

6.4.2. Switching regression estimation

Therefore, we apply an endogenous switching regression estimation. This allows us to control specifically for selection effects and isolate the VD treatment effect. The analysis investigates whether there are any unobserved selection effects. In addition, we examine how a startup that received VD would have developed without this investment and hypothetically received VC funding instead. This helps us to answer the two questions: 1) Are there any unobserved selection effects that explain the more positive development of VD-funded startups? and 2) What would the startup development have been if it had not received VD funding (but received VC funding)?

We adopt a typical Heckman (1977, 1979) two-step sample selection approach that sorts the startups over two different funding options (VD-backed and VC-backed). In

the first stage, the estimates of the VD selection equation are used to compute the inverse Mill's ratio (*IMR(VD)*).

$$VD^*_{i,t} = \gamma' w_{i,t} + \varepsilon_{i,t}; VD_{i,t} = 1 \; if \; VD^*_{i,t} > 0; \; VD_{i,t} = 0 \; if \; VD^*_{i,t} \leq 0$$

$VD^*_{i,t}$ is the dummy dependent variable that captures whether a VD provider chose to invest in startup i at time t. If a startup receives VD funding, $VD_{i,t}$ equals "1" and "0" otherwise. The vector "w" includes our control variables that could affect VD selection: the logarithmic number of patents filed by startup i before year t, the logarithmic amount of cumulative funding that startup i received before year t, the logarithmic startup age, the startup stage, the number of funding rounds startup i received before year t (prior funding), the number of investors involved in the funding round at year t (syndication), the dummy variable if a VC was involved in startup i before year t, the dummy variable (VCBest) if one of the largest VC investors from the FundComp's list was involved in startup i before year t, location dummies, number of founders, the time dummy (yrlate) capturing if the funding round happened during the last observed three years (dummy = 1 for the years 2018, 2019, 2020), the gender heterogeneity of the founding team of startup i, industry dummies, and VD market characteristics captured via the logarithmic aggregate value of the VD market lagged by one year.

Then, the inverse Mill's ratio is used as a control variable in a within-group regression of the subset of startups that received VD funding and those that only received VC funding. The idea behind this is to control for the unobserved heterogeneity that affects the selection equation and the startup development outcome equation.[15]

$$\text{VD-backed startups:} Success^*_{i,t} = \beta'_1 X_{i,t} + \beta_{\lambda 1}[\phi(\gamma' w_{i,t})/\Phi(\gamma' w_{i,t})] + \epsilon_{1i,t} \quad (3)$$

[15] Startups that received both VD and VC funding are treated as VD-backed for the years after VD investment.

$$Success_{i,t} = 1(Success^*_{i,t} > 0)$$

$$\text{VC-backed startups: } Success^*_{i,t} = \beta_2' X_{i,t} + \beta_{\lambda 2}[-\phi(\gamma' w_{i,t})/(1 - \Phi(\gamma' w_{i,t}))] + \epsilon_{2i,t} \quad (4)$$
$$Success_{i,t} = 1(Success^*_{i,t} > 0)$$

The inverse mills ratio ($\lambda = [\phi[.]/\Phi[.]$) captures the unobservable VD-selection factor, and the vector X includes the control variables. As noted by Certo et al. (2016), it is essential to include an exclusion restriction variable for the two-step Heckman regression that should have a significant impact on the selection in the first step but no impact on the treatment in the second step. This variable should then be excluded from the second step. As an exclusion restriction variable, we use *VD deal value* since the aggregated deal value of VD should affect the probability of a startup receiving additional VD funding; however, these variables should have no impact on the actual treatment effect of VD.

Last, we use the model estimates from the second step of the regression for a hypothetical (counterfactual) analysis to assess the superiority of one investor type over another. We compute the hypothetical probability of a startup experiencing a positive startup development outcome for VD-backed (VC-backed) startups if they had not received VD (VC) funding and instead received VC (VD) funding. We obtain the probability of positive startup development outcomes by including the funding round-level attributes of the VD-backed subsample in the second-step regression for VC-backed startups and vice versa. To analyze the difference in the VD treatment effect (VC treatment effect), we measure the difference between the actual and hypothetical probability of a positive startup development outcome of VD-backed (VC-backed) startups.

Table 6-5: Switching regression: Steps 1 and 2

Dependent variable	First Step	Second Step	
	VD year dummy	Success	
		VD-backed	VC-backed
	(1)	(2)	(3)
IMR *(Inverse Mills Ratio)*		5.98*** (0.75)	4.92*** (0.14)
Patents	0.03 (0.02)	0.19*** (0.04)	0.18*** (0.01)
Prior Funding	0.01*** (0.00)	0.08*** (0.01)	0.06*** (0.00)
Age	0.43*** (0.04)	2.16*** (0.29)	1.88*** (0.05)
Stage	0.04*** (0.01)	0.22*** (0.03)	0.27*** (0.01)
# Funding rounds	0.02 (0.02)	0.16*** (0.02)	0.09*** (0.01)
Syndication	0.05*** (0.01)	0.26*** (0.03)	0.27*** (0.01)
VCinv	-0.16*** (0.05)	-0.67*** (0.13)	-0.49*** (0.03)
VCBest	0.10** (0.04)	0.67*** (0.10)	0.56*** (0.02)
# Founders	0.01 (0.01)	0.12*** (0.03)	0.20*** (0.01)
VD Deal Value	0.20*** (0.07)		
Gender	-0.17 (0.11)	-1.08*** (0.24)	-0.93*** (0.04)
yrlate	-0.22*** (0.04)	-2.16*** (0.14)	-1.81*** (0.03)
State	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Observations (N)	81,996	2,950	79,066
χ^2/R^2	209.52***	0.17	0.13

Note: Step 1 dependent variable (VD year dummy) is a dummy variable that equals 1 for the year a startup received its first VD investment and 0 otherwise. It is set to missing in the following years after VD funding. The dependent variable in step 2 is the positive development outcome variable (Success). Step 2 includes the inverse Mills ratio obtained from step 1.
** Significance at 10% level, ** Significance at 5% level , *** Significance at 1% level*

Table 6-5 reports the results of the switching regression. Column 1 illustrates the probit regression of the first step that examines the drivers of VD funding. Columns 2 and 3 report the results for the second-step subsample regression with the included inverse Mills ratio that was obtained from the first-step regression.

After the first step, we see that the determinants of receiving VD funding are, for the most part, in line with prior research. Surprisingly, the number of patents is not statistically significant in our model, which is in contrast to the findings of de Rassenfosse & Fischer (2016), who found that intellectual property plays a crucial part

in VD investments. However, VD providers also use intangible assets that cannot be patented as securities, which cannot be observed in our dataset.

Interestingly, we find that *VCinv* has a negative significant impact on the selection of startups by VD. However, the involvement of one of the largest VC investors (*VCBest*) from FundComp's list has a positive impact on the selection. These findings suggest that VD providers highly consider the quality of the involved VC investor for their decision to invest in a startup or not.

In the second step, we see that the inverse Mill's ratios for both VD-backed and VC-backed startups are positive and significant. However, the coefficient of VD-backed startups is higher than that of VC-backed startups. This indicates that both VD and VC investors have additional unobservable selection criteria that are not captured by our control variables but that explain the positive development of their portfolio companies. In other words, both VD and VC investors select startups that have more promising startup development outcomes due to further unobserved characteristics of these startups. However, with a coefficient value of the inverse Mill's ratio (IMR) of 5.98 for VD providers and 4.92 for VC investors, VD providers seem to have a slightly superior unobserved selection process in identifying promising startups.

These findings indicate that hypothesis 1 regarding the selection criteria is true, since numerous selection criteria which are important for VD providers are positive and significant. However, the inverse Mill's ratio indicates that there are still unobserved selection criteria for VD and VC investors that we do not capture with our analysis.

