Essays on
the Finance of Startups

Dissertation

zur Erlangung des Doktorgrades
der Wirtschafts- und Sozialwissenschaftlichen Fakultät
der Eberhard Karls Universität Tübingen

vorgelegt von
Laura Kristina Uhl, M.Sc.
aus Böblingen

Tübingen
2023

Tag der mündlichen Prüfung:	07. Juli 2023
Dekan:	Professor Dr. Ansgar Thiel
1. Gutachter:	Professor Dr. Werner Neus
2. Gutachter:	Professor Dr. Martin Ruf

Acknowledgments

This thesis was written during my employment at the Chair of Banking at the Eberhard Karls University Tübingen between 2018 and 2023. At this point, I would like to thank all the people who have accompanied me to reach this next step of my academic career. I would not have come that far eleven years after starting my bachelor's program without you.

First, I want to thank my doctoral supervisor, Prof. Dr. Werner Neus. He gave me valuable advice for all of the four projects during planned or ad hoc discussions when passing each other's door. The friendly work atmosphere made me look forward to going to work every day. The great flexibility in terms of working place and hours allowed me to continue working as a volunteer in my private life, which means a lot to me personally. Of course, I also want to thank my second supervisor, Prof. Dr. Martin Ruf, who raised my interest in tax research, which led to one of the projects of this thesis.

Next, I would like to thank my colleagues who became very good friends throughout the years. I got to know them more and more closely, first, through organizational activities at work, but soon thereafter through many events, evenings and weekends spent together. In particular, I want to thank my direct colleague Moritz Sefried whose door was always open and who supported me physically and mentally in any situation. Additionally, I want to mention Stefanie Ehmann, Viktoria Müller-Henneberg, and Maximiliane Unsorg (my "third floor coffee crew", "running crew", "painting crew", . . .) with whom I spent hours and hours in the past five years. Overall, the fun and laughter have made our time together unforgettable. And I am sure there is much more to come. Thanks for your support and the steady backing in good but also difficult times!

I also thank my colleagues at the chair Jan Riepe, Eva Schäberle, Markus Merz, Dorothee Amann, Britta Schmid, Bianca Idler, Justine Rehbronn, and our student assistants for the pleasant work atmosphere, the valuable discussions, and the reliable support. For the uncomplicated co-authorship while writing one of the chapters of this thesis, I thank Ferdinand Springer.

Last but not least, I would like to give special thanks to my family. Not only within my educational career but throughout all the years, Hanns-Joachim, Alice and Philipp Uhl as well as Gaby and Reiner Wodey supported me at any time and never doubted that I can make it.

Challenging times, especially in the past three years, made me see again and again how important family and friends are. Therefore, I can just say thanks again to all of you who brought this journey to a successful end.

Tuebingen, July 2023 *Laura Kristina Uhl*

Contents

List of Figures

List of Tables

List of Derivations

Chapter 1
Introduction

Startups are drivers of economic growth. They characterize through their innovative nature, and create breakthroughs which may be highly important for the development of the sector they operate in. Startups discover new markets or lead to competition in existing markets (Akcigit and Kerr 2018; Knott and Vieregger 2020). In recent years, the relevance of startup investments has increased worldwide. Exemplarily, the U.S. venture capital market shows a fundraising size of USD 121.5 billion in the first six months of 2022, compared to a total amount of USD 138.9 billion in the entire year of 2021 (KPMG 2022). Similarly, the importance of venture capital has increased in Europe. As an example, German startups received EUR 17.4 billion in 2021 via venture capital funding which is more than three times the amount raised in the year before. It was collected in 1,160 deals, which describes a surplus of 56% in the absolute number of deals compared to 2020. This increase is distributed over all sizes of startup investment rounds in venture capital (EY 2022a).

While startups create chances for the development of the whole economic system (Aldrich and Ruef 2011), they often bear high losses and high risk of failure in the beginning of their lifetime (Reisdorfer-Leite et al. 2020). On the one hand, challenges of early-stage startups result from their environment, e.g., the macroeconomic circumstances (e.g., Ning et al. 2015; Berre and Le Pendeven 2021). On the other hand, startups often suffer from internal resource constraints due to their short firm history (Hvide and Møen 2010). Unlike renowned firms, they cannot easily resolve these issues due to their liability of newness (Stichcombe 1965) and liability of smallness (Baum 1996). To promote a sound startup ecosystem, a deep understanding of the factors influencing startup development is crucial. In turn, the results of this thesis are of main interest for researchers as well as public policy makers and politicians. Within four chapters, this thesis will shed light on some influential factors for startup survival and growth. The thesis ends with summarizing remarks on these results.

One major constraint for startups is their financial situation which strongly influences future decisions and actions. With 40%, almost every second startup reports restricted financial resources as one of the most pressing challenges (Kollmann et al. 2019). However, as internal financial resources in startups are usually scarce, they must rely on external financial support in order to exploit potentially profitable investment opportunities (Bottazzi et al. 2014) and to not restrict their performance and growth (Levine 2005). Due to lacking credit history, missing collateral, and high-risk business models at the same time, startups often cannot draw on traditional financing methods, e.g., bank loans. Hence, they must employ non-traditional ways of financing, e.g., venture capital or capital from private investors.

Besides financial constraints, startups often face the lack of non-financial resources (Alvarez-Garrido and Dushnitsky 2016). These non-financial assets, e.g., marketing advice (Anderson et al. 2018) or network effects (Baum et al. 2000) offered by investors, are crucial for startup success. Corporate venture capitalists (CVCs) constitute one major provider of financial and non-financial support for early-stage startups. They tolerate startups' high risk as they also know about the potential breakthrough, and, in turn, the possibility of high profits. The first part of the following analyses (Chapter 2, "Startups' Demand for Non-Financial Resources: Descriptive Evidence from an International Corporate Venture Capitalist") concentrates on startups' perceived importance of different areas of non-financial support provided by large CVCs. After revealing the general importance of investors' commercial connections and other non-financial resources for startups, further analyses investigate the perceived relevance split by startups' financial situation, their business model, and size. In Chapter 3 ("Financial Constraints, Entrepreneurial Challenges, and the Effects on Performance"), I use the same proprietary dataset. Therein, I investigate the challenges which early-stage startups prioritize to tackle in the short run, and how these aspects differ depending on their financial situation. Specifically, I reveal the interaction of a differing access to financial resources and the startups' challenges tackled, and relate it to startup performance. By analyzing detailed information on the startups' needs from the management system of one major CVC, I add to the literature by uncovering internal startup decisions.

Similar to professional investors, e.g., corporate venture capitalists, private investors may support early-stage startups financially through, e.g., the investment alternative of crowdinvesting. In return for a share in the firm, investors provide financial support which helps startups to raise the funds needed to reach the next stage of development. Studies show that informational differences play a major role in decision-making (Kleinert and Volkmann 2019). Chapter 4 ("How Close is Your Crowd? The Role of Information Asymmetries for Investment Decisions in Crowdinvesting") investigates the effect of information asymmetries on investment decisions in crowdinvesting, especially the investment probability and investment amount. In this part of the thesis, I look at the interaction between informational disadvantages of investors compared to startups, and factors which decrease investors' uncertainty. Specifically, I look at the interaction between information asymmetries and the investor-startup-relationship and objectively observable signals, respectively, which have shown in former studies to influence investors' decision-making (Angerer et al. 2017; Courtney et al. 2017). I exploit detailed data on investor and startup characteristics to fill the gap in the literature looking at the interplay between these factors.

The last part of the analyses (Chapter 5, "The Effects of a Reform in Corporate Tax Law on Startup Investments") focuses on one specific macroeconomic factor, the tax environment, which leads to different slack financial resources for startups. In general, tax policy should correspond to the principles of decision and investment neutrality (Boadway and Bruce 1984; Devereux

and Freeman 1991), i.e., tax payments should not systematically influence neither economic nor investment decisions. However, the direct impact on startups through the taxation of their revenues as well as the indirect effect through differing investment decisions due to the taxation of investors' revenues influence startup growth (Carroll et al. 2000; Mirrlees and Adam 2011). I focus on the tax reform of the Sections 8c / 8d in the German corporate tax law which constitutes an exogenous event to analyze the effect of a tax change on investment decisions in startups and, in turn, the external financial resources which startups can lean on. For this purpose, I compare the development of investment decisions in Germany to the development within a synthetic control group in comparable European countries.

Summing up, this thesis reveals the impact of several factors fostering or limiting startup performance and growth. Specifically, this thesis focuses on financial constraints, the effect of accessible non-financial resources, information asymmetries between investors and startups, and the tax environment. Thereby, this thesis provides a base for future research as well as decisions of politicians and public policy makers in order to create a sound startup system which fosters startup growth, and the development of the whole economy (Aldrich and Ruef 2011).

Chapter 2
Startups' Demand for Non-Financial Resources: Descriptive Evidence from an International Corporate Venture Capitalist

Abstract Using proprietary data from Europe and Latin America, we show how startup characteristics shape their demand for non-financial resources from their corporate venture capitalists. We first highlight the investors' commercial network, investors' ties to other investors and their contacts to retail clients as the most important non-financial resources for early-stage startups. Second, we uncover systematic differences in startups' demand for non-financial resources depending on startups' slack financial resources, their business model, and size. Overall, we provide direct evidence on startups' demand for non-financial resources which is hard to detect and to quantify for researchers based on public data.

The only mistake you can make is not asking for help.
– Sandeep Jauhar, U.S. author

Acknowledgments This chapter is adapted from my publication "Startups' Demand for Non-Financial Resources: Descriptive Evidence from an International Corporate Venture Capitalist" in the Finance Research Letters in 2020. It was joint work with Jan Riepe from the Eberhard Karls University of Tübingen and supported by the Fritz-Thyssen Foundation. We appreciate the helpful comments from Editor Narjess Boubakri as well as from the anonymous reviewer. We would also like to thank Felix Karth and Saniya Tukayeva for their excellent research assistance. Moreover, we gratefully thank Werner Neus, Christoph Sextroh, Theresa Veer, and the participants of the internal research seminar for their valuable comments and insights.

2.1 Introduction

Young startups are key drivers of innovation and economic growth, turning the question of performance-influencing factors into a major challenge for researchers, managers, and economists. The literature stresses the access to financial (Beck and Demirgüç-Kunt 2006; Long 2019) and non-financial resources (Alvarez-Garrido and Dushnitsky 2016) as crucial parameters for startup success. However, we lack comprehensive evidence on the nature of the needed resources from the startups' perspective because startups usually seek and receive non-financial resources in private transactions. Therefore, researchers frequently have to make assumptions or rely on indirect evidence about the startups' demand for these resources (Kerr et al. 2014). Nevertheless, economists, policy makers, and investors need a better understanding of startups' needs for non-financial resources to develop and promote a sound startup ecosystem.

In this study, we fill the literature gap by exploring the resource demand from early-stage high-tech startups in Europe and Latin America. We use proprietary data of 360 startups in 12 countries from a major corporate venture capitalist (CVC) which supports all startups with the same financial assets but a varying amount in non-financial resources. In the analysis, we condition the startups' demand for non-financial resources on different startup-specific characteristics, namely the startups' amount of slack financial resources, their business model, and size.

Our findings underscore the importance of networks as well as connections to potential investors and retail clients as those non-financial resources which startups seek from investors in their early development stage. By documenting large differences in the startups' demand for non-financial resources, this study complements the literature on the consequences of external financing for startup growth (Beck and Demirgüç-Kunt 2006; Long 2019). We show that the investor-startup-relationship extends far beyond the supply of financial resources. It also rests on non-financial CVC resources.

2.2 Financial Slack and Non-Financial Resources

Startups are typically resource-constrained (Hvide and Møen 2010) and depend on external financial and non-financial resources. Frictions in the access to finance – so-called financial constraints – strongly restrict startup growth (Beck and Demirgüç-Kunt 2006; Allen et al. 2013; Farinha and Félix 2015; Long 2019). Startups without sufficient financial resources cannot benefit from all profitable investment projects and, in turn, do not turn into high-growth firms (Bottazzi et al. 2008; Long 2019).

Besides banks, strategic long-term investors such as venture capitalists (VCs) are major entities in helping startups to overcome their resource constraints (see Da Rin et al. 2013; Manigart and Sapienza 2017 for a literature review on the VC industry). Most VCs are established as

independent entities with dispersed ownership while few of them get sponsored by large and resource-rich corporations, the so-called CVCs, or governments (Riyanto and Schwienbacher 2006; Tykvová 2018). Startups benefit from VCs' financial but also non-financial resources, such as the assistance in building networks (e.g., Baum et al. 2000), the advice in internal processes, e.g., in human resources and legal issues (e.g., Dushnitsky and Lenox 2005), or marketing (e.g., Homburg et al. 2014; Anderson et al. 2018). The provided non-financial resources help startups to reduce time as well as capital investments as, e.g., startups can exploit the CVCs' knowledge and infrastructure, and get faster access to the market (Alvarez-Garrido and Dushnitsky 2016). Furthermore, they can focus on their core business and take advantage of the positive signaling effect from the cooperation with the CVC (Riyanto and Schwienbacher 2006). Baum et al. (2000, p. 267) summarize alliances "to be particularly beneficial to young, resource-constrained firms with established firms [. . .] to overcome liabilities of newness and/or smallness".

Financial constraints also impact startups' demand for non-financial resources. The resource dependence perspective predicts that financial slack buffers startups' demand for resources that they can easily buy (Patzelt et al. 2008). They consequently demand "harder-to-replace" non-financial resources. On the contrary, financially constrained startups cannot convert financial into non-financial resources and, therefore, demand the most vital resources without replacement considerations.

2.3 Data and Measures

We use unique, proprietary information from the Management Information System (MIS) of one CVC within the information and communication technology sector. The CVC is a legally separate subsidiary of a globally acting European corporation which is listed in the EURO STOXX 50 Index. It operates offices in 12 countries in Europe and Latin America.[1] All startups are engaged with this CVC and receive the same contract with a one-time fixed financial payout but a varying amount and composition of non-financial resources.

Data is collected by the CVC within regularly conducted startup interviews. Therein, startups indicate the key business area in which they need the CVC's non-financial assistance. The seven possible areas are *commercial connections to the parent corporation, fundraising activities, human resources, legal advice, marketing, network to other associated startups* and *product/operations*. Additionally, we consider static startup characteristics as well as evolving information on startups' current business activities. Data is available for ten quarters in the years 2014 to 2016. The sample consists of 360 startups with 1,215 observations.[2] *Table 2.1* provides sample descriptions regarding the local distribution of startups.

[1] During the observation period (2014-2016), major economic turbulences in Venezuela occurred. We exclude Venezuelan observations from the sample to alleviate concerns that these dynamics are somehow unique which might drive our results.

[2] The difference between the number of startups and observations results from the situation that some startups receive non-financial support by the CVC throughout a longer period of time and thus respond to the CVC's quarterly interview in several periods.

Table 2.1: *Local Distribution of Startups and Observations*

	Startups (N=360)		Observations (N=1,215)	
	Freq.	%	Freq.	%
Latin America	**191**	**53.06**	**749**	**61.65**
Argentina	42	11.67	165	13.58
Brazil	17	4.72	39	3.21
Chile	32	8.89	155	12.70
Colombia	35	9.72	161	13.25
Mexico	37	10.28	154	12.67
Peru	28	7.78	75	6.17
Europe	**169**	**46.94**	**466**	**38.35**
Czech Republic	15	4.17	52	4.28
Germany	21	5.83	62	5.10
Ireland	26	7.22	71	5.84
Spain	54	15.00	143	11.77
United Kingdom	53	14.72	138	11.36

This table displays the distribution of startups and observations. It is split by continents. Countries are sorted alphabetically within each group.

We measure the startups' financial constraints using the CVC's liquidity rating[3] which is periodically assigned to each startup. It is based on private information, especially startups' available cash and current cash burn rate. Ratings are ten-point scaled with higher ratings characterizing better equipped startups. Thereby, a rating of ten refers to startups with sufficient cash to cover 18 months at the current cash burn rate whereas a rating of zero refers to startups without enough cash for six months at the current cash burn rate. By using this internal measure for financial constraints, we avoid pitfalls from other proxies (Musso and Schiavo 2008). We classify startups with a liquidity rating at and below the 25% quantile per country as financially constrained (30.70% of the observations).

Looking at the startups' business model, 52.35% follow a pure business-to-business (B2B) approach, 17.04% focus on retail customers (B2C) only, and 30.62% target both, businesses and retail customers (B2B & B2C). Startups show an average headcount of 7.95 full-time equivalents and receive a mean liquidity rating of 5.12 (out of 10) from the CVC. *Table A.2.4* of the Appendix displays the definitions of all variables.

2.4 Results

In the following, we first descriptively display the startups' demand for different non-financial resources to document the startups' needs and characteristics which influence their resource demand. Subsequently, we conduct multivariate regressions including these key characteristics

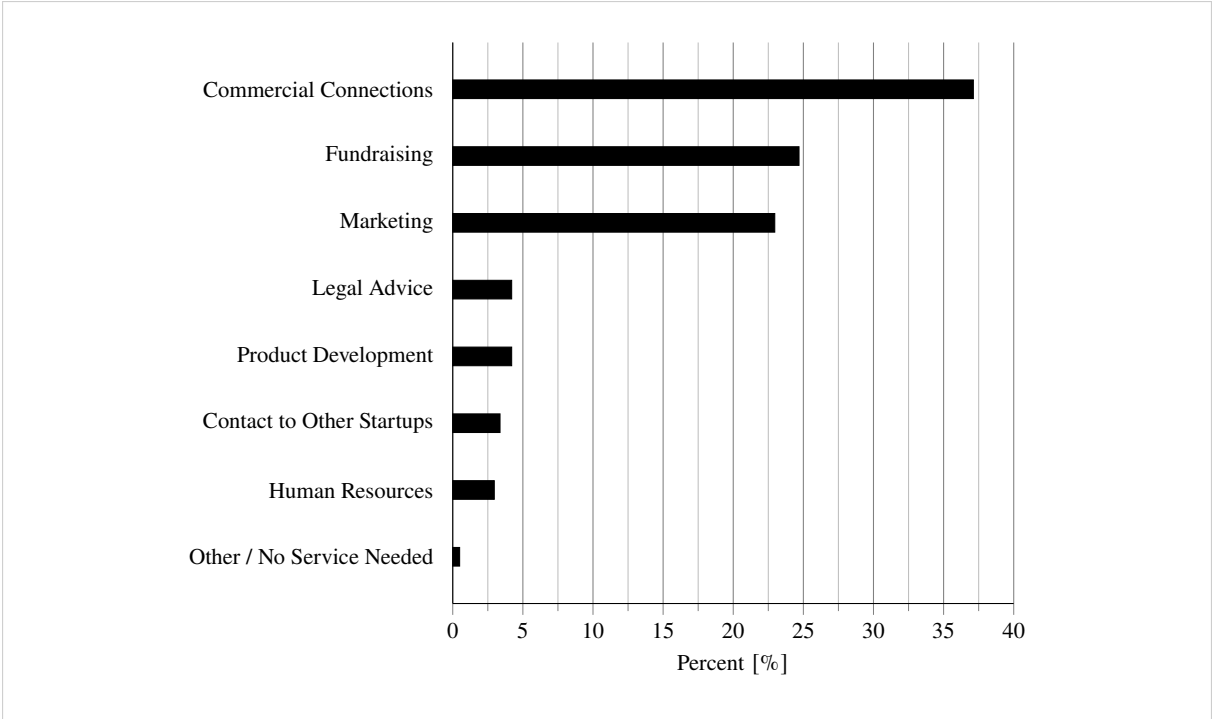
[3] Other ratings cover the startups' current situation regarding their commercial status, the competitive situation, market opportunities, product quality, revenues, team quality, and third party funding.

to uncover systematic differences within the demand structure between groups. All values displayed in *Figure 2.1* to *Figure 2.4* of this section are reported in *Table A.2.1* to *Table A.2.3* of the Appendix.