In the third step, we performed a counterfactual analysis (Table 6-6) to analyze whether there remains a positive treatment effect of VD providers on their portfolio companies after controlling for unobserved selection effects. We found that the probability of success of VD-backed startups is higher if they received actual VD funding compared to hypothetical VC funding. Additionally, for VC-backed startups, the success probability is higher if they had received VD funding instead. Both times, the differences between the real and hypothetical probabilities of success are

statistically significant. This indicates that VD providers not only select more promising startups but also positively influence their portfolio companies with their treatment. Consequently, we can accept hypothesis 2a and reject hypothesis 2b.

Table 6-6: Switching regression: Counterfactual analysis

	Actual value of VD-backed startups	Predicted value of VD-backed startups if they had received VC instead of VD (counterfactual)	Difference between (1) and (2)	Actual value of VC-backed startups	Predicted value of VC-backed startups if they had received VD instead of VC (counterfactual)	Difference between (4) and (5)
	(1)	(2)	(3)	(4)	(5)	(6)
Success	0.72	0.51	0.21***	0.64	0.70	-0.06***

Note: This table reports the counterfactual analysis based on the results of the second-step switching regression. Columns 1 and 4 present the means of the actual probability of VD and VC-backed startups experiencing a successful development outcome. Columns 2 and 5 present the means of the counterfactual (hypothetical) probability of startup development outcomes of VD-backed (VC-backed) startups if they had not received VD (VC) funding and received VC (VD) funding instead. Columns 3 and 6 present the difference of means.

** Significance at 10% level for t-test of mean difference, ** Significance at 5% level for t-test of mean difference, *** Significance at 1% level for t-test of mean difference*

6.4.3. Parametric hazard rate analysis

Table 6-7: Proportional hazard analysis

Dependent variable	Log of time to exit			
	(1)	(2)	(3)	(4)
Hazard type	Success	Subsequent funding	Trade sale	IPO
VD-backed	-0.10*** (0.02)	-0.07*** (0.03)	-0.29*** (0.07)	0.16 (0.16)
Patents	-0.05*** (0.01)	-0.05*** (0.01)	-0.02 (0.02)	-0.14*** (0.04)
Prior Funding	-0.00** (0.00)	-0.00*** (0.00)	0.01** (0.00)	-0.10*** (0.01)
Age	0.10*** (0.01)	0.13*** (0.01)	-0.21*** (0.02)	-0.32*** (0.07)
Stage	-0.06*** (0.00)	-0.04*** (0.00)	-0.12*** (0.01)	-0.27*** (0.02)
# Funding Rounds	-0.03*** (0.01)	-0.04*** (0.01)	0.02 (0.02)	0.04 (0.04)
Syndication	-0.05*** (0.00)	-0.05*** (0.00)	-0.05*** (0.00)	-0.10*** (0.01)
VCinv	-0.26*** (0.02)	-0.26*** (0.02)	-0.36*** (0.05)	0.89*** (0.18)
VCBest	-0.07*** (0.01)	-0.03* (0.02)	-0.37*** (0.04)	-0.55*** (0.10)
# Founders	-0.15*** (0.00)	-0.15*** (0.00)	-0.10*** (0.01)	-0.18*** (0.04)
Gender	0.11*** (0.03)	0.08** (0.03)	0.43*** (0.12)	0.64* (0.34)
VD Deal Value	0.07** (0.03)	0.08** (0.03)	-0.02 (0.11)	-0.09 (0.27)
State	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes

Note: The hazard types are defined as follows: success (dummy = 1 for IPOs, trade sales, or subsequent funding), subsequent funding (dummy = 1 for subsequent funding), trade sales (dummy = 1 for trade sales), and IPOs (dummy = 1 for IPOs). Negative (positive) coefficients indicate that the variable decreases (increases) the time a startup takes to exit.
** Significance at 10% level, ** Significance at 5% level , *** Significance at 1% level*

Finally, we apply a parametric hazard analysis for the separate events to further investigate the differences in time-to-exit for VD-backed and VC-backed startups. Therefore, we employ a parametric accelerated time-to-exit model with a log-normal distribution. Since our dataset is limited to the final year 2020, startups that have not experienced an exit up to that point are right-censored and might exit after our sample period. We include all of our prior control variables.

Table 6-7 reports the results of our hazard analysis with an accelerated time-to-exit parametric hazard model. Negative (positive) coefficients indicate that the time between the funding and the respective event decreases (increases). The main focus is on the variable VD-backed, which equals "1" for the years a startup is VD-backed and

"0" otherwise. In columns (1), (2), and (3), the variable VD-backed is negative and significant, which indicates that VD-backed startups need less time to reach successful events. In particular, trade sales are heavily influenced by the backing of VD providers. However, for IPOs, we do not find statistically significant evidence of an influence of the involvement of VD providers.

6.5. Robustness

We conducted two different robustness checks. First, we apply the same methodology for the switching regression as before but with a subsample of our dataset. Since VD providers are very heterogeneous, we classified them into two groups according to their business model: VD providers that solely do VD deals (pure VD providers) and other investors where VD is just one part of their business and they also do other types of investments (e.g., investment banks and VC investors with VD branches). This allows us to perform a subsample analysis in which we only use the VD funding rounds of startups that received funding from pure VD providers. This approach results in fewer false classified VD funding rounds since the participation of a pure VD provider in a funding round should highly indicate that the funding round is indeed a VD funding round. However, only including pure VD providers results in a smaller dataset and does not capture the whole VD market.

Second, we apply a probit regression in which we discriminate between the different startup development outcomes (subsequent funding, trade sales, and IPO) and regress them separately against our baseline outcome (nothing happened yet). This allows us to investigate whether our previous results are driven by a single outcome that biases our overall results.

Table 6-8: Switching regression: Steps 1 and 2 (subsample analysis)

Dependent variable	First Step	Second Step	
	VD year dummy	Success	
		VD-backed	VC-backed
	(1)	(2)	(3)
IMR		3.55*** (0.65)	2.79*** (0.08)
Patents	0.03 (0.03)	0.16*** (0.06)	0.14*** (0.01)
Prior Funding	0.00 (0.00)	0.14** (0.01)	0.00*** (0.00)
Age	0.50*** (0.11)	1.55*** (0.31)	1.26*** (0.04)
Stage	0.03 (0.02)	0.07** (0.03)	0.14*** (0.01)
# Funding rounds	0.04 (0.04)	0.16*** (0.04)	0.10*** (0.01)
Syndication	0.03*** (0.01)	0.12*** (0.02)	0.13*** (0.00)
VCinv	-0.04 (0.07)	0.04 (0.13)	0.11*** (0.02)
VCBest	-0.08 (0.07)	-0.15 (0.12)	-0.11*** (0.02)
# Founders	-0.01 (0.02)	0.01 (0.04)	0.11*** (0.01)
VD Deal Value	0.34*** (0.11)		
Gender	-0.04 (0.17)	-0.13 (0.34)	-0.26*** (0.03)
yrlate	-0.24*** (0.06)	-1.73*** (0.15)	-1.44*** (0.02)
State	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Observations (N)	79,622	1,203	77,523
χ^2/R^2	69.44***	0.16	0.14

Note: Step 1 dependent variable (VD year dummy) is a dummy variable that equals 1 for the year a startup received its first VD investment and 0 otherwise. It is set to missing in the following years after VD funding. The dependent variable in step 2 is the positive development outcome variable (Success). Step 2 includes the inverse Mills ratio obtained from step 1. For these regressions, we use a subsample of our dataset where we excluded startups that received funding from VD providers that also provide other types of investments (e.g., banks and VC investors with VD branches).

** Significance at 10% level, ** Significance at 5% level , *** Significance at 1% level*

Table 6-8 and Table 6-9 show the results of the switching regression for the subsample. Surprisingly, only two of our selection variables stay significant during the first step. However, the inverse Mill's ratio stays positive and significant for both regressions in the second step. Additionally, the coefficient for the VD-backed subsample stays larger than that for the VC-backed subsample. This is in line with our hypothesis 1 and the results of our main analysis.

For the counterfactual analysis in Table 6-9, we see a change in our results and find that VC-backed startups would perform better with their VC funding compared to

hypothetical VD funding. However, the results remain the same for VD-backed startups – they perform better with VD compared to a hypothetical VC funding round.

This does not completely contradict our previous findings but provides an indication that further improved data quality regarding VD is necessary to ultimately answer the question about the overall treatment effect of VD.

Table 6-9: Switching regression: Counterfactual analysis (subsample analysis)

	Actual value of VD-backed startup	Predicted value of VD-backed startup if they had received VC instead of VD (counterfactual)	Difference between (1) and (2)	Actual value of VC-backed startup	Predicted value of VC-backed startup if they had received VD instead of VC (counterfactual)	Difference between (4) and (5)
	(1)	(2)	(3)	(4)	(5)	(6)
Success	0.68	0.47	0.20***	0.63	0.53	0.10***

Note: This table reports the counterfactual analysis based on the results of the second-stage switching regression. Columns 1 and 4 present the means of the actual probability of VD and VC-backed ventures experiencing a successful development outcome. Columns 2 and 5 present the means of the counterfactual (hypothetical) probability of startup development outcomes of VD-backed (VC-backed) ventures if they had not received VD (VC) funding and received VC (VD) funding instead. Columns 3 and 6 present the difference of means.
** Significance at 10% level for t-test of mean difference, ** Significance at 5% level for t-test of mean difference, *** Significance at 1% level for t-test of mean difference*

Table 6-10 summarizes the results of the specified regressions of the single startup development outcomes against the baseline event (nothing followed yet after a funding round). The results show a positive and significant influence of VD on the subsequent funding round and the subsequent event trade sale. For the following event IPO, the coefficient VD-backed is positive but not significant. This indicates that our findings are not driven by a single event, which provides further robustness to our previous results.

Table 6-10: Probit estimation (single outcomes)

Dependent variable	Subsequent funding	Trade sale	IPO
	(1)	(2)	(3)
VD-backed	0.08** (0.03)	0.69*** (0.16)	0.07 (0.44)
Patents	0.05*** (0.01)	0.12** (0.05)	0.78*** (0.11)
Prior Funding	0.00 (0.00)	-0.01* (0.01)	0.21*** (0.03)
Age	-0.10*** (0.01)	0.55*** (0.04)	1.77*** (0.15)
Stage	0.06*** (0.01)	0.35*** (0.03)	0.81*** (0.08)
# Funding rounds	-0.04*** (0.01)	-0.11*** (0.04)	-0.26*** (0.09)
Syndication	0.06*** (0.00)	0.19*** (0.01)	0.38*** (0.04)
VCinv	0.17*** (0.02)	0.74*** (0.10)	-2.77*** (0.31)
VCBest	0.12*** (0.02)	1.20*** (0.11)	1.56*** (0.31)
# Founders	0.18*** (0.01)	0.39*** (0.03)	0.52*** (0.10)
VD Deal Value	-0.38*** (0.03)	-0.19 (0.19)	-1.50** (0.59)
Gender	-0.12*** (0.04)	-1.08*** (0.23)	-2.39*** (0.84)
Year	Yes	Yes	Yes
State	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Observations (N)	75,768	34,966	30,630
χ^2	7795.23***	1146.18***	1025.98***

Note: This table reports the regression results where the single startup development outcomes (subsequent funding, trade sale, and IPO) are regressed against the baseline outcome (nothing followed, yet) using the probit estimation.
** Significance at 10% level, ** Significance at 5% level , *** Significance at 1% level*

6.6. Discussion and conclusion

6.6.1. Discussion

The aim of our study was to investigate the effect of VD on startup development. More specifically, we wanted to disentangle the selection and treatment effects of VD on startup development.

To address this question, we used a large dataset of US startups after the financial crisis and investigated positive events that follow after VD funding rounds. Following Dutta & Folta (2016) and Croce et al. (2013), we first conducted a baseline probit regression and further advanced the analysis with a switching regression model to disentangle selection and treatment effects. Finally, we complemented the analysis

with a proportional hazard model to investigate the different events separately. We tested the robustness of our results with a subsample and counterfactual analysis.

Our results show that VD providers seem to select more promising startups (picking winners) but also have a positive treatment effect on their portfolio firms (making winners). In other words, the startups that received VD funding had more positive development outcomes due to the involvement of a VD provider. Furthermore, the time until a startup experienced subsequent funding rounds or an exit via trade sale decreased with VD involvement, which further supports the value-adding argument for VD providers.

This finding indicates that the lower involvement of VD providers in the startups' activities and the higher freedom provided to startups in their decision-making processes seem to have a positive effect on the startups' development. However, this result raises the question of whether the value-adding effect of VC investors emphasized in prior literature (Sapienza, 1992) is of higher value to startups than maintaining their entrepreneurial freedom. The recent paper by Lerner & Nanda (2020) provides a starting point to answer this question, as it outlines the change in the entrepreneurial finance industry and the changing role of VC investors. As highlighted by the authors, VC investors started to develop more "founder-friendly" contracts to obtain better deals where their traditional value-added services are less pronounced. This finding might also be related to the changes in the entrepreneurial finance landscape (Block et al. 2017) where entrepreneurs receive more education and support through early-stage programs. Overall, our findings support this development by indicating that value-adding support by VC investors became less important, and other types of entrepreneurial finance can bring additional value (Naulin and Moritz (in press)). Consequently, it is likely that we will see more VD-funded startups in the future because VD seems to support this development by providing more entrepreneurial freedom in daily business activities. However, our results suggest that VD cannot be the only source of funding for entrepreneurs. In line with prior research, we find that VD providers have strong selection criteria, such as the involvement of a

reputable VC investor (de Rassenfosse & Fischer, 2016; Tykvová, 2017) and other startup-specific characteristics (e.g., cumulative prior funding, age, stage) that lower the startup's default probability (Chua et al., 2011). We further show that VC investor involvement is of lesser importance but that the quality of the VC investor matters most. This result highlights that startups need to attract high-quality VC investors first to be able to access VD funding. This connection between VC and VD can push the best startups even more to achieve more favorable development outcomes. Furthermore, our results emphasize that VD investments are more likely after startups show prior success in receiving funding and in later stages of their development.

6.6.2. Implications

Through our study, we provide several contributions to the existing literature. First, we contribute to the growing VD literature (e.g., Ibrahim, 2010; Fischer & Ringler, 2014; de Rassenfosse & Fischer, 2016; Tykvová, 2017; Hochberg et al., 2018) by investigating which influence VD funding has on a startup's development. We show that VD-funded companies develop better than non-VD-funded companies. Second, we contribute to the literature disentangling selection from the treatment effects of startup investors (e.g., Aerts et al., 2007; Bertoni et al., 2011; Lee & Zhang, 2011; Croce et al., 2013; González-Uribe & Leatherbee, 2018; Bonini et al., 2019). Our study contributes to this research stream by examining VD as an alternative funding option for startups and shows that better startup development can be attributed to both the selection and the treatment by VD providers. Third, we contribute to the broader research stream dealing with capital structure and the signaling effects of debt funding (Ross, 1977; Flannery, 1986; Harris & Raviv, 1990). We find empirical evidence that is consistent with the debt literature and show that high-quality ventures are preferred by debt providers, even in earlier stages, as is the case with VD.