2.4.1 Descriptive Evidence

Figure 2.1 shows the startups' responses to the question: "Which area can [the CVC] help you with?" With 37.12% of our observations, startups most often ask for support in establishing commercial connections to the CVC's parent corporation. As the true motives behind these requests, startups specify in the subsequent open question "to get closer to potential clients", "to achieve new partnerships around the world" and "to get commercial connections to pilot the product".[4] Results indicate startups' early focus on obtaining access to diverse information and a broad set of capabilities from the parent corporation at low costs. Our finding is in line with Baum et al. (2000) who highlight the value of alliances and information spillovers at the beginning of startups' lives.

Figure 2.1: *Demand for Non-Financial Resources*



Second, startups demand CVC's support in fundraising activities (24.69%). In the open question, startups underscore that they wish the CVC "to introduce some potential investor who fit with [the startup's] project", "to help by connecting [the startup] to credible VCs with specialized

[4] Similar answers were given over 100 times.

experience", or "to find and endorse the company to interested angel investors". One startup even explicitly states needing "help with contacts for our next funding round and orientation on how to not fuck it up". These answers highlight the central role of the CVC's network in generating and credibly conveying soft information to potential investors, making the CVC perform similar functions as traditional financial institutions (Levine 2005).

Figure 2.1 also reveals the essential role of marketing activities for startups (22.96%). In the open question, startups clearly state their need for "better contacts to retail clients", "press connections both print and TV" and "marketing strategies or ideas to make people get to know [the startup] and start [its product]". In line with Homburg et al. (2014) and Anderson et al. (2018), we find the support in advertising and marketing activities to appear highly relevant to early-stage startups. Results are also consistent with the role of the CVC and its parent corporation in linking their own and startups' market activities in a strategic way (Riyanto and Schwienbacher 2006). Other non-financial resources, e.g., legal advice, support with human resource processes, or with regard to product development, appear to be less relevant to high-tech startups. *Figure 2.1* indicates that less than five percent of the answers relate to the support in any of these areas.

Figure 2.2 compares startups' demand for non-financial resources with higher and lower slack financial resources. Because startups can partially substitute financial and non-financial resources, we expect differences in startups' demand for non-financial resources. The figure reveals a lower demand for commercial connections and for marketing support by financially constrained startups. At the same time, financially constrained startups more heavily rely on the CVC's network with other investors to improve their fundraising activities.

Figure 2.3 displays the startups' demand conditioned on the startups' business model. Startups engaged in B2B seek commercial connections (and contacts to other startups) significantly more often than those engaged in B2C. For B2C startups, the CVC's investor network and its marketing resources appear more important.

Figure 2.2: *Demand for Non-Financial Resources by Financial Situation*

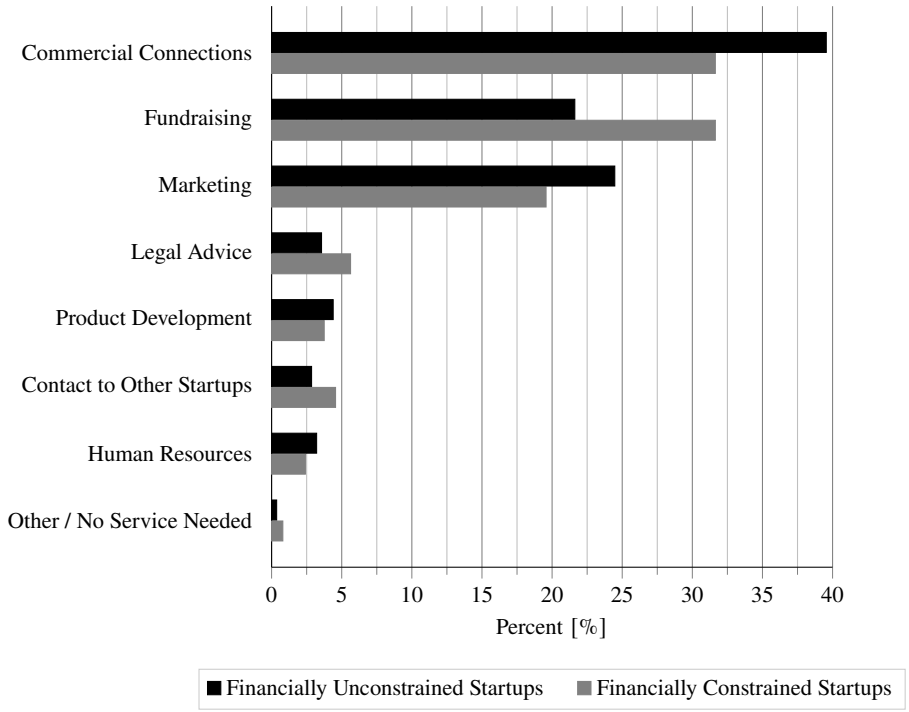


Figure 2.3: *Demand for Non-Financial Resources by Business Model*

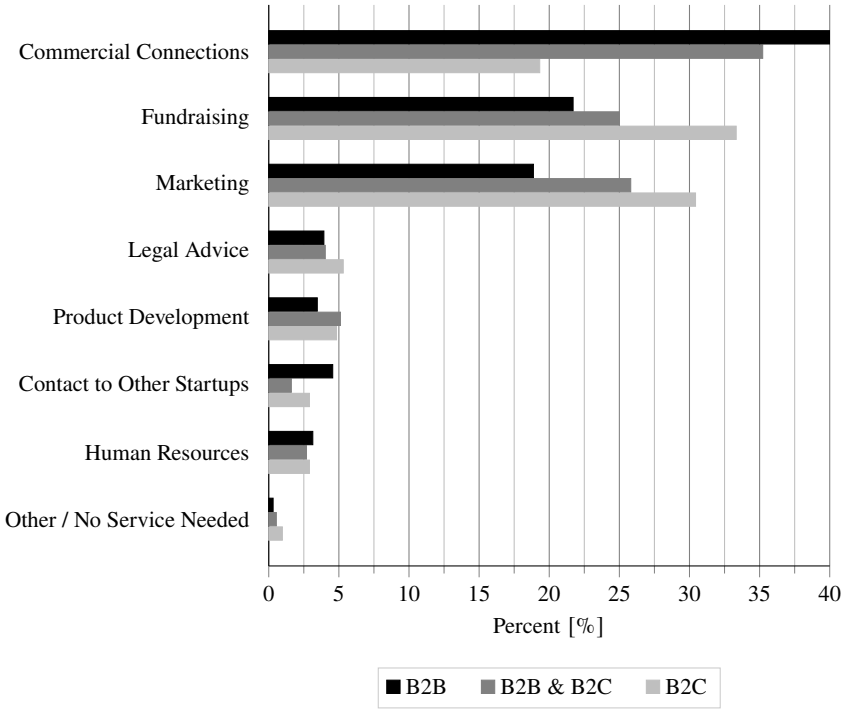
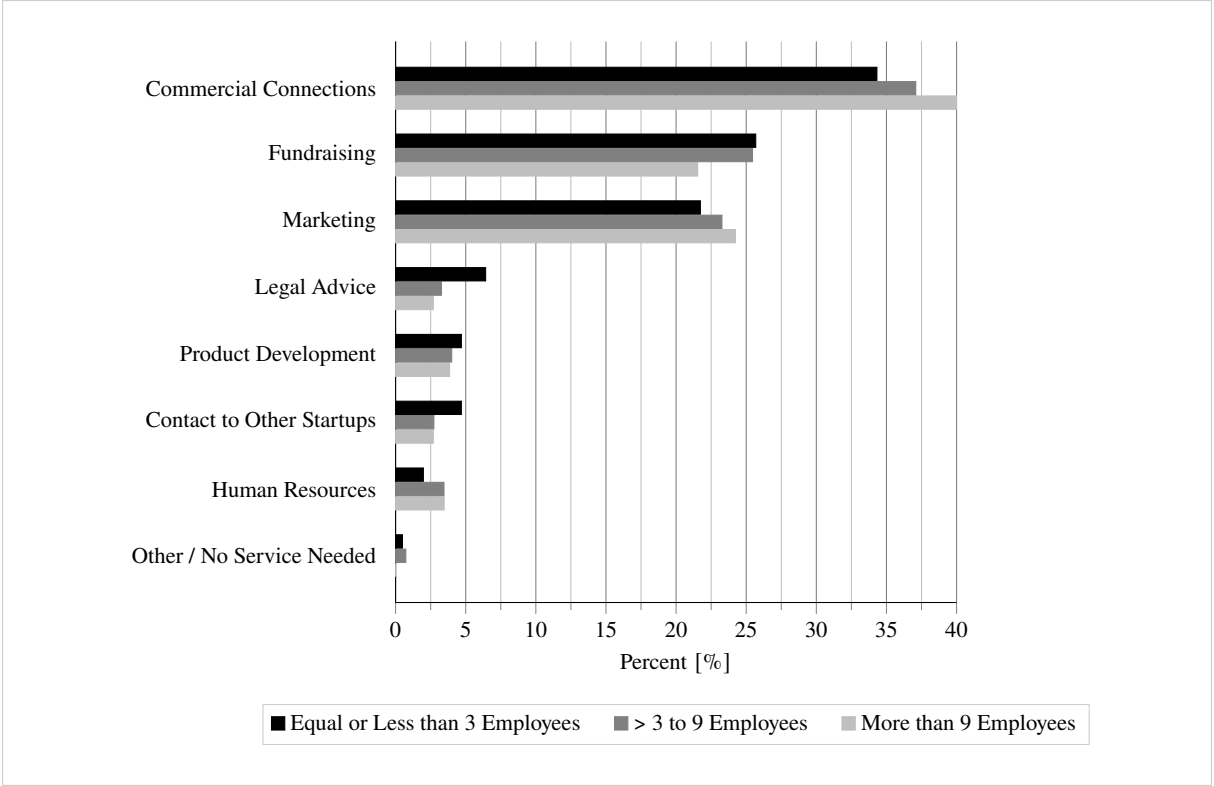


Figure 2.4 displays the startups' demand for non-financial resources conditioned on the startups' size, measured by startups' full-time employees. It reveals the high demand for commercial connections from startups of all sizes. Nevertheless, there is a slightly stronger demand for commercial connections and marketing support by larger startups with more than nine employees whereas smaller startups more often demand help in their fundraising activities. As especially smaller startups are more opaque and face higher information asymmetries vis-à-vis external investors, results are consistent with the CVC's function to overcome these obstacles and ensure startups' access to other investors.

Figure 2.4: *Demand for Non-Financial Resources by Size*



2.4.2 Multivariate Regression

Table 2.2 underscores our descriptive analysis from Section 2.4.1. In the multivariate regression, we find statistically significant differences in the requests for commercial connections and fundraising between financially unconstrained and constrained startups. While the former group requests significantly more help in commercial connections, the latter significantly more often asks for non-financial help in fundraising. *Table 2.2* also reveals the tendency of financially unconstrained startups to request assistance in marketing.

Our results are consistent with the essential function of conveying hard and soft information within the investors' network through the CVC. Furthermore, they are consistent with a higher focus of the managerial team on fundraising activities by financially constrained startups. Although financial constraints can foster the efficient use of resources (Hvide and Møen 2010), our results highlight potential downsides. As managerial attention and the demand for non-financial resources shift towards external fundraising, financial constraints might prevent startups from acquiring non-financial resources in client and growth-related areas.

Table 2.2: *Effects on the Demand of the Main Non-Financial Resources*

Dependent Variable:	(1) Commercial Connections	(2) Fundraising	(3) Marketing
FinanciallyConstrained	**-0.247*** **	**0.333*** **	-0.122
	(0.0042)	**(0.0002)**	(0.193)
B2C	**-0.780*** **	**0.370*** **	**0.405*** **
	(0.000)	**(0.0009)**	**(0.0004)**
B2B&B2C	**-0.251*** **	0.137	**0.267*** **
	(0.0037)	(0.147)	**(0.0049)**
MediumSize	-0.0054	0.0651	0.0468
	(0.952)	(0.494)	(0.630)
LargeSize	0.156	-0.0240	0.00490
	(0.178)	(0.848)	(0.969)
Constant	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Observations	1,215	1,215	1,215
Chi^2	92.91	64.06	62.54
Pseudo R^2	0.0580	0.0472	0.0478

*This table displays the effect of financial constraints on the demand of the main non-financial resources. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on period level.*

Furthermore, *Table 2.2* shows that B2C startups significantly more often seek help in fundraising and marketing, whereas B2B startups request assistance in commercial connections. This enables the latter group to form alliances more easily (Baum et al. 2000; Patzelt et al. 2008). Results are consistent with a stronger focus by B2B startups on their networks, whereas B2C startups use the CVC's non-financial resources to foster their relationship to retail clients. In line with the descriptive evidence from *Figure 2.4*, we do not find significant differences in the requests for non-financial resources when splitting by startup size. However, regression results again indicate the slight tendency of larger startups to ask for help in commercial connections compared to smaller ones.

Table 2.3: *Likelihood Ratio Tests*

	Chi^2	Degrees of Freedom	P-value
Commercial Connections			
Financial Constraints	**8.2449*** **	1	**0.0041**
Business Model	**48.3368*** **	2	**<0.0001**
Size	2.6221	2	0.2695
Fundraising			
Financial Constraints	**14.1653*** **	1	**0.0002**
Business Model	**11.0066*** **	2	**0.0041**
Size	0.85983	2	0.6506
Marketing			
Financial Constraints	1.70388	1	0.1918
Business Model	**15.5416*** **	2	**0.0004**
Size	0.29214	2	0.8641

*This table displays the results of likelihood ratio tests for the link between different startup characteristics and the demand for non-financial resources. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.*

Table 2.3 displays the results from likelihood ratio tests using the main three non-financial resources. It emphasizes the significance of financial constraints and the startups' business model regarding their request for non-financial resources. On the contrary, startup size does not seem to be important regarding startups' requests.

2.5 Discussion and Conclusion

Startups are of crucial importance for innovation and economic growth. In order to properly fulfill this role, they rely on external help in financial as well as non-financial resources, especially in their early development stage. This study adds to the literature on early-stage startups by using proprietary data of startups' hard-to-measure resource demand. We provide descriptive evidence on the non-financial resources which startups seek from their CVC and find significant differences depending on startup-specific characteristics, such as the startups' financial situation, their business model, and size. This underscores the needs of early-stage startups in non-financial aspects. We complement prior studies by highlighting descriptively the importance of non-financial resources for startup performance.

A Appendices

Tables

Table A.2.1: *Demand for Non-Financial Resources by Financial Situation*

	(1) All Startups (N=1,215)	(2) Financially Unconstrained (N=842)	(3) Financially Constrained (N=373)	(2) → (3) Difference
Commercial Connections	37.12%	39.55%	31.64%	**-7.91pp***
Fundraising	24.69%	21.62%	31.64%	**10.02pp***
Marketing	22.96%	24.47%	19.57%	**-4.90pp***
Legal Advice	4.20%	3.56%	5.63%	**2.07pp***
Product Development	4.20%	4.39%	3.75%	-0.64pp
Contact to Other Startups	3.37%	2.85%	4.56%	1.71pp
Human Resources	2.96%	3.21%	2.41%	0.80pp
Others / No Service Needed	0.49%	0.36%	0.80%	0.42pp

*This table displays startups' demand for non-financial resources, split by their financial situation. * indicates significance at the 10% level.*

Table A.2.2: *Demand for Non-Financial Resources by Business Model*

	(1) B2B (N=636)	(2) B2B & B2C (N=372)	(3) B2C (N=207)	(1) → (2) Difference	(2) → (3) Difference	(1) → (3) Difference
Commercial Connections	44.03%	35.22%	19.32%	**-8.81pp***	**-15.89pp***	**-24.70pp***
Fundraising	21.70%	25.00%	33.33%	3.30pp	**8.33pp***	**11.64pp***
Marketing	18.87%	25.81%	30.43%	**6.94pp***	4.63pp	**11.57pp***
Legal Advice	3.93%	4.03%	5.31%	0.10pp	1.28pp	1.38pp
Product Development	3.46%	5.11%	4.83%	1.65pp	-0.28pp	1.37pp
Contact to Other Startups	4.56%	1.61%	2.90%	**-2.95pp***	1.29pp	-1.66pp
Human Resources	3.14%	2.69%	2.90%	-0.46pp	0.21pp	-0.25pp
Others / No Service Needed	0.31%	0.54%	0.97%	0.22pp	0.43pp	0.65pp

*This table displays startups' demand for non-financial resources, split by their type of business. * indicates significance at the 10% level.*

Table A.2.3: *Demand for Non-Financial Resources by Size*

	(1) 1 to 3 Empl. (N=405)	(2) > 3 to 9 Empl. (N=550)	(3) > 9 Empl. (N=260)	(1) → (2) Difference	(2) → (3) Difference	(1) → (3) Difference
Commercial Connections	34.32%	37.09%	41.54%	2.94pp	4.45pp	**7.39pp***
Fundraising	25.68%	25.45%	21.54%	-0.10pp	-3.92pp	-4.01pp
Marketing	21.73%	23.27%	24.23%	1.65pp	0.96pp	2.61pp
Legal Advice	6.42%	3.27%	2.69%	**-3.12pp***	-0.58pp	**-3.70pp***
Product Development	4.69%	4.00%	3.85%	-0.67pp	-0.15pp	-0.82pp
Contact to Other Startups	4.69%	2.73%	2.69%	-1.94pp	-0.03pp	-1.98pp
Human Resources	1.98%	3.45%	3.46%	1.49pp	0.01pp	1.50pp
Others / No Service Needed	0.49%	0.73%	0.00%	-0.26pp	-0.73pp	-0.98pp

*This table displays startups' demand for non-financial resources, split by their number of employees. * indicates significance at the 10% level.*

Variable Definitions

Table A.2.4: *Variable Definitions*

All variables are based on information retrieved from the CVC's internal management system. Some information is created by the CVC (i.e., the internal liquidity rating), some information is provided by the startups to the CVC (i.e., information on the startups' business model, financial situation, and headcount).

Explanatory and Dependent Variables

Variable	*Definition*
B2B&B2C	Dummy variable for startups' business model. It takes the value of one if a startup is active in the B2B and B2C sector, and zero otherwise.
B2C	Dummy variable for startups' business model. It takes the value of one if a startup is active in the B2C sector only, and zero otherwise.
FinanciallyConstrained	Dummy variable for financially constrained startups. It takes the value of one if a startup is financially constrained based on a low rating in the CVC's internal liquidity rating (see variable $LiquidityRating$). The variable characterizes startups as financially constrained with a liquidity rating at and below the 25% quantile per country. It takes the value of zero otherwise.
MediumSize	Dummy variable for startup size. It takes the value of one if a startup employs between more than 3 and 9 persons, and 0 otherwise.
LargeSize	Dummy variable for startup size. It takes the value of one if a startup employs more than 9 persons, and 0 otherwise.
LiquidityRating	Variable for measuring startups' financial situation. It is measured on a scale from 0 to 10. Higher values refer to a longer time horizon with regard to startups' available cash considering the current cash burn rate whereas low values refer to a weak record in this criterion [10 = enough cash for 18 months, considering the cash burn rate; 0 = cash is not sufficient for six months].

Chapter 3
Financial Constraints, Entrepreneurial Challenges, and the Effects on Performance

Abstract Startups face financial and non-financial challenges in their early life, which promote startup failure if they are insufficiently addressed. A restricted access to financial resources represents one of the main difficulties that startups struggle with in an early development stage. In this study, I uncover the challenges which venture-capital-supported startups strive to work on, and how they differ conditional on the startups' current financial situation. I also reveal the interaction effect of a different access to financial resources and several startup challenges on firm performance. Using a unique proprietary dataset with 145 startups and 587 observations by an international corporate venture capitalist (CVC), I find startups mainly tackling issues related to their products/operations, and clients/users. Financially constrained startups significantly more often aim for increasing revenues than financially unconstrained startups. Overall, targeting the development of their human resources or products/operations helps startups to overcome their financial constraints and to induce positive firm performance. Findings suggest that focusing on the latter two business areas is crucial for startup development. The results also indicate that CVCs may indirectly affect what startups strive for by (not) relieving their financial constraints.

In a startup, there have to be challenges. Otherwise, someone else would have done it already.
– Payal Kadakia, U.S. business woman

Acknowledgments This chapter is adapted from my working paper "Financial Constraints, Entrepreneurial Challenges, and the Effects on Performance". I would like to thank Robin Huniar, Benedikte Sandbaek, and Alina Schmidt for their excellent research assistance. Moreover, I gratefully thank Markus Merz, Werner Neus, Jan Riepe, Theresa Veer, and the participants of the VHB annual meeting 2020 and the internal research seminar for their valuable comments and insights.

3.1 Introduction

Startups face many challenges in their early life. Issues to address are, e.g., the acquisition of customers, entry to distribution channels, access to finances, increase of marketing activities, search for personnel, or the development of firm structure and products (e.g., Giardino et al. 2015). While, in former times, high-technology startups could concentrate solely on the improvement of their products and services to become successful, due to increased competition, they lately have to take care of all mentioned business areas already in an early development stage (Chorev and Anderson 2006). Still, working efficiently on all of these topics simultaneously is usually difficult for young firms due to capacity restrictions in terms of, e.g., time and human resources. Thus, it remains an open question which challenges startups actually perceive as the most important ones to address in the short run.

Venture capitalists (VCs) play an active role in many markets. They acquire minority stakes in startups and potentially provide them with both financial and non-financial resources (e.g., Da Rin et al. 2013; Manigart and Sapienza 2017). Nowadays, there is no doubt that lacking financial resources are one of the major issues limiting startup growth (e.g., Levine 2005; Beck and Demirgüç-Kunt 2006). Richard Harroch, U.S. venture capitalist, described the importance of finances for startup development in the early 2000s as follows: "It's almost always harder to raise capital than you thought it would be, and it always takes longer. So plan for that." Because young firms usually have inferior access to internal funds and formal sources of external finances, they are more prone to financial constraints and, consequently, more often have to miss out on profitable investment opportunities (Bottazzi et al. 2014).

Due to limited data access, we still know little about the impact of startups' differing access to financial resources on their priorities regarding the challenges tackled. We also lack knowledge about the relationship of different entrepreneurial challenges, startups' financial situation, and firm performance. In this study, I use proprietary data from one corporate venture capitalist (CVC) about 145 CVC-supported startups in 11 countries in Europe and Latin America. We know that high-technology startups immediately react to the given internal and external situation (e.g., Giardino et al. 2014). Reviewing responses to an open question within individual startup interviews enables me to relate startups' characteristics, their internal decisions, and their short-term performance. Thereby, I extend the current knowledge on entrepreneurial behavior. Additionally, I give first hints towards the business areas which financially constrained and financially unconstrained startups might approach in an early development stage to operate successfully in the short run. I also provide first suggestions on how CVCs might implicitly affect what startups strive for by providing their investees with more or less financial resources.

First, I provide evidence that early-stage startups mainly strive to work on their products and operations in the short run. Approximately every fourth startup response is related to this topic, underscoring that startups identify related issues as the most life-threatening in an early

development stage. Answers include, e.g., the launch of new products, improvement of existing features, or optimization of workflows. On second place, startups mention client-related topics to be worked on, e.g., acquiring new clients or deepening the relationship to existing ones.

Splitting the sample reveals that financially constrained startups (compared to financially unconstrained ones) do neither seem to focus significantly more often on the search for external financial support nor to look significantly more often for non-financial partnerships as substitutional element. Instead, financially constrained startups seem to identify low revenues as the main challenge to tackle in the short run. This might be explained by the startups' assumption that higher revenues are the easiest way to improve their internal financial situation which, in turn, may foster future firm development. At the same time, startups might expect that higher internal funds increase their external reputation and, thus, ease the access to additional financial support from outside the firm.

From the CVC's perspective, supplying startups with too many resources may show a harmful effect on their performance due to lower incentives for the investees' management (Hvide and Møen 2010) and potential misuse of the given resources (Bienz and Hirsch 2012). As CVCs could easily relieve startups' ex ante resource constraints, the finding of supported startups mainly striving for increased revenues might also be explained by the idea that CVCs, on purpose, keep certain startups financially restricted. Thereby, CVCs implicitly induce these startups to focus on their revenues and, in turn, motivate them to improve their internal financial base without providing additional external financial resources.

In the last part of this paper, I explore the interaction of startups' financial situation and their challenges tackled, and link it to firm performance. I find that working on human resources or products/operations enables startups to offset the negative effect of financial constraints on performance, whereas adressing other challenges does not. This finding might be led back to the idea that early-stage startups from the high-technology sector first have to focus on their two main business assets, i.e., products/operations and human resources. The regression results match startup responses from preceding sections of this paper where startups most often name products/operations as the topic which they strive to work on in the short run.

Further analyzing the tackling of challenges related to products/operations, the regression results show stronger effects in later periods. This might be explained by the idea that very early-stage startups first need some time to determine the right way of products/operations-development which ultimately helps them to overcome the negative effects of financial constraints on performance. Additionally, I find that the positive effect of working on products/operations mostly arises from startups in financially less developed countries. Startups in these countries cannot get external financial and non-financial support as easily as in more developed countries which increases the sensitivity of startups' performance to their financial situation and the challenges they tackle. Results are robust when including only those startups into the analysis which respond to the survey in each observation period, and when adapting the measure for

startups' financial constraints so that it accounts for potential cultural differences in the CVC's rating of supported startups.

This study relates to different strands of the literature. The entrepreneurship literature states that understanding entrepreneurial behavior matters for the future development of this type of business and the development of the whole economy (e.g., Carter et al. 1996; Garmaise 2008; Aldrich and Ruef 2011). Helms (2003) underscores that studying startups should be of main interest not only for researchers but also public policymakers. This study seeks to extend the knowledge on startups' internal decisions by providing a sophisticated analysis of internal data regarding the dynamics and effects of different factors on startup performance.

Additionally, a restricted access to financial resources is one of the main limitations for positive firm development, and especially firm growth. This effect appears stronger in firms' early stage, leading to the observable high rate of startup failure in the first years of existence. I especially relate to Beck and Demirgüç-Kunt (2006) and Stucki (2014) who link the access to financial resources and performance for early-stage firms.

If sufficiently financially equipped, startups increase innovation, discover new markets, or lead to higher competitiveness in existing markets. Financial restrictions, on the contrary, interact with many other business areas, e.g., the contact to potential customers or the execution of research and development. Ultimately, financially constrained startups cannot contribute to the economic development of a specific sector and the whole market (Parker and van Praag 2006). Looking at the effects of tackling specific non-financial challenges, and relating them to startups' financial situation and their performance has not existed in the literature on entrepreneurship. Therefore, this study promotes the overall understanding of the entrepreneurial market and startups' decisions while also revealing topics for future research.

Alike for many studies, endogeneity remains a major concern within this study. There might be other factors that influence startups' decisions and their reactions to existing challenges, their financial situation, and performance. Exemplarily, this might be startups' product, i.e., being it hardware or software in the high-technology sector. To alleviate concerns on these omitted factors, I do not only compare the performance effects between financially constrained and financially unconstrained startups but also explore differences between startups with different characteristics within these two groups. Nevertheless, I openly acknowledge that the results of this study are only associations. Therefore, it still remains an open challenge for future research to use more advanced empirical identification strategies which allow causal interpretations. Additionally, the results rely on a sample where all startups are backed by the same corporate venture capitalist with similar CVC-specific contracts. This enables me to rule out biases that go back to CVC-specific factors but limits the external validity of this study. One might also argue that startup responses are biased as interviews are conducted by the supporting CVC's employees. These points of criticism call for future research and replications based on data, e.g., from uninvolved external institutions.

The paper proceeds as follows. Section 3.2 examines existing studies and displays their findings on financial and non-financial entrepreneurial challenges, and the relationship to performance. In this section, I also evolve the hypotheses for the subsequent analyses. Section 3.3 describes the sample, the methodology and the research design, before Section 3.4 displays the empirical results. Section 3.5 tests the robustness of the findings and Section 3.6 presents the limitations of this study. This paper terminates with a discussion and conclusion of the results in Section 3.7.

3.2 Literature Review and Hypotheses Development

The liability of newness (Stichcombe 1965) and liability of smallness (Baum 1996) pose many challenges to startups in their early life. Evers (2003) and Picken (2017) report some characteristics which early-stage startups need to professionalize in order to evolve successfully, e.g., the lack of business knowledge, missing experience in management, technology lags, non-existent relationships to customers and suppliers, and a lacking business strategy. In general, entrepreneurial challenges may stem from any internal business unit, external source or not yet addressed business area. Vesper (1990) concludes that successful startups have to unite business know-how, a product or service idea, personal contacts, physical resources, and customer orders. Startups which insufficiently tackle their challenges risk ineffective decisions, higher costs, personal overstress, and lower sales figures (Picken 2017). In turn, these aspects lead to lower performance, hinder positive startup development, and may end in startup failure.

The access to financial resources constitutes a crucial factor influencing firm performance. If merely existing, financial constraints pose a major restriction for startup growth (e.g., Levine 2005; Beck and Demirgüç-Kunt 2006). Stucki (2014) shows for a ten-year sample of Swiss startups that most startups struggle at some point with a restricted access to financial resources. Financial constraints appear to be very restricting in the first years of a firm's existence. Startups usually have inferior access to internal funds and formal sources of external financing. Therefore, they often have to miss out on profitable investment opportunities (Bottazzi et al. 2014). Oliveira and Fortunato (2006) provide evidence on small and medium-sized Portuguese firms whose growth rates are strongly negatively affected by a restricted access to financial resources. According to Becchetti and Trovato (2002), growth rates appear to be twice as high for small and medium-sized firms which have access to external financial resources. Bottazzi et al. (2014) confirm this relationship, showing that financially constrained startups face higher default risk leading to the implementation of less risky projects and, in turn, lower growth potential. Overall, the literature suggests that financial constraints exert a detrimental effect on firm performance which, in turn, might restrict the development of the whole economy (Levine et al. 2000; Levine 2005).

Many researchers stress that entrepreneurial actions are not based on very detailed business plans, but allow flexibility and prompt reactions to the current situation (e.g., Carter et al. 1996; Brinckmann et al. 2010; Mintzberg 2013). Giardino et al. (2014) and Paternoster et al. (2014) confirm the high reactiveness and flexibility in decision-making for early-stage startups in the software industry. Maintaining these characteristics appears to be important for startups also after a certain time of existence (Greening et al. 1996).

Due to limited data access, empirical evidence on startups' internal decisions is scarce. The previously described negative effects of untackled challenges and financial constraints on performance motivate for further empirical research in this field. Besides traditional financial institutions, venture capitalists (VCs) as strategic long-term investors may help startups to overcome their financial constraints. VCs acquire minority stakes in startups and provide them with both financial as well as non-financial resources. A privileged access to financial markets and a large amount of slack resources enable VCs to potentially relieve their investees' resource constraints (see Da Rin et al. 2013; Manigart and Sapienza 2017 for a comprehensive overview of the literature). To avoid misuse of the given support and create incentives for higher managerial effort, VCs are usually not willing to completely offset startups' restricted access to resources (e.g., Hvide and Møen 2010; Bienz and Hirsch 2012).[5] VCs may, e.g., leave some startups in an unprivileged financial state implying that startups do not receive the individually optimal amount of external support.

Given startups' decisions to be a prompt reaction to the prevailing situation, I hypothesize for early-stage startups supported by a corporate venture capitalist:

Hypothesis 1: Startups mostly address the challenge of a restricted access to financial resources.

Hypothesis 2: Financially constrained startups more often strive to work on their financial situation and non-financial partnerships than financially unconstrained startups.

Overall, the literature shows that not identifying and approaching existing challenges has a negative effect on performance. Due to limited data access, empirical research investigating the interaction of tackling different challenges conditioned on startups' financial situation and linking it to performance is non-existent in the entrepreneurial environment. Therefore, in the final part of this paper, I take a closer look on the link between the startups' financial situation, several challenges and performance. I hypothesize:

Hypothesis 3: Tackling existing challenges helps financially constrained startups to overcome the negative effects of financial constraints on performance.

[5] These doubts often result in staging contracts in venture capital financing (e.g., Hsu 2010). However, staging is not of interest for this study, as in the given surrounding, the CVC supports startups with a one-time fixed amount of financial resources.

3.3 Data and Research Design

3.3.1 Data and Sample

In this study, I rely on unique proprietary data of new ventures, extracted from the internal Management Information System from one corporate venture capitalist (CVC) within the information and communication technology sector. The CVC is a legally separate subsidiary of a globally acting European corporation which is listed in the EURO STOXX 50 Index. Sample startups are in their early development stage and engaged in the high-technology sector. They are all supported by the same corporate venture capitalist with similar contracts, including a one-time fixed amount of financial resources.

Information extracted from the CVC's management system is available for the years 2014 to 2016 and updated four times in the first year and three times per year thereafter (i.e., the time frame consists of 10 periods). The dataset contains static startup characteristics, e.g., the startups' location and product classification, as well as panel information on the startups' current business situation, e.g., the startups' available cash, challenges they strive to tackle in the short run, and the number of employees. Information is given by the startups themselves within regularly conducted interviews. I complement the data on the startups' characteristics with internal ratings created by the supporting CVC's management team. The CVC frequently evaluates startups' current situation regarding eight criteria: Commercial status, competitive strength, liquidity, market potential, product quality, revenue strength, team strength, and third party funding. These ratings serve the CVC as the major tool to manage its future support to associated startups. To ensure the comparability of these ratings between all countries, they are externally audited by a global team of the CVC's parent corporation.

Table 3.1: *Sample Selection*

	Startups	Observations
Initial Sample	**431**	**1,671**
Startup based in Venezuela	-38	-211
Missing CVC internal ratings	-28	-233
Missing headcount	-5	-10
Less than five periods interview timeframe	-215	-416
Observations from the sixth or later interviews	-0	-214
Final Sample	**145**	**587**

This table displays the sample selection process. The initial sample covers all observations retrieved from the CVC's internal management system in ten periods from 2014 to 2016.

The raw dataset consists of panel information from 431 European and Latin American startups with 1,671 observations (= responses). *Table 3.1* shows the selection criteria to create the final

dataset for the subsequent analysis. First, I exclude startups from Venezuela from the sample to avoid biased coefficients due to the unique political and economic situation in this country within the observation period. Additionally, I do not consider observations with a missing internal rating or no information on the number of employees. This decision is necessary due to the creation of the proxies. As about 20% of startups fail in the first year (Bureau of Labor Statistics 2018), I drop all observations from startups which do not respond in at least two years to the interview.[6] This decision implies an exclusion of all startups which do not respond to the interviews in a time frame of at least five periods as startups are asked to provide information once per quarter.[7] It allows economically and statistically meaningful interpretations for entrepreneurial research. At the same time, the proportion of startups responding at least six times to the CVC's interview strongly decreases. Therefore, I exclude the sixth and later observation from each startup from the analysis (but include these startups' first five observations).[8] In turn, the sample consists of startups of a similar development stage. Summing up, the final sample for the following analysis comprises 145 startups with 587 observations.

Table 3.2: *Local Distribution of Startups and Observations*

	Startups (N=145)		Observations (N=587)	
	Freq.	%	Freq.	%
Latin America	**94**	**64.82**	**397**	**67.63**
Argentina	23	15.86	102	17.38
Brazil	2	1.38	8	1.36
Chile	16	11.03	79	13.46
Colombia	19	13.1	89	15.16
Mexico	23	15.86	86	14.65
Peru	11	7.59	33	5.62
Europe	**51**	**35.18**	**190**	**2.37**
Czech Republic	2	1.38	10	1.7
Germany	6	4.14	24	4.09
Ireland	10	6.9	37	6.3
Spain	17	11.72	63	10.73
United Kingdom	16	11.03	56	9.54

This table displays the distribution of startups and observations. It is split by continents. Countries are sorted alphabetically within each group.

The CVC operates offices and supports startups in 12 countries in Europe and Latin America. These countries are Argentina, Brazil, Chile, Colombia, the Czech Republic, Germany, Ireland,

[6] Startups which have failed within the observation period are generally not included in the dataset. An additional argument for dropping startups which respond in less than two years is that these startups might have engaged in a relationship with the CVC at a very late point in time within the observation period. This might bias the results as the CVC might not have been able to adequately assess the quality of these very young startups through their internal ratings (which are used as control variables in the analyses).

[7] In the main analyses, few startups did not respond to the CVC's interview in each of the five observation periods. Section 3.5 contains a robustness test only including observations from startups which respond in each observation period.

[8] When including sixth or later observations, the coefficients tend in the same direction as the main results in Section 3.4. The effects only get slightly weaker.

Mexico, Peru, Spain, and the United Kingdom (and Venezuela which is not included in the sample due to major economic turbulences within the observation period from 2014 to 2016). *Table 3.2* displays the startups' local distribution including only those observations which are incorporated into the subsequent analysis. With 67.63% of all observations from Latin America, the CVC is heavily active in emerging countries. Most observations are provided by startups in Argentina, whereas startups in Brazil provide information the least often.

3.3.2 Variables

3.3.2.1 Entrepreneurial Challenges

To assess startups' challenges and their decisions on which challenges to tackle in the short run, I use answers to an open question from the CVC's internal interviews with each startup. Startups were asked to outline their "plans for the following four-month term, e.g., milestones, new product features, coming pilots or new clients". By evaluating the answers to this open question, I can in detail investigate what startups wish to approach in the upcoming period. As one can assume that startups in an early development stage decide and react immediately to the current surrounding they operate in (e.g., Giardino et al. 2014), I use this question as a proxy for the challenges startups perceive as the most pressing at the time of the interview. The evaluation of an open question allows a more sophisticated empirical analysis and interpretation of the results compared to only assessing prescribed answers from a multiple choice question. In order to group startup responses, I evolved a codebook based on related literature and the data from the interviews. The codebook is displayed in *Table A.3.4* of the Appendix.