Furthermore, we provide practical implications for startups and VD providers. First, our study shows that VD is a very attractive funding source for startups, as VD providers typically do not interfere with the daily business of the startup but, at the

same time, have a positive development effect for the startups. Furthermore, startups can use our results to better understand when to apply for VD and which criteria should be highlighted to increase the likelihood of receiving VD funding. In particular, the involvement of a reputable VC investor. VD providers can use our results to benchmark their selection process to the market. Our results confirm that VD providers seem to select more promising startups and that VD providers' policy of low involvement has positive effects on startups' development.

6.6.3. Limitations and future research

Our study has several limitations. First, the specification of VD providers remains a challenge. First, due to limitations in our dataset, we needed to classify VD providers manually according to the information provided on their website and their prior deals we found in various databases. Second, some investors are not only active in VD but also provide other types of financing, such as VC or traditional bank loan financing, without the specific characteristics of VD investments. In these cases, we were not able to differentiate whether such an investor acts as a VD provider or as another type of debt provider in a funding round since the detailed financing tools are not recorded in the database. We addressed this gap by conducting a subsample analysis for identified pure VD providers. The results are not fundamentally different from the findings of our main analysis.

Overall, VD is still a very under researched field that provides various avenues for future research. Building upon our research, there is room to further dive into the selection and treatment debate of VD on startup development. We have observed that data quality regarding VD is improving. If this development continues, it will be possible to provide an even deeper analysis of the effects of VD on startup development and startup performance in the future.

Additionally, we included as many variables as possible to account for the unique set of selection criteria of VD providers (e.g., Hardymond et al., 2004; Fischer & Ringler, 2014; de Rassenfosse & Fischer, 2016; Hesse & Lutz, 2016; Hochberg et al.,

2018) in our study. However, we still found unobservable selection effects from VD providers that are connected with better startup development outcomes. Therefore, further studies of the unique selection criteria of VD providers should be pursued.

Chapter 7

Summary, implications, and outlook

The final chapter (Chapter 7) provides a conclusion of the dissertation. Section 7.1. summarizes the main findings and outlines limitations connected with the interpretation of the results. In addition, the theoretical and practical implications of the dissertation are deduced (Section 7.2.) and potential avenues for further research are discussed (Section 7.3.).

7.1. Summary and limitations

Summary

Today, developed economies are spawning and hunting for high-growth startups, in order to secure new jobs, spur economic growth, and generate wealth (Calvino et al., 2015; Kuckertz et al., 2023; Kuratko & Audretsch, 2022). Startups are often very capital-intensive and require a lot of external capital to maintain their high-growth path. If local ecosystems are not able to provide these financial resources, these startups emigrate to other ecosystems more fitting to their funding needs. Europe is facing a high emigration proportion of its high-growth startups to the US (e.g., Bucak, 2022; Pan Finance, 2022; Pless, 2022; Rist, 2022). The focus of my dissertation lies on a developing financial instrument that addresses the capital hunger of scale-up startups: VD. The aim of the dissertation was exploratory in nature with two main research questions: First, to investigate the driving forces and the emergence of VD in Europe using a holistic and qualitative approach. Second, this dissertation looked deeper into the impact of VD on startup development.

My dissertation started by providing a basic understanding of VD and how VD fits into the entrepreneurial finance ecosystem and the startup funding life cycle. I showed that VD is designed to address the funding needs of a startup's expansion stage but also how VD differs from VC, bank loans, and other private debt investments. Even though startups in Europe face a large funding gap in their expansion stage which limits startup growth (Honjo et al., 2014; Lam, 2010), little is known about whether VD is a financial instrument with the possibility to successfully address this gap. Prior studies have shown that debt is an important source of financing for startups (Berger & Udell, 1998) and that VD is designed to address the funding needs in the expansion stage of startups (Hesse et al., 2016; Ibrahim, 2010). However, these studies mainly focus on the use of debt in general and the business model of VD providers. A deeper understanding of the effects of VD on startups is yet to be understood. In addition,

even though VD is attracting attention in Europe as a tool to fulfill the expansion phase financing gap (EIB, 2022), it is not known whether VD is a suitable tool for addressing this issue. This is unsatisfactory as VD providers do not follow traditional entrepreneurial finance business approaches and the academic discourse remains uninformed about the driving forces behind VD. My dissertation aimed to tap into this research gap and examine the emergence of VD in Europe based on an interview study involving 28 interview partners from VD providers, VCs, and entrepreneurs. Following qualitative research (Corbin & Strauss, 2008; Gioia et al., 2013; Leitch et al., 2010), the results reveal two VD-specific aspects that fostered the emergence of VD in Europe: 1) the VD provider's personality and 2) the specific VD entrepreneurial opportunity in Europe. My findings suggest that VD closes a disequilibrium state in the European entrepreneurial finance landscape and is able to address the expansion phase financing gap for the market participants. However, VD is still developing and has not reached full legitimacy in the European ecosystem.

Even though these results highlight VD's potential to induce additional capital into the startup ecosystem and reduce the expansion phase funding gap of high-growth startups, the potential impact on the startup's development under the consideration of the commitment of capital resources to repay the debt remain so far unexplored. From an entrepreneur's perspective, the decision to pursue VD in addition to or in place of another round of VC funding can be viewed as a strategic decision (Mintzberg, Raisinghani & Théoret, 1976; Eisenhardt & Zbaracki, 1992). Against this background, startups need to understand the influences of VD on startup development. My dissertation taps into this research gap and finds that:

VD impacts the development of startups based on 5 effects: 1) Stronger (financial) discipline, 2) freedom to operate, 3) time to funding, 4) certification effects, and 5) other value-adding effects. However, the analysis revealed that these effects can have both positive and negative influences on startup development. The results also reflect the conflicting findings on the influence of debt identified in prior literature. In detail, debt has a negative impact on startups due to an increased risk of bankruptcy (Baxter, 1967)

but also a positive impact on startups due to a positive signaling effect to outside investors (Epure & Guasch, 2020).

In addition, the quantitative results suggest that the positive impact surpasses the negative impact of VD on startup development. VD-funded startups show a higher capability for acquiring financial resources via subsequent funding rounds, trade sales, and IPOs compared to only VC-funded startups. Furthermore, this dissertation found that this positive impact on startup development can be credited to both the better selection ability of VD providers and the direct non-financial impact of VD providers on their portfolio companies. Thus, the results suggest that startups should pursue VD funding in their funding life cycle to experience a more favorable development path.

Limitations

This dissertation has several limitations connected with the interpretation of the results. With respect to the semi-structured interviews conducted for the analysis of the emergence of VD in Europe and the mechanism of VD's impact on startups, it has to be noted that the interviews were conducted over the course of 2 years. Even though all interviews were conducted before the COVID-19 crisis and the following radical change in the financial landscape worldwide, the interviews can be subject to biases regarding nuanced different economic environments at the time of the specific interviews. This can lead to a variation in the interpretation of VD by different interview partners solely based on a changed economic environment. In addition, the interview partners from VD providers had an average of 7.4 years of experience in VD. Thus, my dissertation is faced with limitations regarding the interview partners' capability of capturing the whole 20+ years of development of VD and its emergence in Europe. Since all of the interview partners are located in Europe, there are additional limitations regarding the interpretation of the impact of VD. The market of VD is diverse in different local ecosystems. Thus, the interviews might only reflect the impact of VD on startups in Europe and face limitations with a general interpretation of the impact of VD on startups worldwide.