I coded the startups' answers using the qualitative data analysis program ATLAS.ti (ATLAS.ti Scientific Software Development GmbH, version 8; Berlin, Germany) and combined some coding groups thereafter to allow an economically meaningful analysis. Ultimately, this step resulted in the following challenges which startups strive to tackle in the short run: Clients/users, distribution channel, finances, firm development, geographic scope, human resources, marketing/PR, non-financial partnerships, products/operations, research & development, revenues, and others (or the question was not answered). As part of the main analysis, Section 3.4.1 contains the relative shares of these challenges. I create a dummy variable for each entrepreneurial challenge. These binary variables take a value of one if startups express a particular challenge, and a value of zero otherwise.

It is important to keep in mind that, within one interview, startups could mention several topics they strive to work on in the upcoming period. This fact enables me to investigate startups' challenges and internal decisions in detail instead of focusing only on one main aspect. However, I cannot identify the most important of all named aspects. As I examine the relative importance of each of the different business areas, all startup citations are equally weighted.

This method assumes that the importance of any of the challenges named is, e.g., independent of the amount of challenges which a startup expresses within one interview.

3.3.2.2 Financial Constraints

Financial constraints represent a major restriction for startup growth. However, measuring financial constraints of early-stage startups is very difficult for researchers because direct measures are hard to observe from public data (Musso and Schiavo 2008). In this study, I rely on private information of a CVC's management team which supervises its investees on a regular basis. The CVC assesses the startups' available cash and current cash burn rate and periodically summarizes its evaluation in an internal liquidity rating. Consequently, this rating measures how much slack financial resources a startup holds. Ratings are ten-point scaled with higher ratings identifying better-equipped startups. A liquidity rating of 10 refers to startups with sufficient cash to cover 18 months at the current cash burn rate whereas a rating of 0 refers to startups without enough cash for six months at the current cash burn rate.

If startups show low levels of or limited access to financial resources, and consequently more often have to miss out on profitable investment opportunities (Bottazzi et al. 2014), I classify these startups as financially constrained. Using a binary proxy for categorizing financial constraints allows an easily understandable interpretation of the following empirical results. Furthermore, this procedure alleviates concerns on the non-linear distribution of the CVC's rating on the startups' financial situation. I categorize startups with an above median rating, i.e., a liquidity rating of six or above, as financially unconstrained. On the contrary, startups with a rating at or below the median, i.e., a liquidity rating of five or below, are classified as financially constrained. I use financially unconstrained startups as the reference group in the regression.

3.3.2.3 Startup Performance

As startups in an early development stage do not show a stable income yet, the use of revenues, sales or asset growth as performance measures appears usually not appropriate in the entrepreneurial environment (e.g., Beck et al. 2005). Therefore, I proxy startups' performance using the change in full-time equivalent employees in logarithmic terms. This is in line with studies by several researchers (e.g., Evans 1987; Nichter and Goldmark 2009).[9]

With respect to the data availability, using employee growth as the proxy for startup performance is highly suitable in this study. The CVC frequently reports the startups' number of employees in its internal Management Information System. Economically, using the change in employees in logarithmic terms enables me to explore startup growth (= performance) in

[9] Few startups do not report their headcount in all observation periods. I fill in missing values in the growth rates with the calculated average growth between two filled observation periods. To check for potentially biased regression coefficients, I reconduct the analyses within a robustness test in Section 3.5 including only those observations from startups which respond in each period.

percentage terms while, at the same time, accounting for decreasing marginal effects with an increasing number of employees.

3.3.2.4 Control Variables

Within the evaluation of the effects of financial constraints and other entrepreneurial challenges on startup performance, I include the other seven CVC internal ratings on the startups' individual situation as control variables into the analyses (besides the liquidity rating which is used for creating the proxy for startups' financial situation). As described in Section 3.3.1, the CVC frequently evaluates the startups' commercial status, competitive strength, market potential, product quality, revenue strength, team strength, and third party funding.

In order to precisely control for the startups' characteristics, I include the exact ratings (measured on an ordinal scale between 0 and 10) into the analyses. As opposed to when creating the proxy for financially constrained versus financially unconstrained startups, I do not group startups into high- and low-level ones with regard to each criterion. This decision enables me to capture startups' characteristics and their current situation in detail, which would otherwise lead to biased coefficients of the main variables.

3.3.3 Descriptive Statistics

Table 3.3 displays the summary statistics on observation level. The proxy for financial constraints classifies 57% of the observations as being from financially constrained startups. This coincides with a mean liquidity rating of 5.19 and a median liquidity rating of five (within the original ten-point scale).

Sample startups show an average headcount of 7.23 with a median of five persons. 75% of these startups report having eight or less employees, indicating that the sample primarily consists of early-stage startups. This highly right-skewed distribution justifies the usage of the natural logarithm in the proxy for startup performance.

The control variables are measured on a scale from zero to ten. *Table 3.3* displays considerably lower rating means for third party funding (4.49) and the startups' level of revenues (3.30) compared to the rating means of the other control variables. Additionally, observations of these two ratings are more widely spread which might be explained by the early development stage of the startups in the sample. *Table A.3.5* of the Appendix displays the definitions of all variables.

Table 3.3: *Descriptive Statistics*

	N	Mean	StdDev	p25	p50	p75
Main Variables						
FinanciallyConstrained	587	0.57	0.49	0.00	0.00	1.00
LiquidityRating	587	5.19	3.39	2.50	5.00	8.00
Headcount	587	7.23	8.74	3.00	5.00	8.00
StartupPerformance [= Δ ln(Headcount)]	416	0.79	0.73	0.39	0.79	1.20
Control Variables: CVC Internal Ratings						
CommercialStatus	587	6.08	2.52	4.00	7.00	8.00
CompetitiveStrength	587	6.45	2.00	5.00	7.00	8.00
MarketPotential	587	6.84	2.24	5.00	7.50	8.00
ProductQuality	587	6.73	2.40	5.00	7.00	8.00
RevenueStrength	587	3.30	2.94	0.00	2.50	5.00
TeamStrength	587	6.67	2.78	5.00	7.00	9.00
ThirdPartyFunding	587	4.49	3.39	2.00	4.00	7.00

This table displays the descriptive statistics including all variables of the empirical analysis. N describes the number of observations (for sample selection criteria, see Section 3.3.1). The sample decreases from 587 to 416 observations when analyzing startups' performance due to the impossibility of calculating growth rates, i.e., the change in the number of employees, from the last period onwards. Table A.3.5 of the Appendix displays the definitions of all variables.

Table 3.4 displays the absolute and relative amount of observations in which startups express a specific amount of different challenges which they want to tackle in the upcoming period. Startups most often mention between one and three different issues they aim to work on, which leads to a mean citation of 2.38 challenges per observation. Unreported evidence shows that the longer startups exist, the fewer different topics they name. In the first observation period, startups on average express 2.46 different challenges per interview. This rate almost constantly decreases to 2.15 in the fifth observation period, indicating that startups at a later development stage focus on some aspects instead of trying to address many issues at once. This behavior might enable them to more efficiently make use of their resources as concentrating on few business areas faster increases their knowledge in these areas. Furthermore, it might be explained by the idea that startups have already worked on a number of issues which decreases the amount of challenges they still have to deal with and allows focusing on some specific aspects.

Table 3.4: *Challenges Expressed in One Answer*

	Amount of Different Challenges									
	0	1	2	3	4	5	6	7	8	9
Freq. (N=587)	20	146	173	142	66	32	4	3	0	1
%	3.58	24.70	29.47	24.19	11.24	5.45	0.68	0.51	0.00	0.17

This table displays the absolute and relative number of observations in which startups express a certain amount of different challenges which they strive to tackle in the short run. The minimum number of challenges mentioned is zero, the maximum number is nine.

3.3.4 Research Design

3.3.4.1 Entrepreneurial Challenges

The empirical analysis in Section 3.4 starts with an examination of the startups' challenges. Opposed to many other researchers, the underlying dataset enables me to investigate startups' challenges in detail as startups explicitly express in their answer to an open question what they are going to work on in the upcoming period. I expect that *startups mostly address the challenge of a restricted access to financial resources* (*Hypothesis 1*). To test this hypothesis, I compare the relative frequencies of the startups' challenges mentioned.

3.3.4.2 The Effect of Financial Constraints

Subsequently, I examine the effect of financial constraints on the challenges which startups tackle. As financial constraints are a major restriction for startup performance (e.g., Beck and Demirgüç-Kunt 2006), I expect that *financially constrained startups more often strive to work on their financial situation and non-financial partnerships than financially unconstrained startups* (*Hypothesis 2*). For analyzing this relationship, I split the sample into financially constrained and financially unconstrained startups, and compare the relative frequencies of the startups' challenges using t-tests / Chi^2-tests.

3.3.4.3 The Effect on Startup Performance

In the final part of this paper, I uncover the moderating effect of startups' decisions due to existing challenges on the link between financial constraints and startup performance. As financial constraints represent a major restriction for startup growth but working on the most pressing issues positively influences startup performance, I expect that *tackling existing challenges helps financially constrained startups to overcome the negative effects of financial constraints on performance* (*Hypothesis 3*). For analyzing this relationship, I specify the following regression equation:

$$\begin{aligned}\Delta ln(Headcount)_{s,[t;t+1]} = \alpha &+ \beta_1 * FinanciallyConstrained_{s,t} \\ &+ \beta_2 * Entrepren.Challenge_{s,t} \\ &+ \beta_3 * FinanciallyConstrained_{s,t} * Entrepren.Challenge_{s,t} \\ &+ \beta_4 * CommercialStatus_{s,t} + \beta_5 * CompetitiveStrength_{s,t} \\ &+ \beta_6 * MarketPotential_{s,t} + \beta_7 * ProductQuality_{s,t} \\ &+ \beta_8 * RevenueStrength_{s,t} + \beta_9 * TeamStrength_{s,t} \\ &+ \beta_{10} * ThirdPartyFunding_{s,t} + \rho_k + \theta_t + \epsilon_{s,t}\end{aligned} \tag{3.1}$$

where $\Delta ln(Headcount)_{s,[t;t+1]}$ represents the proxy for the growth (= performance) of startup s and refers to the first difference in the natural logarithms of a startup's number of full-time equivalent employees between period t and $t+1$. $FinanciallyConstrained_{s,t}$ represents a dummy variable for financially constrained startups which takes the value of one if a startup s is regarded as financially constrained in period t. $Entrepren.Challenge_{s,t}$ represents one out of several dummy variables which take the value of one if a startup s expresses a particular of the following eight startup challenges in period t to be addressed in the short run: Clients/users, finances, geographic scope, human resources, marketing/PR, non-financial partnerships, products/operations, revenues.[10] The regression equation is separately estimated for each of these startup challenges, i.e., includes only one dummy variable at a time. β_3 captures the moderating effect of tackling a specific entrepreneurial challenge on the link between the startups' financial constraints and performance (*Hypothesis 3*).

To control for startups' unobserved characteristics which might drive their responses, seven control variables depicting the CVC's internal startup ratings are included into the regression: $CommercialStatus_{s,t}$, $CompetitiveStrength_{s,t}$, $MarketPotential_{s,t}$, $ProductQuality_{s,t}$, $RevenueStrength_{s,t}$, $TeamStrength_{s,t}$, and $ThirdPartyFunding_{s,t}$. They refer to the different ratings of startup s in period t.[11] I include fixed effects for countries k (ρ_k) and periods t (θ_t), and cluster robust standard errors at the startup level.

3.4 Empirical Results

3.4.1 Entrepreneurial Challenges

Insufficiently addressed challenges in startups' early life foster startup failure (e.g., Picken 2017). To be able to remove existing challenges, identifying and acknowledging them is the first step. As data access on the internal decisions of early-stage startups is usually limited, I first take a closer look on the challenges which startups strive to address in the following four-month term. *Hypothesis 1* suggests that *startups mostly address the challenge of a restricted access to financial resources*. In other words, I expect issues in this regard being the base for most startup plans in the short run. *Figure 3.1* displays the relative importance of specific challenges which startups aim to address in the following period in percentage terms. For the codebook of categories, I refer to *Table A.3.4* of the Appendix.

[10] The other challenges (distribution channel, firm development, research & development, others) were mentioned in less than five percent of the cases so that I do not include them in the regression analysis as they do not seem to matter much for startups in their early stage.

[11] The correlation matrix of all variables is displayed in *Table A.3.2* of the Appendix.

Figure 3.1: *Entrepreneurial Challenges*

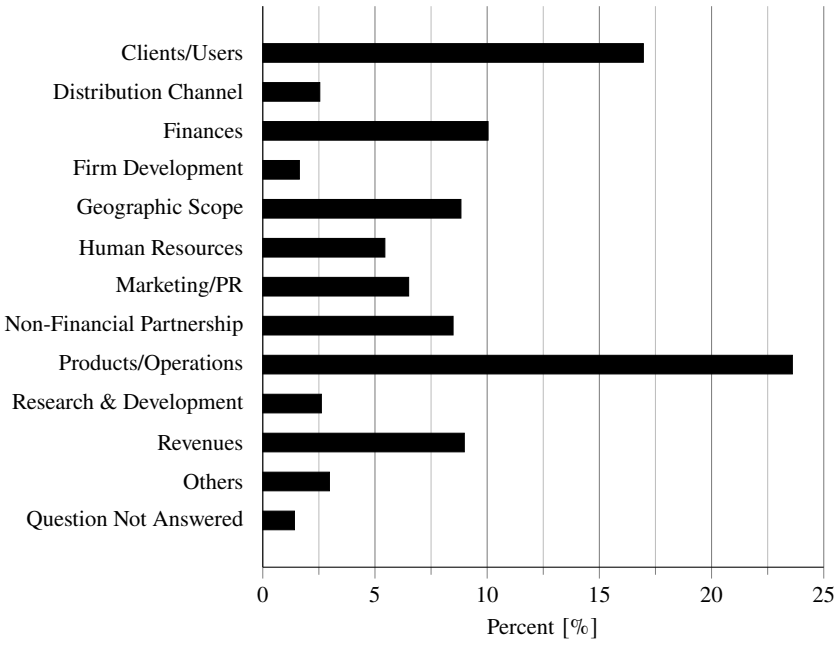


Figure 3.1 shows that with 23.60%, startups mainly wish to work on their products or operations.[12] Comparing this finding to existing studies which often focus on startups' financial situation (e.g., Beck and Demirgüç-Kunt 2006; Long 2019), this result seems quite surprising. Startups want, e.g., to create new high-technology products, to launch premium features of existing products, or to adapt their services in a way that it allows customers to buy more products on their platforms. These statements indicate that startups struggle with identifying the optimal product or operational design which would lead to higher production outcome, higher attention in public and, in turn, the highest sales possible. Unreported evidence shows that from those startups stating products/operations-related challenges to be addressed in the short run, 57.18% want to improve their existing products/operations whereas 38.30% strive to develop new ones and only 4.52% want to continue working with the same products/operations as before. The explanation for this finding is straight-forward. Startups usually still work on and elaborate their range of products/operations or wish to improve the alpha version of existing ones in order to boost the business. For startups in the high-technology sector, products/operations are unequivocally their main business asset. Thus, working on this topic increases their chances for survival and positive future firm development.

Second, startups indicate that they strive to tackle client/user-related issues in the upcoming period (16.96%). They want to acquire "new clients for [their] new platform", reach "more [...] companies buying [their] services" or want to "improve the [clients'] experience". However,

[12] All relative frequencies in the following empirical analysis are examined on "% of challenges"-level (not on "% of startups" or "% of observations"-level), unless stated otherwise.

sample startups clearly seem to focus on the acquisition of new clients or users (91.30%) whereas deepening the relationship to existing clients/users (8.70%) seems not to be of main interest. This finding might be led back to the fact that all sample startups are still in a very early development stage. Most of them are just about to start their business and have not yet been able to establish strong relationships to clients/users. At the same time, it is highly important for them to approach (potential) clients/users as startups need a sound customer base for future growth and the customers' needs must be carefully considered when developing and adapting products and operations.

Several challenges follow these two (products/operations and clients/users) with almost equal relative importance for startups. However, these challenges are all far less often mentioned in the CVC's interviews. One of them is the financial situation (10.04%) which, as unreported evidence shows, startups mainly wish to address by getting in touch with banks or other investors. Furthermore, startups want to increase their revenues (8.98%), their national or international geographic scope (8.83%) or get in touch with partners who assist them with non-financial resources in different ways (8.48%). Working on the internal marketing activities (6.50%) or human resources (5.44%) is also stated in more than five percent of the cases. All values are reported in *Table A.3.1* of the Appendix.

Summing up, *Hypothesis 1* suggests that startups mostly address the challenge of a restricted access to financial resources. This hypothesis cannot be supported as sample startups underscore the importance of further developing their products/operations, and their relationship to clients/users. One might argue that increasing revenues could also be seen as part of addressing financial challenges as higher revenues are the presumed easiest way to increase available financial resources. Following this thought, i.e., subsuming finance-related as well as revenue-related plans under "financial issues", this category aggregates a cumulative response rate of 18.96%. In this case, it would denote on second place in the order of relative importance of specific challenges for startups, but it still remains approximately 4.58% behind the startups' aim to further develop their products/operations.

Table 3.5 shows that startups persist working on the challenges once detected. I do neither find significant changes in the startups' challenges to be tackled from one period to the other nor between the first and last observation period. This finding is in line with the literature, underscoring that a certain degree of persistence seems to be crucial for startups' survival and future success (e.g., Markman et al. 2002; Wu et al. 2007). On first place remains working on products/operations at any point in time, which must be led back to the constitution of the sample (145 startups from the high-technology sector in an early development stage). With a constantly growing share from 7.46% to 9.64% of the challenges named, unsurprisingly, startups seem to turn their attention to increasing their geographic scope over time. Approximately three fourth of these startups consider an international expansion of their business while one fourth first wants to grow on national level. This is in line with Bailetti (2012) and Stayton and Mangematin

(2016), showing that startups should not only operate on regional or national level if they strive to grow in the near future.

Table 3.5: *Entrepreneurial Challenges by Observation Period*

	Period 1		Period 2		Period 3		Period 4		Period 5	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Clients/Users	72	19.89	46	17.69	45	16.07	37	14.02	40	16.06
Distribution Channel	5	1.38	11	4.23	9	3.21	5	1.89	6	2.41
Finances	44	12.15	24	9.23	24	8.57	23	8.71	27	10.84
Firm Development	5	1.38	4	1.54	5	1.79	4	1.52	5	2.01
Geographic Scope	27	7.46	22	8.46	26	9.29	26	9.85	24	9.64
Human Resources	14	3.87	16	6.15	16	5.71	18	6.82	13	5.22
Marketing/PR	19	5.25	19	7.31	22	7.86	18	6.82	14	5.62
Non-Financial Partnership	32	8.84	16	6.15	25	8.93	26	9.85	21	8.43
Products/Operations	87	24.03	62	23.85	60	21.43	67	25.38	58	23.29
Research & Development	12	3.31	5	1.92	7	2.50	7	2.65	6	2.41
Revenues	31	8.56	20	7.69	32	11.43	22	8.33	22	8.84
Others	8	2.21	11	4.23	6	2.14	8	3.03	9	3.61
Question Not Answered	6	1.66	4	1.54	3	1.07	3	1.14	4	1.61
Total	362	100.00	260	100.00	280	100.00	264	100.00	249	100.00

This table displays the absolute and relative shares of all challenges which startups strive to tackle in the different observation periods. Observations periods are sorted in ascending order from the first to the fifth period.

In all following analyses, I focus on the main eight challenges which individually account for more than five percent of the plans expressed. As displayed in *Figure 3.1*, these challenges relate to clients/users, finances, geographic scope, human resources, marketing/PR, non-financial partnerships, products/operations, and revenues.

3.4.2 Effects of Financial Constraints

Several researchers state that financial constraints are one of the major restrictions for startup performance (e.g., Beck and Demirgüç-Kunt 2006). Therefore, I now examine the impact of financial constraints on the startups' decision which challenges to tackle in the short run. Subsequently, I uncover the interaction effect of both components on startup performance. Knowing about the crucial role of a sound financial situation but also the possibility to partially substitute financial through external non-financial resources, *Hypothesis 2* suggests that *financially constrained startups more often strive to work on their financial situation and non-financial partnerships than financially unconstrained startups*.

Table 3.6 displays the relative shares of startup challenges tackled, split by startups' financial endowment. With 10.80%, financially constrained startups more often want to search for external financial support through banks and other investors than their financially unconstrained peers

(8.97%). However, this difference of 1.83pp is non-significant (p-value: 25.79%). Furthermore, financially constrained startups do not seek external non-financial partnerships more often than financially unconstrained ones. The relative share of financially constrained startups looking for non-financial partnerships is even lower (8.37% compared to 8.63%) indicating that these startups do not try to solve their financial issues by getting non-financial support from outside the startup. Summing up, I do not find support for *Hypothesis 2*.

Table 3.6: *Entrepreneurial Challenges by Financial Situation*

	(1) Financially Unconstrained	(2) Financially Constrained	(3) Difference	(4) P-value
Clients/Users	17.43%	16.63%	-0.80pp	69.19%
Finances	8.97%	10.80%	1.83pp	25.79%
Geographic Scope	9.31%	8.50%	-0.81pp	59.61%
Human Resources	6.26%	4.85%	-1.41pp	25.03%
Marketing/PR	6.43%	6.55%	0.12pp	92.59%
Non-Financial Partnership	8.63%	8.37%	-0.26pp	86.49%
Products/Operations	24.70%	22.82%	-1.88pp	40.96%
Revenues	7.45%	10.07%	**2.62pp***	**8.82%**

*This table displays the relative shares of challenges tackled by financially unconstrained and financially constrained startups, respectively. Columns (3) and (4) depict the results of a t-test with the null hypothesis that relative shares are equal for financially constrained and financially unconstrained startups. * indicates significance at the 10% level. This table is an extract of Table A.3.1 of the Appendix. Table A.3.5 of the Appendix displays the definitions of all variables.*

Interestingly, with a p-value of 8.82%, financially constrained startups significantly more often express striving to work on their revenues in the following months (10.07% compared to 7.45%). They wish to, e.g., "achieve the operating breakeven", "achieve 10,000 [USD] in recurrent revenue", "bill over 100,000 [USD]" or "achieve 80,000 [GBP] in sales". These statements exemplarily show that financially constrained startups seem to be aware of their difficult financial situation and strive to improve it by increasing their revenues and sales. Apparently, they perceive this way of financing as the easiest way of getting additional funds which might be true due to their non-existing financial records. An alternative explanation for this finding might be that external financial supporters (in this case, the CVC), on purpose, keep some startups financially constrained. This study shows that, thereby, the probability of startups focusing on their revenues increases which, in turn, improves their financial base and their chances for positive future firm development. This idea is supported by the literature showing that ex post measurable targets lead to higher performance (Lunenburg 2011).

However, a qualitative analysis of the given statements shows that most financially constrained startups do not provide concrete approaches on how they aim to achieve target values in revenues. In contrast, financially unconstrained start-ups more often explicitly express other plans on how to proceed at the same time (besides the revenue-related ones). They, e.g., want to "start a

business in [another country]", "add a major new feature to [their] site", or "close new deals with other partners". These explanations show their deeper reflection on existing challenges and what they might do in order to improve the situation. Furthermore, findings suggest a higher ex ante planning effort of financially unconstrained startups with regard to their future firm development. This is in line with Delmar and Shane (2003) who underline the importance of having an idea on how to proceed before taking actions in the development of startups. All values are reported in *Table A.3.1* of the Appendix.

3.4.3 Effects on Startup Performance

This section links startups' financial constraints and their internal decisions based on existing challenges to performance. Specifically, I investigate if working on existing challenges can offset the supposed negative effect of financial constraints on performance. *Hypothesis 3* suggests that *tackling existing challenges helps financially constrained startups to overcome the negative effects of financial constraints on performance*. Thus, the interaction term between financial constraints and the startups' challenges is expected to be positive. *Table 3.7* displays the estimation results of four OLS regressions. They include four of the main eight startup challenges which individually enter as dummy variables into the regression model. These issues are related to finances, human resources, non-financial partnerships and products/operations.[13]

Table 3.7 displays that the relationship of financial constraints and firm performance depends on the currently existing startups' challenges. The effect of financial constraints is significantly negative for startups which want to work on their human resources (column (3) of *Table 3.7*; -0.1413, p-value: 0.0443) or products/operations (column (5); -0.2565, p-value: 0.0137) in the short run. It appears negative but non-significant for startups with plans related to their financial situation (column (2)) and non-financial partnerships (column (4)). This finding might be explained by the idea that different challenges require different needs in terms of, e.g., financial resources or internal working time. Overall, the results support existing literature describing the negative effect of a restricted access to financial resources on firm performance (e.g., Levine 2005; Beck and Demirgüç-Kunt 2006).

The interaction term between financial constraints and the startups' challenges appears significantly positive for startups engaged in human resources and products/operations. With an interaction coefficient of 0.3058 (p-value: 0.0920), human resource-related plans overcompensate the negative main effect of startups' financial constraints on performance (-0.1413, p-value: 0.0443). The coefficient for the interaction term related to products/operations (0.2681, p-value: 0.0394) also equals the negative coefficient of startups' financial constraints (-0.2568, p-value: 0.0137) on performance. Relating this finding to the analyses within the Sections 3.4.1 and 3.4.2,

[13] Regression results comprising the other entrepreneurial challenges (clients/users, geographic scope, marketing/PR and revenues) are displayed in *Table A.3.3* of the Appendix. Results for these four startup challenges show non-significant coefficients and are, therefore, not of main interest for this study.

startups seem to be aware that they first need to work on their main business asset, i.e., their products/operations, to increase their chances of survival. In contrast, early-stage startups do not seem to value the tackling of challenges in human resources.

Table 3.7: *Link between Financial Constraints, Entrepreneurial Challenges, and Performance*

Dependent Variable: Δ ln(Headcount)	(1) Basic Model	(2) Finances	(3) Human Resources	(4) Non-Financial Partnership	(5) Products/ Operations
FinanciallyConstrained	-0.1001	-0.0789	**-0.1413****	-0.0394	**-0.2565****
	(0.1366)	(0.3072)	**(0.0443)**	(0.6131)	**(0.0137)**
Entrepren.Challenge		0.0517	**-0.2531***	0.1715	**-0.1952***
		(0.6283)	**(0.0699)**	(0.1361)	**(0.0720)**
FinanciallyConstrained × Entrepren.Challenge		-0.0850	**0.3058***	**-0.2936****	**0.2681****
		(0.5213)	**(0.0920)**	**(0.0404)**	**(0.0394)**
CommercialStatus	**0.0524****	**0.0514****	**0.0550****	**0.0554****	**0.0512****
	(0.0321)	**(0.0348)**	**(0.0217)**	**(0.0238)**	**(0.0314)**
CompetitiveStrength	**-0.0489****	**-0.0478****	**-0.0448***	**-0.0505****	**-0.0466***
	(0.0417)	**(0.0460)**	**(0.0571)**	**(0.0341)**	**(0.0534)**
MarketPotential	0.0092	0.0083	0.0069	0.0116	0.0077
	(0.7166)	(0.7458)	(0.7759)	(0.6419)	(0.7600)
ProductQuality	-0.0356	-0.0356	-0.0400	-0.0385	-0.0348
	(0.1854)	(0.1861)	(0.1402)	(0.1561)	(0.1816)
RevenueStrength	**0.0554*****	**0.0559*****	**0.0571*****	**0.0544*****	**0.0557*****
	(0.0003)	**(0.0003)**	**(0.0002)**	**(0.0003)**	**(0.0002)**
TeamStrength	**0.0395****	**0.0401****	**0.0394****	**0.0379****	**0.0386****
	(0.0280)	**(0.0273)**	**(0.0287)**	**(0.0356)**	**(0.0295)**
ThirdPartyFunding	**0.0607*****	**0.0606*****	**0.0606*****	**0.0602*****	**0.0620*****
	(<0.0001)	**(<0.0001)**	**(<0.0001)**	**(<0.0001)**	**(<0.0001)**
Constant	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Observations	416	416	416	416	416
R^2	0.4341	0.4347	0.4408	0.4405	0.4429
F-stat	11.14	10.02	10.60	11.26	10.53

*This table displays the results of different OLS regressions. Column (1) displays the results of the basic model using financial constraints and the control variables as independent variables. Columns (2) to (5) display the results for different challenges tackled which enter as independent variable and within the interaction into the regression analysis. Robust standard errors are clustered at the startup level. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on period level. Table A.3.5 of the Appendix displays the definitions of all variables.*

The coefficients for the specifications including plans in finances (column (2)) and non-financial partnerships (column (4)) are mostly non-significant. Of some interest might be the significant but changing sign of the interaction coefficient within the latter specification. The interaction term shows a significantly negative value for the regression including non-financial partnerships (-0.2936, p-value: 0.0404) as the challenge to be tackled in the short run. This finding points towards a worsening effect on the already negative effect of financial constraints on performance.

It might seem quite surprising as it suggests that financially constrained startups might better not invest much time in seeking non-financial external support. However, as the main effect of financial constraints appears non-significant in this specification (-0.0394, p-value: 0.6131), one has to interpret this interaction term with some caution.

The rating controls show mostly positive associations with startup performance. Higher ratings by the CVC reflect higher growth potential for startups. I find a significantly positive coefficient for the rating of the startups' team strength. It depicts that startups with a balanced founders' team which is "full-time dedicated and provides experienced entrepreneurial background"[14] grow more than startups without these characteristics. It is in line with the studies by Peña (2002) and Watson et al. (2003) who show a positive correlation of higher levels of education, work experience and entrepreneurs' motivation, and startup growth. Furthermore, it supports the findings by Gompers et al. (2020) who show that VCs identify the startups' management team as the most important business asset for IT startups. The coefficients of the startups' revenues, commercial situation and past third party funding are also significantly positive, which is in line with the literature showing that a better financial base helps startups to grow (e.g., Beck and Demirgüç-Kunt 2006). The significantly negative rating coefficient for startups' competitive strength can be explained by the measurement of this variable. It is defined by higher rating scores describing less competitors which, in turn, decreases the startups' pressure to rapidly increase their staff size and perform best in the short run. The coefficients confirm that the CVC reasonably rates associated startups with regard to their current situation.

Summing up, these results are mostly in line with *Hypothesis 3*. Specifically, I find support for *Hypothesis 3* if startups work on challenges related to their human resources or products/ operations. This finding supports the idea that these two areas compose the main business assets of early-stage startups in the high-technology sector. Without solving issues related to products/operations and human resources, startups in this sector cannot develop successfully in the near future. In contrast, working on challenges related to other than these two areas does not seem to help financially constrained startups to overcome a restrictive financial situation and to achieve positive firm performance.

3.4.4 Further Analyses

Finding significant differences in the effect on performance of financially constrained and unconstrained startups if they strive to work on their challenges in human resources or products/ operations, I now take a closer look on further characteristics of these startups.

[14] This citation depicts the CVC's definition of the characteristics which a startup must show to get a high team rating.

Table 3.8: *Link between Financial Constraints, Entrepreneurial Challenges, and Performance, Split by Observation Period*

Dependent Variable:	(1)	(2)	(3)	(4)
Δ ln(Headcount)	Period 1	Period 2	Period 3	Period 4
Panel A: Human Resources				
FinanciallyConstrained	0.0642	**-0.2273***	**-0.3126***	-0.0729
	(0.5297)	**(0.0937)**	**(0.0614)**	(0.6596)
HumanResources (≙ Entrepren.Challenge)	**-0.6449****	0.1429	-0.4146	**-0.5051****
	(0.0213)	(0.5494)	(0.1401)	**(0.0462)**
FinanciallyConstrained × HumanResources	**0.8540*****	-0.2885	0.2495	**0.7655***
	(0.0073)	(0.4355)	(0.4876)	**(0.0546)**
Rating Controls	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	138	95	99	84
R^2	0.4221	0.5542	0.5236	0.7064
Panel B: Products/Operations				
FinanciallyConstrained	0.0576	**-0.4147****	-0.3354	-0.3314
	(0.7533)	**(0.0467)**	(0.1672)	(0.1760)
Products/Operations (≙ Entrepren.Challenge)	-0.0626	-0.1570	-0.1117	**-0.3929***
	(0.7126)	(0.4185)	(0.6126)	**(0.0899)**
FinanciallyConstrained × Products/Operations	0.1099	0.1990	0.0387	**0.6003****
	(0.6151)	(0.5098)	(0.8818)	**(0.0494)**
Rating Controls	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	138	95	99	84
R^2	0.3958	0.5547	0.5105	0.7019

*This table displays the results of different OLS regressions for different observation periods. Panel A displays the results for human resource-related challenges tackled, Panel B for products/operations-related challenges tackled. Robust standard errors are clustered at the startup level. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on period level. Table A.3.5 of the Appendix displays the definitions of all variables.*

First, I split the full sample with 416 observations from different countries over time. Columns (1) to (4) of *Table 3.8* display the regression results for the different observation (= response) periods.[15] For most periods, I find a negative main coefficient of financial constraints on performance. However, it does not show to be significantly negative in any case. The interaction term does also not show consistently significant results. It is significantly positive for startups tackling challenges in human resources in the first and fourth period (0.8540, p-value: 0.0073 and 0.7655, p-value: 0.0546, respectively). Unreported evidence shows that these startups mainly strive to keep their personnel at a low level (or even fire an employee) in the first period in

[15] There is no regression for the fifth period as, due to sample selection and variable creation methods, growth cannot be calculated for the fifth period onwards.

contrast to hiring additional employees in the fourth period. The significant results suggest that this transition in startup decisions fosters startup performance. It might be explained by the high costs of staff in the information and communication technology sector. To cover these costs, some money must first be earned which is not available for startups in the first, however, in later periods.

Furthermore, the significant coefficient of the interaction term in the last period points towards the thought that focusing on products/operations has a higher effect on firm performance in later periods (0.6003, p-value: 0.0494). This might be explained by the idea that after having founded a startup, entrepreneurs first need to figure out the individually optimal way on how to proceed their business operations. Due to lacking ex ante information, the areas they work on might not be exactly the ones that ex post reveal to be optimal with regard to their performance. Approaching tasks related to human resources and products/operations in later periods of startups' early life, however, evolves a positive effect on performance, and turns the negative link between financial constraints and performance into positive. Still, as the main effect of financial constraints on performance is non-significant, the interpretation has to be taken with some caution.

Additionally, I investigate the link to countries' financial development on the relationships found. A well-developed financial sector alleviates financial frictions by providing ex ante information, allocating financial resources to the most profitable projects and monitoring the use of financial resources within the projects (Levine 2005). As small firms, and a fortiori startups, are informationally more opaque, they rely on the external provision of information and suffer most from the lack of screening and monitoring in the financial sector (e.g., Berger and Udell 2006; Deloof et al. 2019). On the contrary, a well-developed financial system enhances positive firm development and growth (e.g., Beck et al. 2006).

For measuring the current situation in the countries' financial sector, I employ a common measure for financial market depth assessing the activity of financial intermediaries (e.g., Levine et al. 2000; Čihák et al. 2013; Law and Singh 2014). The World Bank annually publishes the *Domestic credit to the private sector (% of GDP)*[16] ranging for the sample countries and years from 13.67% in Argentina in 2016 to 136.85% in the United Kingdom in 2014. To alleviate concerns regarding biased coefficients due to a non-linear functional form in this variable and large cross-sectional differences, I split the sample into two groups with financially more and less developed countries, respectively. The split is conducted at the highest relative differences between one country-year observation and the next, and approximately coincides with a median split of the sample. It characterizes Brazil, Chile, Germany, Ireland (2014), Spain, and the United Kingdom as financially more developed countries, whereas Argentina, Colombia, the Czech Republic, Ireland (2015, 2016), Mexico, and Peru are identified as financially less developed ones.

[16] World Bank Database: Variable code FS.AST.PRVT.GD.ZS.

Table 3.9: *Link between Financial Constraints, Entrepreneurial Challenges, and Performance, Split by Countries' Financial Development*

	(1)	(2)	(3)	(4)
	Human Resources		Products/Operations	
Dependent Variable:	Financially	Financially	Financially	Financially
Δ ln(Headcount)	More Developed	Less Developed	More Developed	Less Developed
FinanciallyConstrained	-0.1318	-0.0985	-0.2109	**-0.2696***
	(0.2200)	(0.3051)	(0.1390)	**(0.0785)**
Entrepren.Challenge	-0.1182	-0.3710	-0.0545	**-0.2908***
	(0.4943)	(0.1105)	(0.6826)	**(0.0818)**
FinanciallyConstrained × Entrepren.Challenge	0.2700	0.2598	0.2184	**0.3403***
	(0.1871)	(0.4203)	(0.1946)	**(0.0775)**
Rating Controls	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	189	227	189	227
R^2	0.5478	0.4441	0.5503	0.4484

*This table displays the results of different OLS regressions. Columns (1) and (2) display the results for human resource-related challenges tackled, split by countries' financial development. Columns (3) and (4) display the results for products/operations-related challenges tackled, split by countries' financial development. Domestic credit to the private sector (% of GDP) serves as the proxy for countries' financial development. Robust standard errors are clustered at the startup level. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on period level. Table A.3.5 of the Appendix displays the definitions of all variables.*

Table 3.9 displays the regression results for startups which aim to tackle challenges related to their human resources and products/operations, respectively, splitting the sample by countries' financial development. I find a negative main effect of financial constraints on startup performance in all countries. However, while this main coefficient shows to be significantly negative in the full-sample-regressions above (see Section 3.4.3), the effect only persists significantly negative for startups from financially less developed countries with products/operations-related plans (-0.2696, p-value: 0.0785). This finding might be explained by the idea that startups in financially less developed countries cannot get external support as easily as in more developed markets so that financial constraints more negatively affect the performance of startups in these countries.

As for the full sample, the interaction term shows positive signs for both challenges addressed and independent of countries' macroeconomic financial situation. However, it again only stays significantly positive for the specification including startups with products/operations-related plans in financially less developed countries (0.3403, p-value: 0.0775). Working on products/operations seems to make startups overcome the negative link between financial constraints and performance. This finding can be explained by the high importance of improved products/operations in financially less developed markets as startups in these markets characterize themselves through their own work and resources. Due to the lacking existence of external partners, they

cannot count on assistance in this regard in contrast to startups in more developed markets, which increases the positive effect of better-developed products/operations on performance.

3.5 Robustness Tests

To test the robustness of the findings above, I first only include those startups into the analysis which respond to the CVC's interviews in each of the five observation periods. In the final sample of the foregoing analysis, either some startups did not respond to the CVC's interviews in each of the five observation periods or the CVC did not periodically enter the given information into its internal Management Information System. This restriction allows me to rule out biases which stem from different response rates by the startups included in the original sample. However, it results in a decrease of the sample size from 416 to 232 observations, which makes a cautious interpretation of the results necessary.