With regard to the quantitative analyses, there are limitations connected with the investigated Crunchbase dataset. The specification of VD investors remains a challenge and VD providers were classified manually according to the information provided on their website and their prior deals in various databases. Currently, there exists no clear classification of VD providers in databases and also not all VD rounds are reported in databases since VD is not adopted by the majority of market players. Hence, we only used US data since the US is the farthest developed market that offers still limited but the best data availability. Second, some VD providers are not only active in VD but also provide other types of financing, such as VC or traditional bank loan financing. In these cases, it was not possible to differentiate whether such a lender acts as a VD provider or as another type of debt provider in a funding round since the detailed financing tools are not recorded in the database. Further limitations regarding the interpretation of the quantitative results originate from the statistical methods used. For the analyses, econometric methods were employed such as multinomial regressions, counterfactual regressions, and hazard regressions. However, these methods show constricted robustness compared to other quasi-experimental econometric methods (e.g., difference-in-difference regressions, regression discontinuity designs). Since the dataset did not allow the use of more sophisticated econometric methods, the analyses were conducted with methods that might lead to more error-prone results and limit their validity. Finally, the quantitative results are limited in their overarching geographic heterogeneity. The dataset only included US-based startups and the US constitutes the most developed and largest VD market. The impact of VD on startups can vary between the US and other regions. VD was invented in the US and has the longest history, the most market players, and the largest market size. Hence, the US VD market represents a very well-developed and institutionalized ecosystem. Thus, the quantitative results of my dissertation have limited face validity in markets outside of the US.

Consequently, the results of my dissertation should be understood as preliminary results in their respective research contexts. For more comprehensive results further

research as well as an even better-developed data basis is required. Some potential avenues for future research will be discussed in Section 7.3.

7.2. Implications

7.2.1. Theoretical implications

My dissertation contributes to several literature streams in the entrepreneurial finance literature, in the growing field of VD, and in the category emergence literature.

Entrepreneurial finance literature: My dissertation provides several contributions to the overarching entrepreneurial finance literature. Prior literature has shown that startups heavily rely on debt financing while also struggling to access debt (Chen et al., 2010; Coleman et al., 2016; Colombo & Grilli, 2007: Rob & Robinson, 2014; Scherr et al., 1993). Research focusing on determinants that influence a startup's access to debt considered a variety of factors such as growth prospects, firm size, tangible assets, and generating revenue, as well as owner characteristics such as age, net worth, work experience, and education. My dissertation contributes to this literature stream by highlighting that factors such as VC involvement, intangible collateral, and equity warrants are key influence factors for a startup's access to external debt.

Extant literature investigated the direct and indirect effects of debt on startups (Cole & Sokolyk, 2018; Epure & Guasch, 2020; Fuertes-Callén et al., 2020; Hechavarria et al., 2016; Tanrisever et al., 2012). In this context, prior research has shown that the involvement of external debt in early-stage startups can serve as a reliable signal for other external equity investors. However, there are conflicting empirical findings regarding a startup's development and survival with increased usage of debt. In addition, external debt is only considered as an aggregated class in prior studies. Since VD is a non-traditional source of professional debt connected with a unique business model and lending philosophy it is necessary to investigate VD separately. The results of my dissertation contribute to this literature stream by generating further insights into how VD in particular impacts the development of startups. I displayed the

superior ability of a startup to attract new financial resources via trade sales and follow-up funding when VD was used in prior funding rounds.

Venture debt literature: My dissertation contributes to the evolving but still scarce literature on VD in several ways. Prior research on VD has investigated the rationale behind VD (Ibrahim, 2010) and the business model of VD providers (Hesse et al., 2016). Even though Iyer (2020) investigated the Indian VD market in comparison to VD markets in developed countries, the backgrounds and conditions that lead to the development and emergence of VD were not explored. My dissertation addresses this research gap. The results of the dissertation have shown that VD has emerged based on a Kirznerian entrepreneurial opportunity (Kirzner, 1973) to address unanswered market needs that resulted from the disruption of the entrepreneurial finance sector from new financing tools and stricter regulations. Additionally, the findings revealed that the VD business model spilled over from the US to the European market where European VD pioneers copy-catted US businesses. These results indicate the importance of the interconnectedness of international markets and how local economies are influenced by spill-over effects from other regions.

Furthermore, prior literature investigated the selection criteria of VD providers (de Rassenfosse & Fischer, 2016; Hochberg et al., 2018), the success of startups to access VD (Lehnertz et al., 2022; Tykvová, 2017), and the structuring of VD contracts (Hesse & Lutz, 2016). Overall, these studies only focus on the VD process up to the point of contract completion. My dissertation extends this literature by highlighting 1) the mechanism of how VD providers influence startups during the investment period and 2) the general impact of how startups develop based on the influencing mechanisms of VD. The results of my dissertation highlighted that VD providers impact their portfolio companies in several opposing ways, especially with regard to a startup's freedom to operate and the certification of a startup (both positive and negative). The results of the empirical examination of the development of VD-funded startups, however, have shown that VD-funded startups develop more successfully in contrast to only VC-funded startups.

In addition, extant literature emphasized not only the impact of a specific funding tool but also the impact based on the investor's reputation. A highly reputable investor can certify the underlying quality of their portfolio companies (Dranove & Jin, 2010; Kreps & Wilson, 1982; Milgrom & Roberts, 1982; Shapiro, 1983). More specifically, entrepreneurial finance research found that the reputation of involved VC investors is crucial to future financial resource acquisition (Bygrave & Timmons, 1992; Hsu, 2005). However, whether this reputation effect is equally important in the special context of VD was unexplored. My dissertation contributes to this research by examining whether a highly reputable VD provider can serve as a quality certification of a startup resulting in increased access to external financial resources. The results confirm a positive reputational certification effect of VD by increasing a startup's ability to acquire additional financial resources via IPO.

Category emergence literature: The category emergence literature is rich with findings on the development of novel technologies and categorial features that are hard to classify in existing category systems (Durand & Khai-re, 2017) and are often connected with the destruction and disruption of existing markets. However, the emergence of new market categories connected with closing disequilibrium states in the market should be equally well represented in the ecosystem (de Jong & Marsili, 2015). My dissertation contributes to this literature and investigated the special case of VD emergence in Europe. The results suggest that VD exploits the disequilibrium in the entrepreneurial finance market and addresses a lack of alternative financing options for expansion, bridging, and other special purposes. Therefore, the emergence of VD can be characterized as the exploitation of a Kirznerian entrepreneurial opportunity (Kirzner, 1973).

7.2.2. Practical implications

My dissertation provides practical implications for startups, VD providers, other startup investors (e.g., VCs), and policymakers.

Startups: Startups experience financing gaps throughout their lifecycle and in particular at the beginning and their growth phase (Honjo et al., 2014; Lam, 2010). Especially European startups face liquidity shortages (Reypens et al., 2020) which result in startups having a higher tendency of leaving Europe to find funding elsewhere (e.g., Pless, 2022). Even though there are various financing options available for startups the classic funding instruments seem not to be sufficient. However, past discussions showed that startups are often not aware of all financing options and how these different alternatives might fit to their businesses (Ebben & Johnson, 2006; Holmes & Kent, 1991; Romano et al., 2001; Vanacker et al., 2011). The results of my dissertations can help to increase awareness and knowledge about one particular financing option - VD.

In addition, startups are faced with a strategic decision of whether to pursue VD financing as a complementary or substitutional funding opportunity. In such funding decisions, not only the amount of funding but also the non-monetary impact and value-adding practices need to be considered in the startup's decision (Croce, et al., 2013; Cumming et al., 2005; Sapienza et al., 1996). My dissertation shows how VD providers impact their portfolio companies directly and indirectly. Startups can base their decision on these results.

Furthermore, Bygrave & Timmons (1992, p.208) have highlighted that "it is far more important whose money you get than how much you get or how much your pay for it". Hence, the results regarding the reputational effect of VD providers bring forth further insights into the importance of seeking highly reputable investors in the VD context. Startups can use these results to evaluate their development path and if they should pursue a highly reputable VD provider in order to benefit from this reputational effect.

VD providers: The VD market is constantly growing and VD providers are gaining increased recognition across the entrepreneurial finance landscape. However, major differences between geographic regions exist. Outside of the US, the most developed VD market, VD providers are struggling to achieve legitimacy. VD providers still need to educate various market participants about VD as a financial instrument and build a professional reputation.