Column (1) of *Table 3.10* shows the regression results for all startups in the restricted sample. As in the main analysis, regression coefficients are significant for startups striving to work on their human resources. When including products/operations-related challenges which startups will work on as a dummy variable into the regression model, the main effect of financial constraints as well as the interaction coefficient show to be significant, similar to the full-sample regression above. Looking at the size of the coefficient of financial constraints, in both panels, the negative main effect on performance appears to be of the same magnitude as in the original sample. The positive interaction coefficient increases for both challenges tackled. This finding confirms the idea that working on these two business assets seems to outperform the negative performance effect of startups' financial constraints.

When splitting the sample into more and less developed countries (columns (2) and (3) of *Table 3.10*), the effects arising from startups in financially less developed countries in the full sample seem to diminish in this restricted case. However, this finding must be interpreted with some caution. It might be led back to the small sample size in this part of the analyses. To evaluate the effects over time, columns (4) and (5) display the regression results for the first and last observation period. The main effect of financial constraints on firm performance and the interaction term tend in the same direction as in the analysis above. Especially in the specification with products/operations-related plans, the effects increase in size and significance in later periods.

Table 3.10: *Results Only Including Respondents of All Periods*

Dependent Variable: Δ ln(Headcount)	(1) Full Sample	(2) Financially More Developed	(3) Financially Less Developed	(4) Period 1	(5) Period 4
Panel A: Human Resources					
FinanciallyConstrained	**-0.1459***	**-0.2037***	0.0160	-0.1322	-0.2868
	(0.0972)	**(0.0584)**	(0.9061)	(0.4203)	(0.1038)
HumanResources (≙ Entrepren.Challenge)	**-0.2842***	-0.0654	**-0.5743*****	**-1.0333*****	**-0.7026****
	(0.0638)	(0.7392)	**(0.0059)**	**(<0.0001)**	**(0.0340)**
FinanciallyConstrained × HumanResources	**0.4278***	0.1823	0.6133	**1.4244*****	**0.9567***
	(0.0876)	(0.3817)	(0.2528)	**(0.0049)**	**(0.0640)**
Rating Controls	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Observations	232	112	120	58	58
R^2	0.5987	0.7649	0.5664	0.6751	0.7994
Panel B: Products/Operations					
FinanciallyConstrained	**-0.2556****	-0.1846	-0.2431	-0.1632	**-0.6514***
	(0.0496)	(0.1949)	(0.2556)	(0.5674)	**(0.0550)**
Products/Operations (≙ Entrepren.Challenge)	-0.1820	0.0278	-0.3508	-0.0300	-0.4381
	(0.1701)	(0.8461)	(0.1203)	(0.8906)	(0.1223)
FinanciallyConstrained × Products/Operations	**0.3143***	0.0299	**0.6093****	0.2270	**0.8222***
	(0.0562)	(0.8599)	**(0.0377)**	(0.5132)	**(0.0782)**
Rating Controls	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Observations	232	112	120	58	58
R^2	0.5985	0.7637	0.5735	0.6010	0.7937

*This table displays the results of different OLS regressions. Panel A includes human resource-related challenges tackled, Panel B includes products/operations-related challenges tackled. Column (1) displays the results for all startups of the restricted sample. Columns (2) and (3) display the results for sample splits by countries' financial development. Columns (4) and (5) display the results for sample splits by observation periods. Robust standard errors are clustered at the startup level. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on period level. Table A.3.5 of the Appendix displays the definitions of all variables.*

As a second robustness test, I reconduct the analyses with a different proxy for startups' financial constraints. I now classify startups with a liquidity rating at and below the median per country as financially constrained (56.56% of observations).[17] This alternative measurement accounts for systematic differences in the ratings between countries, which might occur due to cultural diversity, or other diverging surroundings. Still employing the median as the threshold is based on the idea to make the results of this robustness test comparable to the findings of the main analysis.

[17] In the main analysis, the threshold was set at the median liquidity rating throughout all observations, and not country wise.

Table 3.11: *Results Employing the Liquidity Rating per Country as Proxy for Financial Constraints*

Dependent Variable: Δ ln(Headcount)	(1) Full Sample	(2) Financially More Developed	(3) Financially Less Developed	(4) Period 1	(5) Period 4
Panel A: Human Resources					
FinanciallyConstrained	-0.0918	-0.0034	-0.1324	**0.1656***	-0.0486
	(0.2043)	(0.9744)	(0.1828)	**(0.0778)**	(0.7986)
HumanResources (≙ Entrepren.Challenge)	-0.1587	-0.1112	-0.2027	**-0.6082****	**-0.5073***
	(0.2270)	(0.4759)	(0.3931)	**(0.0251)**	**(0.0567)**
FinanciallyConstrained × HumanResources	0.1396	0.2831	-0.0221	**0.7638****	**0.7176***
	(0.4197)	(0.1741)	(0.9389)	**(0.0144)**	**(0.0825)**
Rating Controls	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Observations	416	189	227	138	84
R^2	0.4352	0.5465	0.4456	0.4330	0.7014
Panel B: Products/Operations					
FinanciallyConstrained	**-0.2200***	-0.0352	**-0.3691****	0.1591	**-0.5201***
	(0.0513)	(0.8035)	**(0.0245)**	(0.3691)	**(0.0847)**
Products/Operations (≙ Entrepren.Challenge)	-0.1765	-0.0032	**-0.3135***	-0.0356	**-0.5636****
	(0.1097)	(0.9798)	**(0.0737)**	(0.8340)	**(0.0319)**
FinanciallyConstrained × Products/Operations	**0.2366***	0.1435	**0.3447***	0.0962	**0.7993****
	(0.0660)	(0.3747)	**(0.0681)**	(0.6564)	**(0.0185)**
Rating Controls	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Observations	416	189	227	138	84
R^2	0.4397	0.5457	0.4548	0.4120	0.7163

*This table displays the results of different OLS regressions. Panel A includes human resource-related challenges tackled, Panel B includes products/operations-related challenges tackled. Column (1) displays the results for all startups of the restricted sample. Columns (2) and (3) display the results for sample splits by countries' financial development. Columns (4) and (5) display the results for sample splits by observation periods. Robust standard errors are clustered at the startup level. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on period level. Table A.3.5 of the Appendix displays the definitions of all variables.*

Table 3.11 displays the regression results. Again, I mostly find a negative main effect of financial constraints on firm performance. Within the distinction between more and less developed countries (columns (2) and (3)), I find similar results to the original regressions, i.e., non-significant coefficients for startups with human resource-related plans and significant results for products/operations-related challenges tackled, but only in financially less developed countries. When splitting the sample over time, interestingly, the main effect of financial constraints for startups engaging in human resources turns significantly positive for very early responses. On the contrary, for startups active in products/operations, the originally non-significant negative

main effect turns significantly negative, pointing towards an increasing effect in later periods. A significantly positive interaction effect is revealed in both later-stage regressions.

3.6 Possible Limitations and Implications for Future Research

This study empirically links the research areas of financial constraints, entrepreneurial challenges, and performance. It is of main importance in the research area of entrepreneurship as all these factors together influence startups' future development and their chances of survival. Due to limited data access, this combination has by now been under-investigated. This paper tries to fill the gap but as any empirical research project, it shows some limitations which call for further research in the near future. First, endogeneity remains a major concern. There might be other influencing factors that affect startups' decisions, their financial situation, or overall performance. Exemplarily, this might be startups' business model, e.g., whether they develop hardware or software products, or whether they follow a business-to-business or business-to-consumer approach. Additionally, startups may, e.g., have just recently invested a larger amount of money into R&D activities, which temporarily decreases their available liquid funds. However, this situation does not automatically decrease their chances of positive firm development in the near future. These effects are included in the error term within the regression analysis in this study. To alleviate concerns on other omitted factors, I compare the performance effects between financially constrained and financially unconstrained startups as well as the differences for startups showing different characteristics within these two groups.

Second, I openly acknowledge that the aforementioned results are only associations. The applied empirical methods do not allow causal interpretations. Therefore, it still remains an open challenge for future research to use more advanced empirical identification strategies and innovative experimental designs which enable researchers to reveal causal effects in this research context.

Furthermore, the results rely on a sample where all startups are backed by the same CVC with similar CVC-specific contracts. This enables me to rule out biases that go back to CVC-specific factors but limits the study's external validity. Analyzing startups' internal decisions is usually difficult due to limited data access. Using data from one international CVC enables me to analyze the relationship between different entrepreneurial challenges, financial constraints, and performance in detail. However, future research should be conducted with other databases to complement and confirm the results above.

Additionally, one might argue that startup responses could be biased due to the situation that interviews are conducted by the CVC's employees. The CVC is the financial and non-financial partner of all sample startups which might lead startups to answer in a way which is implicitly demanded by the CVC in order to improve their chances for future support.

Finally, the underlying dataset does not allow measuring the importance or difficulty of tackling different challenges neither within nor between answers, and neither in absolute nor in relative terms to each other. Even though one might argue that first-mentioned challenges in the startups' answers are of higher importance than later-mentioned issues, this idea is highly speculative. I also cannot observe the challenges solved in subsequent periods so that timing effects cannot be considered in this study.

Summing up, these points of criticism call for future research and replications to validate the findings of the analyses above. Specifically, other researchers could conduct similar analyses with data from other CVCs and external institutions which are not directly involved in a given CVC-startup-relationship. The advantage of this study of using private data by an international CVC to uncover the relationship between several highly relevant factors in the entrepreneurial environment can, however, not be denied. The findings above complement existing studies in entrepreneurship and provide a sound base for future research.

3.7 Discussion and Conclusion

This paper raises the question on the challenges which CVC-supported startups most urgently tackle in an early development stage. Furthermore, the study investigates whether startups' decisions differ between financially constrained and financially unconstrained firms. It additionally uncovers if tackling certain challenges helps startups to offset the effect on performance of a restricted access to financial resources and to achieve positive firm performance. Among many issues, financial constraints appear to be one of the main factors which most strongly impede positive startup development (e.g., Levine 2005; Beck and Demirgüç-Kunt 2006). Due to better access to the market and size advantages, CVCs are potentially able to relieve startups' resource constraints. However, to increase incentives for the management (Hvide and Møen 2010) and avoid misuse of the given resources (Bienz and Hirsch 2012), CVCs often do not unlimitedly do so. This study complements existing studies by linking startups' financial situation to other entrepreneurial challenges, and connecting both factors to performance.

The final sample of this paper which is extracted from a unique proprietary database from an international corporate venture capitalist consists of 587 observations by 145 early-stage startups from the high-technology sector. This study documents that startups most often strive to work on their products/operations and clients/users. Financially constrained startups do not significantly more often look for external financial assistance or non-financial partnerships. However, I find financial constraints leading to a significant increase in the startups' aim to boost their revenues. The underlying idea might be that the number of products sold might be the easiest way of getting additional funds. As the CVC could potentially relieve startups' resource constraints, this finding might also be explained by the idea that the CVC wants certain startups to remain

resource-constrained in their early development stage. Thereby, startups might first focus on ex post measurable figures to increase their internal financial base and their future chances to survive. Last, financially constrained startups seem to tackle their challenges in human resources and products/operations first to increment their performance. Working on these two areas enables startups to turn the negative link between financial constraints and performance into positive firm performance. Further analyses show that these effects mostly arise from startups in less developed countries and later-stage periods. Results show to be persistent when testing them in different robustness checks.

The results are of main importance for startups as well as corporate venture capitalists. First, startups must not underestimate the performance effect of approaching particular challenges in an early development stage. Even though it might take some time to identify the correct business areas to work on for optimal future firm development, especially for financially constrained startups, it is important to carefully think about their focus in the near future. A limited access to financial resources poses a major challenge to startups. However, startups might be able to turn the negative effect of financial constraints on performance into positive. Especially working on startups' products/operations and human resources might help early-stage startups to overcome their financial issues. From the CVC's perspective, they may keep in mind that, as financial supporter, they may indirectly manipulate the decisions of startups. If the CVC wants startups to focus on revenue-related figures, they should keep them (to a certain degree) financially constrained. On the contrary, if the CVC wants startups to not only focus "on the pure numbers" but work on the development of their products/operations, results suggest to provide startups with a larger amount of financial resources.

A Appendices

Tables

Table A.3.1: *Entrepreneurial Challenges*

	(1)	(2)	(3)	(4)	(5)	(6)	(4) → (6)	
	All Startups		Financially Unconstrained		Financially Constrained		Difference	P-value
	Freq.	%	Freq.	%	Freq.	%	pp	%
Clients/Users	240	16.96	103	17.43	137	16.63	-0.80	69.19
Distribution Channel	36	2.54	15	2.54	21	2.55	0.01	99.02
Finances	142	10.04	53	8.97	89	10.80	1.83	25.79
Firm Development	23	1.63	9	1.52	14	1.70	0.18	79.61
Geographic Scope	125	8.83	55	9.31	70	8.50	-0.81	59.61
Human Resources	77	5.44	37	6.26	40	4.85	-1.41	25.03
Marketing/PR	92	6.50	38	6.43	54	6.55	0.12	92.59
Non-Financial Partnership	120	8.48	51	8.63	69	8.37	-0.26	86.49
Products/Operations	334	23.60	146	24.70	188	22.82	-1.88	40.96
Research & Development	37	2.61	13	2.20	24	2.91	0.71	40.74
Revenues	127	8.98	44	7.45	83	10.07	**2.62***	**8.82**
Others	42	2.97	17	2.88	25	3.03	0.15	86.34
Question Not Answered	20	1.41	10	1.69	10	1.21	-0.48	45.23
Total	1,415	100.00	591	100.00	824	100.00		

*This table displays the absolute and relative shares of all challenges which startups strive to tackle. In columns (1) and (2), the challenges named are depicted for all startups. In columns (3) to (6), the sample is split by startups' financial situation. Columns (7) and (8) depict the results of a t-test with the null hypothesis that relative shares are equal for financially constrained and financially unconstrained startups. * indicates significance at the 10% level. Table A.3.5 of the Appendix displays the definitions of all variables.*

Table A.3.2: *Correlation Matrix*

	Clients/Users	Distribution Channel	Finances	Firm Development	Geographic Scope	Human Resources	Marketing/PR	Non-Financial Partnership	Products/Operations	Research & Development	Revenues	Others	Question Not Answered	Rating: Commercial Status	Rating: Competitive Strength	Rating: Market Potential	Rating: Product Quality	Rating: Revenue Strength	Rating: Team Strength	Rating: Third Party Funding
Clients/Users	1																			
Distribution Chan.	-0.0393	1																		
Finances	-0.0328	0.0712	1																	
Firm Development	-0.0429	-0.0516	-0.0116	1																
Geographic Scope	-0.0940	0.1099	0.0171	-0.0407	1															
Human Resources	0.0669	0.1951	0.1105	-0.0265	0.0444	1														
Marketing/PR	0.0132	0.0265	0.0300	-0.0388	0.0734	0.0268	1													
Non-Fin. Partners.	-0.0177	0.0817	0.0392	-0.0153	0.0149	-0.0093	0.1301	1												
Products/Operations	-0.0459	-0.0212	0.0257	-0.0370	-0.0095	0.0222	0.0629	0.0573	1											
Research & Devel.	-0.0446	0.0214	-0.0483	0.0199	0.0021	-0.0800	0.0039	0.0771	0.0417	1										
Revenues	0.0006	0.0899	0.0413	-0.0208	0.0097	0.0164	-0.0331	0.0106	-0.0607	-0.0341	1									
Others	-0.0292	-0.0159	-0.0333	-0.0220	-0.0637	0.0096	0.0440	-0.0260	-0.0921	-0.0720	-0.0175	1								
Question Not Answ.	-0.1562	-0.0480	-0.1061	-0.0379	-0.0977	-0.0730	-0.0810	-0.0952	-0.2158	-0.0487	-0.0987	-0.0521	1							
Rating: Comm. Stat.	-0.0139	0.1058	-0.0144	0.0213	0.0905	0.0515	-0.1153	0.0028	-0.0168	-0.0515	0.0191	-0.0562	-0.0359	1						
Rating: Comp. Str.	0.0095	-0.0063	0.0394	0.0180	0.0333	0.0535	-0.0859	-0.0175	0.0455	-0.0623	-0.0009	0.0050	0.0280	0.5201	1					
Rating: Market Pot.	0.0123	0.0326	0.0351	0.0223	0.0205	0.0267	-0.0330	-0.0128	-0.0408	-0.0253	0.0099	0.0169	0.0575	0.5001	0.6965	1				
Rating: Prod. Qual.	-0.0349	0.0790	0.0259	0.0537	0.1129	0.0203	-0.0818	0.0048	-0.0113	-0.0499	0.0088	-0.0751	-0.0377	0.8038	0.5498	0.5405	1			
Rating: Revenue Str.	-0.0765	0.1151	-0.0234	0.0107	0.1505	0.0657	-0.0076	0.0321	0.0185	-0.1125	0.0256	-0.0296	-0.0097	0.6081	0.2912	0.2485	0.5566	1		
Rating: Team Str.	-0.0115	0.0471	0.0350	-0.0171	0.0335	0.0754	0.0091	0.0109	0.0172	-0.0424	-0.0246	-0.0694	0.0055	0.6810	0.5592	0.5821	0.6408	0.5050	1	
Rating: 3rd Part. Fun.	-0.0223	0.0577	0.0840	-0.0109	0.0986	0.0806	0.0834	0.0863	-0.0127	-0.0580	-0.0505	-0.1083	0.0174	0.4180	0.3316	0.3835	0.4334	0.4113	0.4815	1

This table displays the pairwise correlations between all variables and entrepreneurial challenges included in the analysis. Table A.3.4 of the Appendix displays the codebook of challenges. Table A.3.5 of the Appendix displays the definitions of all variables.

Table A.3.3: *Link between Financial Constraints, Entrepreneurial Challenges, and Performance*

Dependent Variable: Δ ln(Headcount)	(1) Clients/Users	(2) Geographic Scope	(3) Marketing/PR	(4) Revenues
FinanciallyConstrained	-0.0506	-0.0647	-0.0955	-0.0693
	(0.5609)	(0.3792)	(0.1946)	(0.3127)
Entrepren.Challenge	0.0651	0.1420	-0.0577	-0.0429
	(0.4422)	(0.2162)	(0.6489)	(0.7159)
FinanciallyConstrained × Entrepren.Challenge	-0.1119	-0.1730	-0.0075	-0.1041
	(0.3474)	(0.2450)	(0.9648)	(0.4684)
Commercial Status	**0.0520****	**0.0527****	**0.0506****	**0.0528****
	(0.0338)	**(0.0300)**	**(0.0403)**	**(0.0315)**
Competitive Strength	**-0.0509****	**-0.0484****	**-0.0509****	**-0.0453***
	(0.0375)	**(0.0456)**	**(0.0418)**	**(0.0609)**
Market Potential	0.0098	0.0087	0.0099	0.0085
	(0.7007)	(0.7283)	(0.6973)	(0.7419)
Product Quality	-0.0357	-0.0360	-0.0352	-0.0357
	(0.1862)	(0.1732)	(0.1927)	(0.1777)
Revenue Strength	**0.0560*****	**0.0553*****	**0.0559*****	**0.0548*****
	(0.0003)	**(0.0003)**	**(0.0003)**	**(0.0004)**
Team Strength	**0.0402****	**0.0400****	**0.0401****	**0.0387****
	(0.0277)	**(0.0275)**	**(0.0287)**	**(0.0324)**
Third Party Funding	**0.0606*****	**0.0606*****	**0.0617*****	**0.0611*****
	(<0.0001)	**(<0.0001)**	**(<0.0001)**	**(<0.0001)**
Constant	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	416	416	416	416
R^2	0.4355	0.4370	0.4350	0.4385
F-stat	10.4587	10.6150	9.9705	10.7419

*This table displays the results of different OLS regressions for different challenges tackled which enter as independent variable and within the interaction into the regression analysis. The challenges within this table are mentioned in more than five percent of the observations (see Table A.3.1) but do not show significant coefficients in the relevant variables for this study (in contrast to the non-financial resources included in Table 3.7). Robust standard errors are clustered at the startup level. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on period level. Table A.3.5 of the Appendix displays the definitions of all variables.*

Table A.3.4: *Codebook of Entrepreneurial Challenges*

Category	**Subcategory (Level 1)**	**Subcategory (Level 2)**	**Description**
FIND NEW PARTNER	Non-Financial Partner	Marketing	Seek non-financial partnership in marketing to achieve direct sales
		Public Relations	Seek non-financial partnership in public relations to improve startup's image
		R&D	Seek non-financial partnership in research and development to improve products/procedures
		Distribution Channel	Seek non-financial partnership to improve startup's distribution channel by fastening, e.g., the movement of goods and services
		Suppliers	Seek non-financial partnership with people/organization who/which supplies, e.g., goods or equipment
		External Employees, Freelancers	Seek non-financial partnership with self-employed persons who work for the startup
		Others	Seek non-financial partnership with people/organization which do not belong to one of the groups above
	Money/Financial Source [including new investment round]	Banks	Seek financial partnership with an institution which manages the customers' money, provides loans, etc.
		Commercial Credits	Seek financial partnership with an institution which provides credits in form of commercial credits
		Donators	Seek financial partnership to people/organization which supports startups with grants
		Government	Seek financial partnership to a group of people with the authority to govern a country or state
		Investors	Seek financial partnership to business angels, shareholders, etc.
		Others	Seek financial partnership with people/organization which do not belong to one of the groups above
	Others		Seek partnership which is neither for financial nor for non-financial reason

Category	Subcategory (Level 1)	Subcategory (Level 2)	Description
DEEPEN EXISTING RELATIONSHIP TO [e.g., offering external training for customers/ partners & change small into big project/ follow-up project with one customer/partner]	Customers	B2B	Deepen relationship to a customer who is engaged in the exchange of products/services between businesses
		B2C	Deepen relationship to a customer who is engaged in the exchange of products/services between businesses and end consumers
		Others	Deepen relationship to a customer who do not (100% sure) belong to one of the groups above
	Non-Financial Partner	Marketing	Deepen relationship to a non-financial partner in marketing to achieve direct sales
		Public Relations	Deepen relationship to a non-financial partner in public relations to improve startup's image
		R&D	Deepen relationship to a non-financial partner in research and development to improve products/procedures
		Distribution Channel	Deepen relationship to a non-financial partner to improve startup's distribution channel by fastening, e.g., the movement of goods and services
		Suppliers	Deepen relationship to a non-financial partner with people/organization who/which supplies, e.g., goods or equipment
		External Employees, Freelancers, etc.	Deepen relationship to a non-financial partner who is self-employed and works for the startup
		Others	Deepen relationship to a non-financial partner who does not belong to one of the groups above
	Money/Financial Source	Banks	Deepen relationship to an institution which manages the customers' money, provides loans, etc.
		Commercial Credits	Deepen relationship to an institution which provides credits in form of commercial credits
		Donators	Deepen relationship to people/organization which supports startups with grants
		Government	Deepen relationship to a group of people with the authority to govern a country or state
		Investors	Deepen relationship to business angels, shareholders, etc.
		Others	Deepen relationship to people/organization which do not belong to one of the groups above
	Others		Deepen partnership which is neither for financial nor for non-financial reason
REDUCTION	Non-Financial Partner	Marketing	Reduce non-financial partnership in marketing to achieve direct sales
		Public Relations	Reduce non-financial partnership in public relations to improve startup's image
		R&D	Reduce non-financial partnership in research and development to improve products/procedures
		Distribution Channel	Reduce non-financial partnership to improve startup's distribution channel by fastening, e.g., the movement of goods and services
		Suppliers	Reduce non-financial partnership with people/organization who/which supplies, e.g., goods or equipment
		External Employees, Freelancers, etc.	Reduce non-financial partnership with self-employed persons who work for the startup
		Others	Reduce non-financial partnership with people/organization which do not belong to one of the groups above
	Money/Financial Source	Banks	Reduce financial partnership with an institution which manages the customers' money, provides loans, etc.
		Commercial Credits	Reduce financial partnership with an institution which provides credits in form of commercial credits
		Donators	Reduce financial partnership to people/organization which supports startups with grants
		Government	Reduce financial partnership to a group of people with the authority to govern a country or state
		Investors	Reduce financial partnership to business angels, shareholders, etc.
		Others	Reduce financial partnership with people/organization which do not belong to one of the groups above
	Others		Reduce partnership which is neither for financial nor for non-financial reason

Category	Subcategory (Level 1)	Subcategory (Level 2)	Description
WORK ON	Key Performance Indicators		E.g., sales, revenues, etc. (excluding customers/projects → see category above)
	Employees		Increase/Reduce employees (excluding managers → see category below)
	Managers	CEO	Chief Executing Officer
		CFO	Chief Financial Officer
		CHRO	Chief Human Resources Officer
		CIO	Chief Information Systems/IT Officer
		CMO	Chief Marketing Officer
		COO	Chief Operating Officer
		Others	Manager with other responsibilities
	Customers/Projects	B2B	Grow in/Reduce B2B business (= customers who are engaged in the exchange of products/services between businesses)
		B2C	Grow in/Reduce B2C business (= customers who are engaged in the exchange of products/services between businesses and end consumers)
		Others	Increase/Reduce number of customers who do not (100% sure) belong to one of the groups above
	Geographic Scope [e.g., measured by sales, customers, R&D]	On National Level	Increase startup's business scope to other regions, states, etc.
		Go International	Increase startup's business scope to other countries (for the first time)
		International Startups Go to Additional Countries	Increase startup's business scope to other countries (when they are already internationally engaged)
		Others	Increase startup's business scope to an option not included above
	Others		Startup wants to grow/reduce their business in general, for a reason which is not included above, etc.
STAY OF SAME SIZE			Startup wants to stay (approximately) of same size
PRODUCTS & BUSINESS OPERATIONS	Create New [including "New Additional"]		Develop/Launch a new/additional product/way of doing something (i.e., process, work flow, etc.)
	Improve Existing		Improve the products/way of doing something (i.e., better work channels, improve products' look, etc.)
	Keep Existing Similar		Continue operating with the same products/the same way as before
	Reduce		Reduce the products/way of doing something (i.e., better work channels, improve products' look, etc.)
	Others		Other product related challenge which does not belong to one of the categories above (e.g., legal)
PRODUCT MARKETING [i.e., get known by people → seeks to achieve direct sales]	Start [including "Start Additional"]		Start a marketing campaign which has not existed before
	Improve/Increase Existing		Change an existing marketing campaign to improve it
	Keep Existing Similar		Continue marketing as before
	Reduce		Change an existing public relations campaign to reduce it
	Others		Work on the startup's marketing campaigns for other reasons

Category	Subcategory (Level 1)	Description
PUBLIC RELATIONS [i.e., improve image → reputation management]	Start [including "Start Additional"]	Start a public relations campaign which has not existed before
	Improve/Increase Existing	Change an existing public relations campaign to improve it
	Keep Existing Similar	Continue public relations as before
	Reduce	Change an existing public relations campaign to reduce it
	Others	Work on the startup's public relations campaigns for other reasons
RESEARCH & DEVELOPMENT [including surveys & testing]	Start [including "Start Additional"]	Start research & development which has not existed before
	Improve/Increase Existing	Change an existing way of doing research & development to improve it
	Keep Existing Similar	Continue research & development as before
	Reduce	Change an existing way of doing research & development to reduce it
	Others	Work on the startup's way of doing research & development for other reasons
DISTRIBUTION CHANNEL [including changes in sales team]	Start [including "Start Additional"]	Go into a new distribution channel which has not been used before
	Improve/Increase Existing	Change an existing distribution channel to improve it
	Keep Existing Similar	Continue using distribution channels as before
	Reduce	Change an existing distribution channel to reduce it
	Others	Work on the startup's distribution channel for other reasons
STRATEGIC FIRM DEVELOPMENT [i.e., startups start thinking about a certain area without real actions]	Business Model	Startup starts thinking about its business model
	Business Plan	Startup starts thinking about its business plan
	Partners (Financial & Non-Financial)	Startup starts thinking about partnerships
	Financial Strategy/Transaction	Startup starts thinking about its financial strategy
	Internationalization	Startup starts thinking about internationalization
	Legal Issues [e.g., Registration, Patents, Terms and Conditions]	Startup starts thinking about legal issues
	Marketing (including Distribution Channel) & Public Relations	Startup starts thinking about marketing or public relations
	Product (e.g., R&D, Trainings)	Startup starts thinking about its product
	Others	Startup starts thinking about topics not included in the categories above
OTHERS		Startup described other challenges they strive to tackle which are not included in the categories above
QUESTION NOT ANSWERED		Startup did not answer the question

This table displays the codebook used for coding the open question from the CVC's interviews on the startups' plans for the following four-month term ("Question 8: Plans for the following four-month term (milestones, new product features, coming pilots, new clients, etc.)"). The coding serves as the base for the evaluation of the startups' challenges tackled as one can suppose that startups tackle the most pressing issues in the short run (e.g., Giardino et al. 2014). The codebook was evolved based on related literature and the data from the interviews. For coding, the qualitative data analysis program ATLAS.ti (ATLAS.ti Scientific Software Development GmbH, version 8; Berlin, Germany) was used. All foregoing analyses are based on the coded answers applying this codebook.

Variable Definitions

***Table A.3.5:** Variable Definitions*

All variables are based on information retrieved from the CVC's internal management system. Some information is created by the CVC (i.e., the internal ratings) and some information is provided by the startups to the CVC (i.e., challenges, financial situation, and headcount).

Explanatory and Dependent Variables

Variable	*Definition*
Entrepren.Challenge	Dummy variables for entrepreneurial challenges which startups strive to tackle in the subsequent period. See *Table A.3.4* of the Appendix for the codebook of challenges. One dummy variable is created for each challenge listed in *Table A.3.1* of the Appendix. It takes the value of one if a startup expresses a certain challenge, and zero otherwise.
FinanciallyConstrained	Dummy variable for financially constrained startups. It takes the value of one if a startup is financially constrained based on a low rating in the CVC's internal liquidity rating (see variable $LiquidityRating$). The variable characterizes startups as financially constrained with a rating of five or below (on a ten-point scale). It takes the value of zero otherwise.
Headcount	Variable for measuring startup size. It is measured in full-time equivalent employees. Higher values refer to a larger size.
Δln(Headcount)	Variable for measuring startup performance. The proxy is measured as startup growth, i.e., the change in the natural logarithm of startups' headcount (see variable $Headcount$). Higher values refer to higher performance.
LiquidityRating	Variable for measuring startups' financial situation. It is measured on a scale from 0 to 10. Higher values refer to enough available cash considering the current cash burn rate whereas low values refer to a weak record in this criterion [10 = enough cash for 18 months considering the current cash burn rate; 0 = cash is not sufficient for six months at the current cash burn rate].

Control Variables: CVC Internal Ratings

Variable	*Definition*
CommercialStatus	Variable for measuring startups' business model. It is measured on a scale from 0 to 10. Higher values refer to a sound business model with established commercial channels. Lower values refer to a weak business model [10 = sound business model and established channels which are already working; 0 = business model still needs to be defined].
CompetitiveStrength	Variable for measuring startups' competitive environment. It is measured on a scale from 0 to 10. Higher values refer to startups in a market without notable competitors. Lower values refer to startups in a market with considerable leaders and high entry barriers [10 = market with non-significant competition without similar solutions; 0 = market with consolidated leaders and high entry barriers].
MarketPotential	Variable for measuring startups' market opportunities. It is measured on a scale from 0 to 10. Higher values refer to a huge market potential. Lower values refer to a local market without potential for differentiation [10 = high added value in the potential market & disruptive invention; 0 = local market/market niche without differentiation].

Control Variables: CVC Internal Ratings (continued)

Variable	*Definition*
ProductQuality	Variable for measuring startups' products and services. It is measured on a scale from 0 to 10. Higher values refer to a running production of goods or delivery of services and a given acceptance by clients. Lower values refer to a weak record in these criteria [10 = products/services already running and with sound traction; 0 = products/services in pre-beta phase].
RevenueStrength	Variable for measuring startups' level of revenues. It is measured on a scale from 0 to 10. Higher values refer to high and recurring revenues in the recent past as well as a high growth rate in revenues. Lower values refer to a weak record in these criteria [10 = last quarter annualized recurring revenues > EUR 50,000 (or equivalent in other currencies at current exchange rates) and quarterly growth rate > 100%; 0 = no recurring revenues].
TeamStrength	Variable for measuring startups' team quality. It is measured on a scale from 0 to 10. Higher values refer to a startup with a balanced founders team with experienced entrepreneurial background. Lower values refer to an unbalanced founders team without entrepreneurial skills [10 = experienced founders team; 0 = team without entrepreneurial skills].
ThirdPartyFunding	Variable for measuring startups' past success in raising third party funding. It is measured on a scale from 0 to 10. Higher values refer to a high quality and quantity of third party funding. Lower values refer to a weak record in this criterion [10 = equity/convertibles > EUR 100,000 already signed; 0 = no third party financing].

Chapter 4
How Close is Your Crowd? The Role of Information Asymmetries for Investment Decisions in Crowdinvesting

Abstract Startups rely on alternative forms of financing, such as crowdinvesting, as they usually miss reliable credit ratings and bank loans. We explore the effect of information asymmetries between investors and startups, and analyze the role of signals and the investor-startup-relationship in investment decisions. Using a unique proprietary dataset from the largest crowdinvesting platform in Mexico, we show that information asymmetries between investors and startups negatively affect the investment probability and investment amount. An investor-startup-relationship only diminishes this effect in specific instances while objective signals do in any case. Evidence is in line with the idea that investors with a close relationship to a startup should be used as fallback options instead of exclusive investors in startups' early development stage. Furthermore, it underscores that signals are of high importance in modern forms of financing.

The new source of power is not money in the hands of a few, but information in the hands of many.
– John Nasbitt, U.S. author

Acknowledgments This chapter is adapted from my working paper "How Close is Your Crowd? The Role of Information Asymmetries for Investment Decisions in Crowdinvesting". It was joint work with Moritz Sefried from the Eberhard Karls University of Tübingen. We would like to thank Amelie Wulff for her excellent research assistance. Moreover, we gratefully thank Victoria Bozhenko, Werner Neus, Jan Riepe, and the participants of the BFGA conference 2022 and the internal research seminar for their valuable comments and insights.

4.1 Introduction

The rising use of the Internet puts online platforms more and more into the center of attention. This is not only true for online sales. The importance of online platforms in the financial sector also constantly increases (OECD 2019). In crowdinvesting, also called equity crowdfunding, platforms enable investors to easily choose from one of multiple equity investments which are offered in a single place. Crowdinvesting platforms lead to a change in investment decisions of private investors as they do not only save time for investors but also increment their access to alternative investment opportunities (Konovalova et al. 2020). They ease the access to information in general as well as through features and details, e.g., comments or answers on frequently asked questions, which can more easily be made available and disseminated online.

Many studies focus on investment decisions in established investment types, usually conducted without online platforms involved. This research strand consistently shows that the physical distance between investors and investees is negatively correlated with the investment probability and investment amount (e.g., Degryse and Ongena 2005; Bae et al. 2008; Dejean 2020). In crowdinvesting, most steps in the investment process are arranged online. This fact might suggest the impression that the comparison and evaluation of investment possibilities have become easier in recent years, leading to a lower relevance of the physical distance between the investment parties. However, studies show that also in this comparably new form of financing, investors experience larger information asymmetries with greater physical distance. This informational disadvantage plays a major role in investors' decision-making in crowdinvesting (Kleinert and Volkmann 2019). A close relationship between investor and investee might decrease information asymmetries, and foster investors' confidence in startup success so that the investment probability and investment amount increase (Mollick 2014; Angerer et al. 2017). Agrawal et al. (2008) conclude that social aspects are able to substitute the physical distance between investors and investees. Similarly, objectively observable signals by other investors may decrease information asymmetries. In turn, these signals may positively influence investment decisions (Courtney et al. 2017).[18]

In this study, we investigate the link between information asymmetries between investors and startups (measured by their physical distance) and the investment probability and investment amount in crowdinvesting. Using detailed data on investor and startup characteristics, we conduct logit regressions with 407,497 observations (investment and no investment observations) as well as OLS regressions with fixed effects with 11,054 observations (investment observations only) from the largest Mexican crowdinvesting platform. Thereby, we investigate if information asymmetries still play a role in investment decisions. More specifically, we concentrate on the investment probability and investment amount. We also analyze the moderating effect of the

[18] Sah and Stiglitz (1986, p. 716) subsume such phenomena under "the architecture of an economic system [which] affects the errors made by individuals within the system, as well as how these errors are aggregated". Ultimately, these interdependencies describe Bayesian arguments.

investor-startup-relationship in this context. If any kind of relationship exists, informational disadvantages of investors should decrease as more information is directly transferred from the better informed party, i.e., the startup, to the less informed one, i.e., the investor, and thus uncertainty decreases. Hence, we expect that relationships mitigate the negative effect of informational disadvantages on the investment size. In the final part of this study, we evaluate the effect of objectively observable signals (in form of other investors' likes) on investment decisions of future investors in crowdinvesting. We assume that a high number of likes proves to be a signal of confidence by other investors who have already had good experience with the investee or are convinced of a startup's success in the near future. In turn, we expect potential investors to be motivated to invest more, leading to a higher investment amount.

Revealing the effects of information asymmetries in crowdinvesting extends the knowledge on this comparatively new form of financing. It deepens the understanding of existing links between information asymmetries, personal relationships, and signals in the field of entrepreneurial research. With the given dataset containing in-depth information on investors and startups, we provide insights into how rationally observable characteristics influence investment decisions in crowdinvesting, i.e., the investment probability and investment amount.

First, we find that informational disadvantages decrease the investment probability and investment amount. A 10% increase in distance decreases the investment probability by 1.42pp and the investment amount by 0.41%. Higher investor experience decreases the investment amount, underscoring the lower risk appetite and higher financial literacy of more mature investors. Furthermore, men who are on average less risk-averse than women support startups with an, on average, 23.31% higher investment amount. The financing goal of a startup also increases investors' willingness to support startups financially.