Furthermore, my dissertation provides information about the impact of VD on startups. The interviews with VD providers have shown that VD fund managers are not completely aware of their impact on startup development. VD providers can use my results to better understand their direct non-monetary impact in terms of quality certification, financial discipline, and other value-adding practices. These insights allow VD providers to further develop their business approach and identify new unique offerings to their portfolio companies to gain strategic advantages in the market.

In addition, VD providers can use the results of my dissertation for a better understanding of the relevance of their reputation. In other entrepreneurial finance markets (e.g., VC) the reputation of investors plays an important signaling role in the acquisition of future external investors. In the case of VD, its presence seems to be more important than the reputation of the provider itself. Thus, VD providers are advised to maintain the current development of increasing recognition of VD in the entrepreneurial finance landscape. However, an outstanding reputation still seems to provide additional benefits, especially in future IPOs of VD portfolio companies.

Policymakers: The 'EIB Operational Plan 2022-2024' (EIB, 2022) aims to strengthen the European startup ecosystem and highlights the need for alternative ways of financing for young and innovative firms. In order to pursue this aim, the EIB increased its efforts in various financing instruments (e.g., mini-bonds, mid-cap bonds, VC) including VD. For the development of a more attractive European startup ecosystem, it is of utmost importance that government support programs are aimed at the right investment vehicle (Román et al., 2013). Currently, startups face increased

liquidity restrictions in their expansion phase. The results of my dissertation indicate that VD is a fitting tool to address this particular financing gap and public support of VD can positively impact the future development of potential startups. Policymakers can use these results to allocate more public financial resources to the VD market and operate with even better-tailored financial instruments for the need of startup companies.

Furthermore, the results of my dissertation suggest that the financial education of market players is still low, in particular with regard to VD. Policymakers could support the financial landscape with educational programs to strengthen the understanding of different alternative funding types. Only with educated market participants regional ecosystems can be competitive, develop further, and become more attractive.

7.3. Directions for further research

Based on the results of my dissertation various promising avenues for future research can be identified. One potential direction is the further theoretical assessment of the formation of VD as a new market category. Existing literature focuses on the formation of new market categories mostly based on new physical products and technologies (Durand & Khaire, 2017; Navis & Glynn, 2010). The emergence of VD provides an interesting new case of a new category that emerged in the financial industry. VD combines a complementing and substituting function in the established entrepreneurial finance landscape. Thus, VD vertically disintegrates the entrepreneurial finance market (Jacobides, 2005) and disrupts existing market players with direct competition. A better theoretical view of the emergence of VD promises new theoretical approaches for the emergence of other market categories.

A second research direction would be a deeper examination of the impact of VD but also different types of VD on startups. The underlying VD data is continuously improving and future research could dive deeper into 1) VD's regional differences, 2)

the impact of specific groups within VD, and 3) a thorough assessment of VD's impact in comparison with other financing options. First, the VD market reached different states of development in different regions including the regulatory environments which might limit the operating activities of VD providers. Hence, the impact of VD on startups in markets in different regions needs separate research attention. Second, the group of VD providers is very heterogeneous including VD funds, investment banks, commercial banks, public VD providers, etc. VD providers with different backgrounds might follow different investment philosophies and can impact both their portfolio companies and the involved investor syndicates differently. Future research could examine these differences and provide further insights into the suitability of certain VD providers to certain businesses. Third, further development of the data quality related to VD will allow an even deeper and more causal analysis of the effects of VD on startup development and performance. Thus, with better data quality and availability, future research could examine the effect of VD on a deeper level and in comparison to other funding instruments (e.g., business angels, crowdfunding) with different non-financial goals (e.g., innovation output, sustainability).

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Appendix

Appendix Chapter 3

Figure A3- 1: Entrepreneurial finance market ~2000

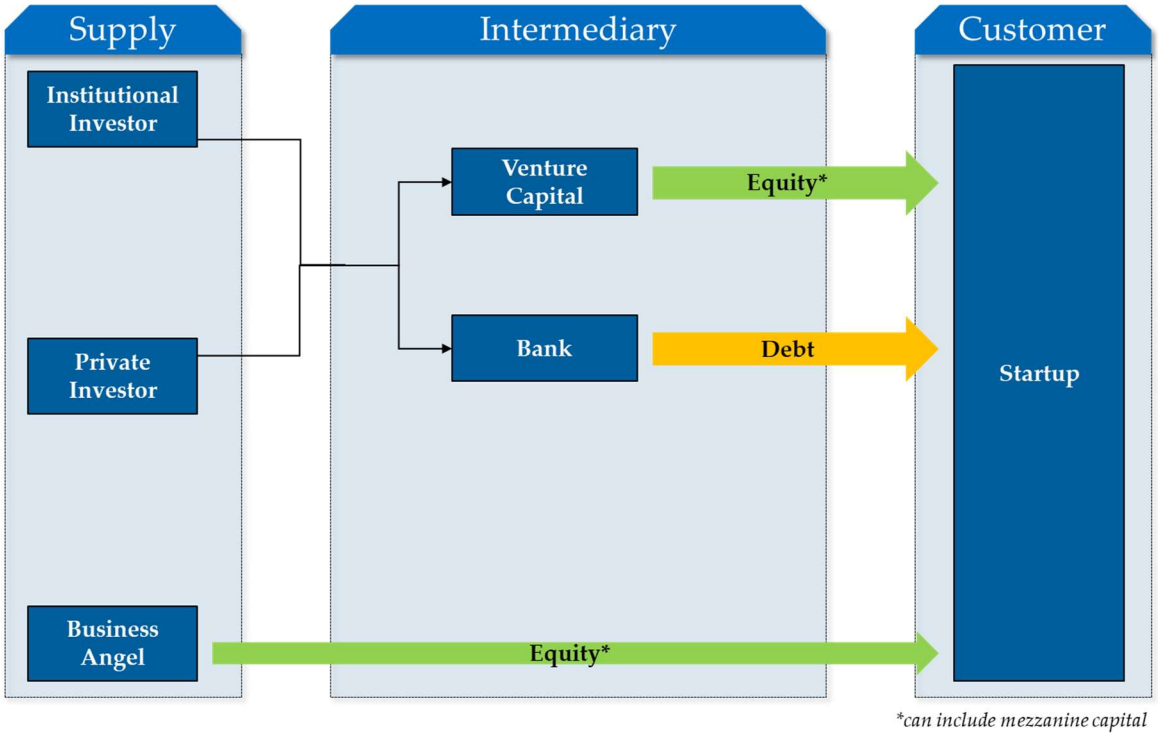


Figure A3- 2: Entrepreneurial finance market ~2022

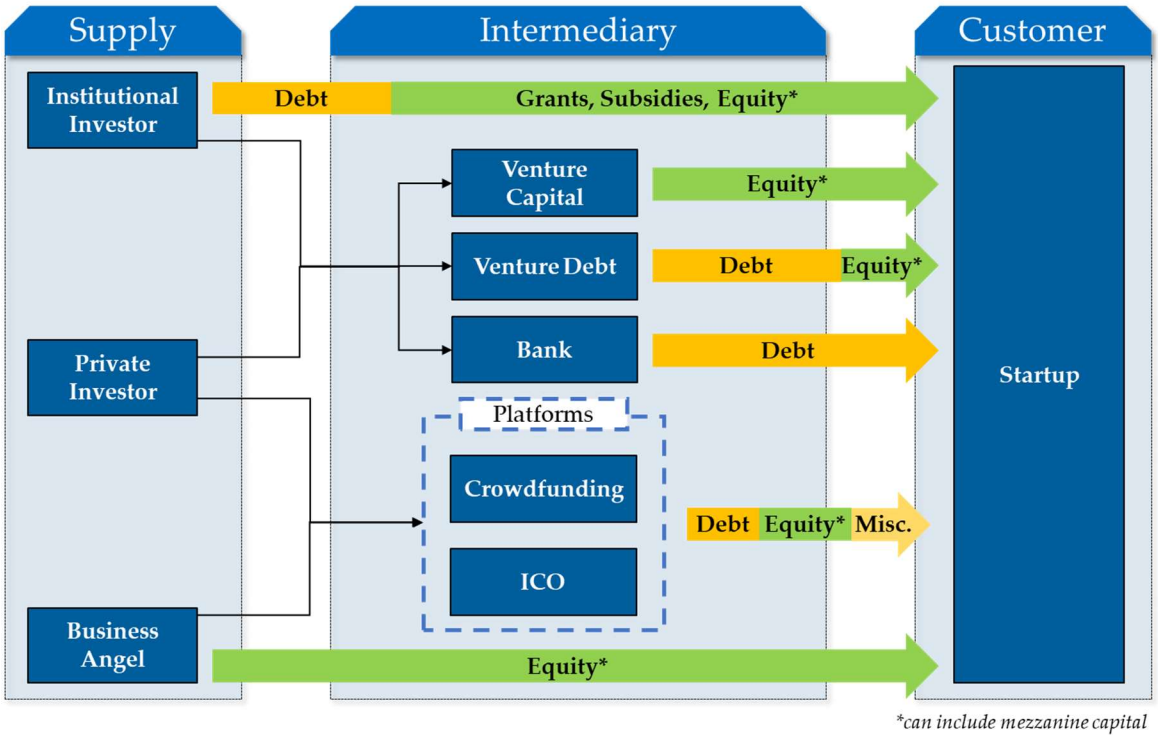
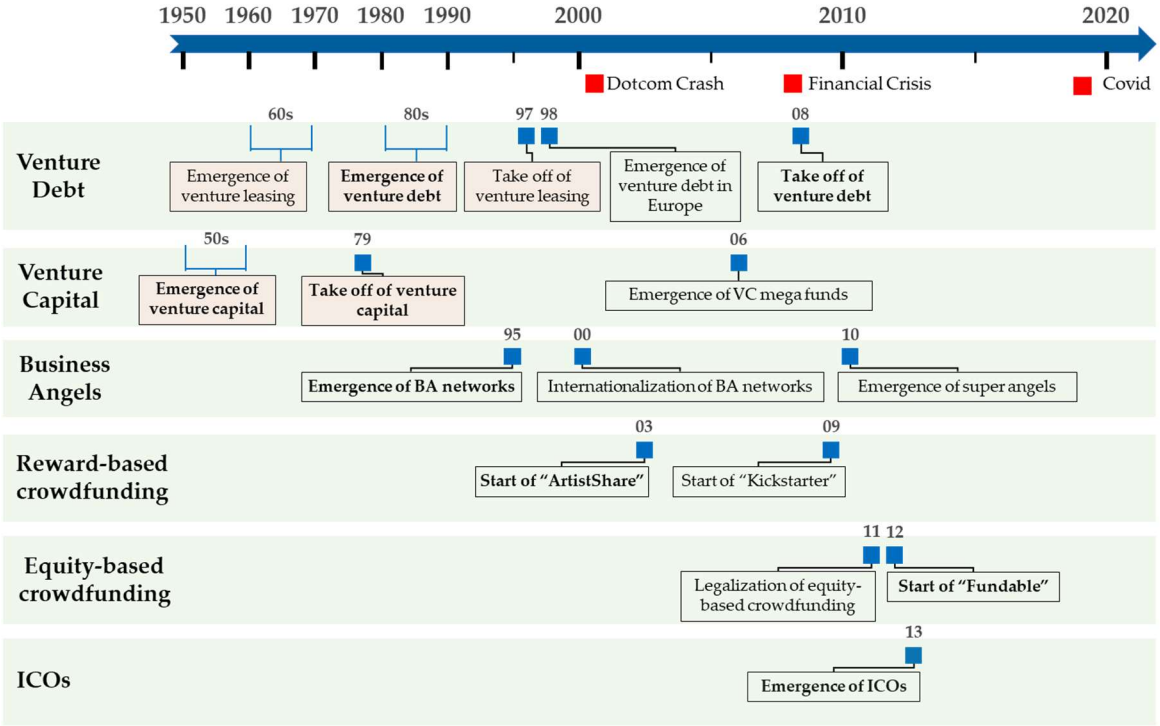


Figure A3- 3: Entrepreneurial finance timeline



Interview guideline: VD funds

Introduction

- **In your opinion, what makes Venture Debt interesting as an asset class?**

Origin of Venture Debt

- **How and why did the Venture Debt market emerge?**
- What changes in the entrepreneurial landscape have **promoted** the emergence of Venture Debt?
- Why did you/your company decide to engage in VD at the time of founding?
- How did the venture debt market change due to the financial crisis?

  Follow-up:

  - *Was there a **need to change** and adapt for other players in entrepreneurial finance during the financial crisis that led to the takeoff of VD?*
  - *From your perspective, where did all the new VD players come from?*
  - *What, if any, effect did changes in the demand of the startups for investors have?*
  - *What, if any, effect did changes in the demand of investors for investment options in the entrepreneurial finance landscape have (with less risk, with higher interest)?*
  - *How did a rising demand for complementary funding options affect the entrepreneurial finance landscape? (down rounds, dilution in later stages, failure)*
- How did changes in the **environmental conditions** drive and/or support the development of Venture Debt?

  Follow-up:

  - *What, if any, role played a continuing low interest environment for the emergence of VD?*
  - *What, if any, role played a developing and liquid private equity market for the emergence of VD?*
  - *What, if any, role played a developing and liquid patent market for the emergence of VD?*
  - *What, if any, role played a developing labor market with people skilled in equity for the emergence of VD?*
  - *What, if any, role played subsidies and public grants for startups for the emergence of VD?*
  - *What, if any, effect did a change in laws and regulations on the emergence of VD have?*

[Summarizing results of the quantitative study again]

Results

- **What is your opinion about these results?**
- **In your opinion, why do you think that we do have the results we have?**
  [Key words: Better Selection, Adverse Selection]

End

- **Connection and referring to other investors and startups in their network**

Interview guideline: Banks

Introduction

- **In your opinion, what makes Venture Debt interesting as an asset class?**

Origin of Venture Debt

- **How and why did the Venture Debt market emerge?**
- What changes in the entrepreneurial landscape have **promoted** the emergence of Venture Debt?
- Was VD an opportunity to expand the existing product portfolio of banks?

  Follow-up:

  - *How did changes in competition among entrepreneurial finance players affect banks to change and adapt?*
  - *What, if any, effect did changes in the demand of the startups for investors have?*
  - *What, if any, effect did changes in the demand of investors for investment options in the entrepreneurial finance landscape have (with less risk, with higher interest)?*
  - *How did a rising demand for complementary funding options affect the entrepreneurial finance landscape? (down rounds, dilution in later stages, failure)*
- How did changes in the **environmental conditions** drive and/or support the emergence of Venture Debt?

  Follow-up:

  - *What, if any, role played a continuing low interest environment for the emergence of VD?*
  - *What, if any, role played a developing and liquid private equity market for the emergence of VD?*
  - *What, if any, role played a developing and liquid patent market for the emergence of VD?*
  - *What, if any, role played a developing labor market with people skilled in equity for the emergence of VD?*
  - *What, if any, role played subsidies and public grants for startups for the emergence of VD?*
  - *What, if any, effect did a change in laws and regulations on the emergence of VD have?*

[Summarizing results of the quantitative study again]

Results

- **What is your opinion about these results?**
- **In your opinion, why do you think that we do have the results we have?**
  [Key words: Better Selection, Adverse Selection]

End

- **Connection and referring to other investors and startups in their network**

Interview guideline: Entrepreneurs

Introduction

- **In your opinion, what makes Venture Debt interesting as a funding tool?**

Attention Venture Debt

- **How did you become aware of venture debt?**

  Follow-up:

  - *Did you learn about VD during your studies? (university, vocational training,…)*
  - *Did you learn about VD during other entrepreneurship-related training programs?*
  - *Was VD recommended to you by friends or colleagues?*
  - *Did an investor recommend taking a VD funding round?*
- In your opinion, did the awareness of VD increase over the last years?

Reasons for Venture Debt funding

- What were the reasons you and your company decided to use VD funding?
- Did you consider other funding options in your situation?
- What are the main differences of VD in comparison to VC and other entrepreneurial funding options?
- What are the main differences of venture debt in comparison to other debt financing options such as bank loans?

  Follow-up:

  - *What, if any, role played unexpected financial constraints?*
  - *What, if any, role played an upcoming milestone? Did you want to extend the runway to reach that milestone?*
  - *What, if any, role played the pressure to avoid a potential down round?*
  - *What, if any, played the less dilutive character of VD funding (including the influence VD providers take in the venture)?*
  - *What, if any, role played the demand of needing cash quickly? Could other funding options not deliver the funding in time?*
- What role played the **environmental conditions** for your decision to take VD?

  Follow-up:

  - *What, if any, role played a continuing low interest environment for your decision to take VD?*
  - *What, if any, role played an exogenous shock (e.g., COVID-19) for your decision to take VD?*
  - *What, if any, role played subsidies and public grants for your startup for your decision to take VD?*
  - *What, if any, effect had laws and regulations on your decision to take VD?*
- In your opinion, for what type of entrepreneur do you suggest taking VD?

End

- **Connection and referring to other investors and startups in their network**

Interview guideline: VCs

Introduction

- **What is your current position of the fund and how did you come across VD in the last years?**

Coopetition VC / VD

- **How** did the **entrepreneurial landscape change over the last years? (keywords: technological changes, regulatory changes,…)**
- In your opinion, did the demand-side for entrepreneurial financing change over the last years (i.e., education of entrepreneurs, financial literacy,…)
- Do entrepreneurs today **rely less on value-adding practices** of VCs?

VD experience:

- What is your experience so far with VD?
- Do you actively advice entrepreneurs to take VD or do you even connect your portfolio companies with VD provider? If yes, why; if no, why?
- If yes: When do you choose to involve VD into a deal?
- In your view, do VDs bring value for VCs and the startup? (Certification / other Effects)
- **How does your relationship with VDs look like?**

  Follow-up:

  - *Is there a competition bw. VD and VC? If yes, under which circumstances?*
  - *Do you work together with VD providers? If yes, how?*

More specific questions about VD (opinion of VC)

- In your view, how do the **selection criteria from VDs** differ from your own selection criteria?
- In your opinion, do VDs collect better deals (come in later, VCs already invested)?
- In your view, how is the **reputation of VD** in the entrepreneurial finance sector?
- From your perspective, how did the **VD market as well as the product change** over the last decade?
- How did changes in the **environmental conditions** drive and/or support the emergence of Venture Debt?

  Follow-up:

  - *What, if any, role played a continuing low interest environment for the emergence of VD?*
  - *Did any changes in the VC market drive the emergence of VD? (if not mentioned before)*

[Summarizing results of the quantitative study again]

Results

- **What is your opinion about these results?**
- **In your opinion, why do you think that we do have the results we have?**
  [Key words: Better Selection, Adverse Selection]

End

- **Connection and referring to other VCs in their network**

Table A3- 1: Coding scheme

100	**VD market characteristics and development**		
	110	Uniqueness of VD	
		111	Difference VD to VC
		112	Difference VD to bank loans
	120	General changes and maturity in the VD market	
	130	Securities	
	140	Relationships with VCs	
		141	Implied security
		142	Competition with VC
	150	Deal Flow	
	160	Impact VD in the entrepreneurial market	
	170	Reputation of VD	
	180	Market players	
		181	VCs moving into VD
		182	Banks moving into VD
		183	Hedge Funds moving into VD
	190	People that move into VD	
200	**Entrepreneurs**		
	210	Entrepreneur demand	
	220	Startup supply for VD	
	230	Entrepreneur education	
300	**Limited partners**		
	310	LP demand	
		320	Money supply for VD
		330	LP sophistication
400	**Environmental changes**		
		410	Impact crisis 2000
		420	Low-interest environment
		430	Impact crisis 2008
		440	Regulatory changes
		450	Patent market
		460	Impact COVID
		470	Governmental subsidies
500	**Changes in the entrepreneurial finance market**		
		510	Education of market participants
		520	Changing role of VCs
		530	New financing types and market players

Appendix Chapter 5

Table A5- 1: Descriptive statistics (on firm level)

	VD-backed	**Only VC-backed**
Average year startup founded	2007.83	2011.59
Average year of first investment	2013.07	2014.72
Startup age in years (at first investment)	5.57	3.41
Proportion of startups with at least one patent	0.39	0.23
Rounds of investment		
≤2	0.37	0.76
3-4	0.30	0.18
>4	0.33	0.06
Industries (multiple classifications possible)		
Advertising	0.16	0.09
Artificial Intelligence	0.06	0.07
Biotechnology	0.10	0.10
Consumer Goods	0.24	0.32
Consumer Services	0.16	0.19
Data and Analytics	0.17	0.16
Education	0.04	0.05
Energy	0.04	0.03
Engineering	0.21	0.22
Financial Services	0.14	0.10
Hardware	0.17	0.15
Health Care	0.22	0.22
Information Technology	0.26	0.20
Media	0.15	0.18
Professional Services	0.38	0.34
Real Estate	0.03	0.04
Software	0.52	0.45
Transportation	0.04	0.05
Other	0.07	0.09
State		
California	0.43	0.38
Illinois	0.04	0.03
Massachusetts	0.06	0.07
New York	0.13	0.13
Texas	0.04	0.05
Other	0.31	0.35
# Founders	2.07	1.93
Observations (N)	1,392	38,922

Table A5- 2: Descriptive statistics and correlations

Variable	Mean	Std	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Depent Variables												
IPO (dummy)	0.0076	0.09										
Trade Sale (dummy)	0.0577	0.23										
Follow-up Funding (dummy)	0.5676	0.50										
Independent Variables												
1. VD (dummy)	0.0175	0.13	1.00									
2. VD Reputation	0.0527	0.73	0.56	1.00								
Control Variables												
3. VC (dummy)	0.4939	0.50	0.05	0.04	1.00							
4. VC-Reputation (dummy)	0.1472	0.35	0.05	0.06	0.42	1.00						
5. Venture Age (ln)	1.3850	0.73	0.10	0.05	0.35	0.16	1.00					
6. Patents (dummy)	0.2662	0-44	0.03	0.03	0.17	0.09	0.28	1.00				
7. Amount of Prior Funding (ln)	5.9192	7.48	0.07	0.06	0.76	0.41	0.38	0.22	1.00			
8. Number of Funding Rounds	1.0084	1.42	0.06	0.05	0.72	0.46	0.39	0.19	0.65	1.00		
9. Funding Round Syndication	2.0720	2.76	0.05	0.06	0.16	0.27	0.00	0.02	0.19	0.16	1.00	
10. Number of Founders	2.0539	1.07	0.00	0.01	0.11	0.15	-0.09	-0.02	0.09	0.12	0.18	1.00

Table A5- 3: Coding scheme

100	**Selection VC**	**300**	**Selection VD**
200	**VD effect**	311	Reliance on VCs
210	Effects on startups	312	Proof of concepts/financials/business model
211	Higher discipline	313	Securities
212	More freedom to operate	314	Other
213	Time to funding		
214	Other		
220	Certification		
221	Negative signal		
222	Positive signal		