Second, we provide evidence that the investor-startup-relationship influences the investment probability as well as the investment amount. A given relationship positively influences investment decisions. However, a relationship does not fully counteract the negative effect of an informational disadvantage by the investor compared to the better informed startup in any case. This can be explained by the idea by Lee and Persson (2016) that startups optimally not exclusively use closely related parties as investors in a very early stage. They state that startups should rather keep closely connected third parties as fallback options for the case that the supposed success does not occur, and that they need immediate financial extra support from outside the firm. We find that only rural investors seem to consider this idea as the main effect of relationships turns from positively significant to non-significant when excluding investors from Mexico City. This study confirms the finding by, e.g., Angerer et al. (2017), that family and friends are frequent investors in startups' early development stage.

Last, we explore the effect of likes, i.e., an objectively observable signal, on investment decisions. We find a significantly negative effect of likes on the investment amount, showing that private investors prefer to hop on projects with an expected positive outcome (indicated

by a high number of likes from other investors) with small amounts of money. The investment probability, however, rises with the number of likes received. As the outcome is still uncertain in crowdinvesting, this is in line with the idea of risk diversification. This result additionally shows that investors consider other investors' opinions in their decision-making process.

Our study relates and contributes to the literature in different ways. First, this study relates to the strand of literature on the effect of information asymmetries between investors and startups in investment decisions (e.g., Coval and Moskowitz 1999; Chen et al. 2010). Using distance as proxy for information asymmetries, we provide novel insights into these effects in crowdinvesting. Furthermore, we add to the literature on the effects of relationships and third-party signals on the link between information asymmetries and investment decisions.

Second, our study relates to the general literature on crowdinvesting which is typically focused on the U.S. and Europe. Our study expands these results by providing new empirical evidence and insights into the development in Mexico. Mexico, with an expected yearly growth rate of 4.75% in the upcoming years (Statista 2022a), constitutes one of the fastest growing markets for crowdinvesting - to compare, Germany expects 4.49% (Statista 2022b) and the U.S. 4.07% (Statista 2022c).

Third, we use a unique dataset including detailed information on crowdinvestment activities, investor and startup characteristics. Thus, we provide new insights into investment decisions within this increasingly demanded modern way of financing. We also shed light on the role of startups' public evaluation in investment decisions. For this purpose, we employ likes as an objectively observable signal displayed on the crowdinvesting platform. This topic has become more and more important as the digitalization proceeds with big steps. In turn, online activities in all areas, especially in financial transactions, become of higher focus and a more and more relevant option to consider in investors' decision-making.

We openly acknowledge the shortcomings of this study. First, our database consists of one crowdinvesting platform, which might lead to a self-selection bias in our results. However, it enables us to exploit specific data of the largest crowdinvesting platform in Mexico, providing detailed information on investors and startups with much heterogeneity between observations in all relevant variables. Mexico, as our country of data origin, also provides advantages to our analyses as one can assume that investors show similar characteristics within the country and Mexico constitutes one of the major countries in the current development of crowdinvesting. We also know about potential endogeneity within our data. To deal with this point of criticism, we control for investor-state-specific and startup-state-specific characteristics. Additionally, we focus on the first bilateral investor-startup-interaction. This calls for future research to evaluate investment timing effects. For this study, it describes a major advantage as we can abstract from learning effects by investors.

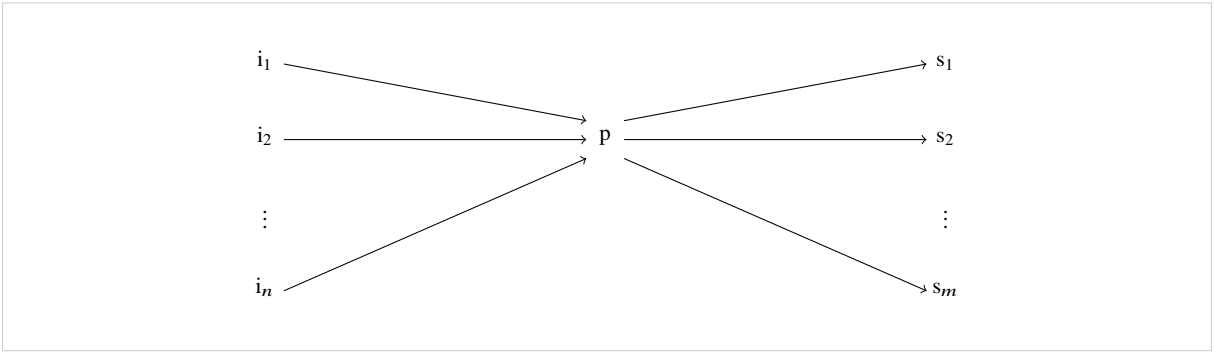
The paper proceeds as follows. Section 4.2 gives an overview on the crowdinvesting process and the platform. Section 4.3 reviews the literature and develops our hypotheses. Section 4.4 describes the sample, methodology, descriptive statistics, and the research design. In Section 4.5, we present and discuss our empirical results. Section 4.6 provides robustness tests and Section 4.7 describes limitations of this study. Section 4.8 concludes with the discussion and a summary of the main findings.

4.2 Institutional Background

Crowdinvesting describes a subcategory of crowdfunding (e.g., Leboeuf and Schwienbacher 2018).[19] It constitutes a form of equity financing and is also known as equity crowdfunding. In crowdinvesting, usually a large number of private investors support early-stage firms, and especially startups, with a relatively small amount of money per person (e.g., Moritz and Block 2014). Similar to other equity investments, investors purchase equity shares in the firm. In return, they receive dividends in later years depending on the success of the investee (e.g., Ahlers et al. 2015).

Crowdinvestment deals are usually arranged via online platforms on the Internet. *Figure 4.1* displays the operating principle of a crowdinvesting platform p which potentially connects n investors (i) with m startups (s). On the platform, startups can register and create a profile with information on themselves and their business idea. Investors looking for an investment opportunity can browse these startups, and decide (not) to support a particular startup financially.

Figure 4.1: *Operating Principle of Crowdinvesting*



Since high information asymmetries exist between (potential) investors and startups (e.g., Kleinert and Volkmann 2019) and the success of early-stage firms is per se uncertain, crowdinvesting is considered relatively risky (e.g., Angerer et al. 2018). Crowdinvesting platforms bundle and ease the access to information. They provide as much information as possible publicly available,

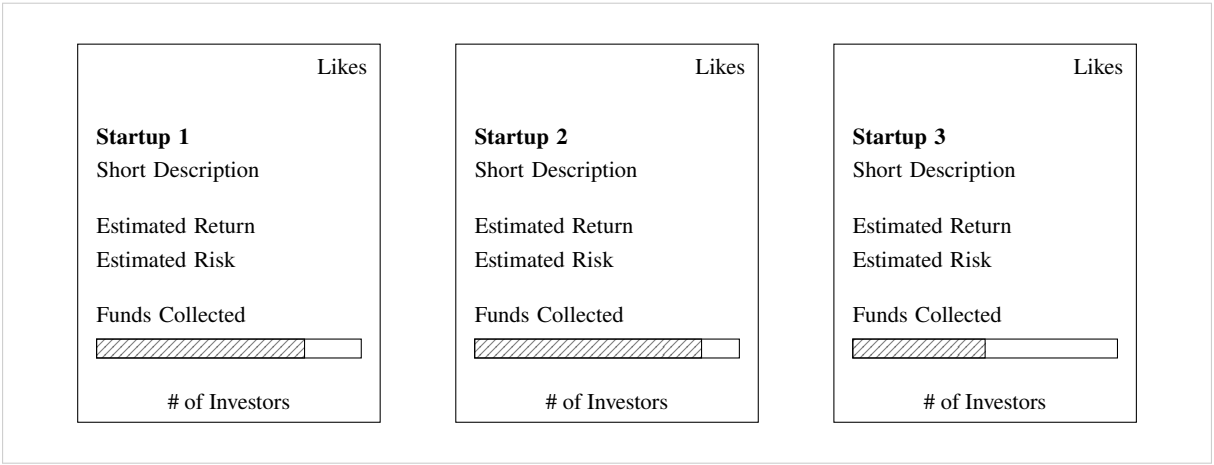
[19] "Crowdfunding" describes a modern form of financing which initiates an open call with or without an intermediary. Crowdfunding consists of three subgroups: Crowdinvesting (= equity capital), crowdlending (= debt capital), and reward-/donation-based crowdfunding.

and create, e.g., rankings in terms of risk for the startups listed on their website. However, investors looking for investment opportunities still remain with some uncertainty about the quality of their potential investments as they cannot assess the correctness of the information given on the website about the startups (e.g., Goethner et al. 2021). Still, crowdinvesting constitutes a convenient way for investors to participate in a potentially profitable project with a small amount of money (e.g., Moritz and Block 2014).

Figure 4.2 depicts the starting page of a crowdinvesting platform.[20] All investment possibilities, i.e., startups, are listed next to each other. The starting page is accessible without registering on the platform. On the top, the current amount of likes which a startup has received from registered users of the platform until that moment is displayed. Subsequently, the startup's name and a short own description provide information on the startup's business model. This information is followed by details created by the crowdinvesting platform. Based on the startup's financial information, the platform's employees internally assess the estimated yearly return (in percent) and the startup's risk (on a 15-point-scale from low, stable, moderate, fluctuating, to high). Additionally, the amount of money already collected (in Mexican Pesos) and the number of engaged investors is displayed. The former information is also depicted in a bar chart as the share of the financing goal, i.e., as the share of the minimum amount of financial resources which a startup strives to raise within this particular investment period.

For startups entering an investment period in the short run, the same information is displayed at the bottom of the crowdinvesting platform's starting page. Upcoming investment possibilities are announced two weeks before they get started. Instead of the bar chart displaying the already collected funds, the startup's minimum financing goal is depicted.

Figure 4.2: *Starting Page on the Crowdinvesting Platform*

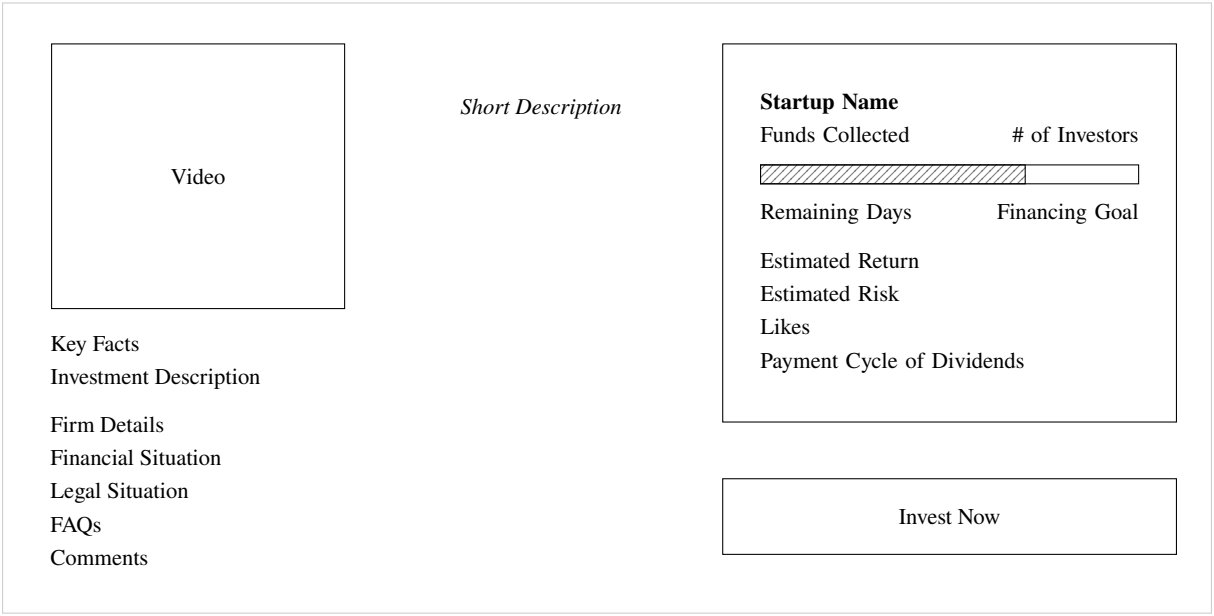


[20] *Figure 4.2* and *Figure 4.3* depict the website layout of our data-providing platform. All information in the text is also platform-specific. Other crowdinvesting platforms are structured similarly.

Figure 4.3 displays the structure of startups' individual websites which can be accessed via the starting page. These individual pages are also accessible without registering on the platform. On the top, the startup presents itself in a short video of approximately two minutes. Additionally, the short description from the starting page is again depicted. Below, further details are shown including key facts on the startup and a description of the investment opportunity. Exemplarily, this might be details on the firm's leading employees, or the startup's business model. Subsequently, further information follow on the startup, its financial and legal situation, some answers on frequently asked questions, and comments about the startup from former users of the platform.

More information on the specific investment possibility is displayed on the right of the individual startup websites. First, the amount of money already collected and the number of engaged investors are shown. The bar chart again displays the collected funds as proportion of startup's overall financing goal. The minimum financing goal is depicted just below the bar chart as well as the remaining days till the investment period expires. The duration of an individual investment period ranges between approximately one and eight months, with a mean of four months. Further below, details on the estimated yearly return and the risk of investment are depicted. It is followed by the number of the startup's likes and the payment cycle of dividends (mostly per trimester but may also be defined ex ante as per semester or yearly by the startup).

Figure 4.3: *Individual Startup Page on the Crowdinvesting Platform*



For investing in a startup, investors need to register on the platform. In the first step, it is sufficient to enter their first and last name, a personal email address, and to choose a password to enter the internal area of the crowdinvesting platform. When investing for the first time, more information is demanded, e.g., investors' date of birth, their highest educational degree, and

the state of residence. The crowdinvesting platform also tries to draw investors' attention to the risk taken through crowdinvesting activities by asking them some questions on their general risk preference. Thereafter, investors can freely choose the amount of money which they want to invest.[21] The amount invested stays between three and six years with the startup, and gets repaid to the investors with a one-time payment at the end of the predefined time period. The crowdinvesting platform charges 5% of the investment amount as fee for their services.

If the minimum financing goal of the startup is reached within the investment period, investors are requested to transfer their investment amount to the crowdinvesting platform after the termination of the investment period. The platform then transfers the money to the startup. Thereby, investors purchase an equity share in the startup. This share is defined as the proportion of the individual investment amount divided by the total funds collected.[22] In subsequent years, investors receive dividends which are defined as the respective share of the startup's earnings from sales or other business activities. Dividends are paid in a regular rhythm, starting immediately after the startup has received the funds collected. The exact size of the dividends paid out may vary between payment periods, depending on the success of the startup. To decrease uncertainty for investors, startups define a minimum and maximum dividend (in percent of earnings). During the payment cycle of dividends, investors receive information on the startup's progress, e.g., in sales, and can communicate with the startup via the crowdinvesting platform.

If the startup's minimum financing goal is not reached within the investment period, investors are not requested to transfer their individual investment amount to the startup (via the crowdinvesting platform).

4.3 Literature Review and Hypotheses Development

Lacking financial resources restrict startup growth (e.g., Levine 2005; Beck et al. 2006). Additionally, an absent credit and firm history often impedes early-stage startups from the access to traditional ways of financing (e.g., Carpenter and Petersen 2002). Crowdinvesting, also known as equity crowdfunding, describes the process of funding a project through the crowd by making an open call and, in return, selling an according number of firm shares to investors providing financial support. In our study, the average individual financial support equals 16,126 Mexican Pesos (MXN) which is approximately 800 U.S. Dollars (USD).

In crowdinvesting, large information asymmetries exist between investors and investees (Kleinert and Volkmann 2019). These information asymmetries between startups as the better and investors as the less informed party play a major role in investors' decision-making. They stem from market imperfections and result in market inefficiencies (e.g., Akerlof 1970; Rosser

[21] Some startups require a minimum amount of money from an individual investment. The investment amount can be increased or withdrawn by the investor at any time during the predefined investment period.

[22] The total amount collected is by definition equal or larger than the startup's minimum financing goal.

2003). Information asymmetries are especially relevant for borrowers in crowdfunding compared to the more traditional ways of financing (Piva and Rossi-Lamastra 2018). The physical distance between investors' and startups' place of domicile increases information asymmetries between the two parties. Several researchers find a preference for local investments due to better access to information about their investees' situation nearby compared to physically more distant ones (e.g., Malloy 2005; Bae et al. 2008). Dejean (2020, p. 337) underscores this finding with the explanation of "a regional attachment or a distant relationship with a particular community".

A broad literature confirms this idea in equity and startup investments. First, Coval and Moskowitz (1999) find a preference for local equity investments in the U.S. When investigating the portfolio composition of stocks, investment managers show a strong bias towards local firms. Chen et al. (2010) display the preference towards geographically closer investments in the venture capital market in the U.S. This effect persists even though non-local investments outperform local venture capital investments in terms of return. Lutz et al. (2013) confirm this finding for the German venture capital environment. Besides currency and legal frameworks, Niemand et al. (2018) also observe the preference for physically close investments in the equity crowdfunding context. However, they call for further research on this financing method on national level. Hornuf et al. (2022) find a local bias for individual equity crowdfunding investments and investment portfolios. This effect appears to be largest for family, friends, and angel-like investors.

Blum and Goldfarb (2006) show that even in the case of purely digital goods sold and used via the Internet, i.e., in the absence of trading and other opportunity costs, informational differences seem to play a role in investment decisions. Consequently, we expect:

Hypothesis 1a: Higher information asymmetries between investors and startups negatively influence investors' decision to invest.

Hypothesis 1b: Higher information asymmetries between investors and startups negatively influence the investment amount.

One factor influencing investors' decision about their investment amount is the relationship between startups and investors. The term "relationship" varies in its usage in entrepreneurial research. In some studies, it describes close connections to third parties, e.g., to family members or friends of the entrepreneur, whereas in other studies, it also includes having a business connection to the startup or being a friend of a friend of the entrepreneur (Polzin et al. 2018). In studies analyzing relationships in investment decisions, a "relationship" may also describe the situation of having already invested in a startup (e.g., Sorenson and Stuart 2001).[23]

Several researchers support the notion that a close relationship is associated with a higher investment amount (e.g., Angerer et al. 2017). Banerji and Reimer (2019) show that the more

[23] We define the term "relationship" for this study in Section 4.4.3.4.

connections a founder has, the higher the amount of money raised. They state "the social connectedness of founders [to be] the best predictor of funds raised" (Banerji and Reimer 2019, p. 46). Mollick (2014) observes similar effects in his exploratory study. Measuring the effect of entrepreneurs' social network by the number of friends online, he shows that larger personal networks are associated with a higher success probability of crowdfunding projects. Leyden et al. (2014) and Vismara (2016) underscore this idea. They explain the effect by arguing that social ties decrease uncertainty stemming from existing information asymmetries.

Polzin et al. (2018) argue that a given investor-startup-relationship might (at least partially) offset missing public information on the startup's financial situation which investors require from startups before taking investment decisions. Agrawal et al. (2008, p. 259) go even further and state that "social proximity [...] substitutes spatial proximity with respect to the effect on knowledge flows". We transfer this finding to our study and argue that an existing investor-startup-relationship might offset information asymmetries between startups and investors. As several studies have already revealed the positive effect of relationships on the investment probability, we exploit the advantage of this dataset of having detailed information on investors, investments, and startups, and focus on these links and respective interactions to the investment amount.[24] Thus, we hypothesize:

Hypothesis 2: An existing investor-startup-relationship positively mitigates the effect of information asymmetries between investors and startups on the investment amount.

Due to, on average, small individual investment amounts in crowdinvesting, the costs of evaluating a startup for crowdinvestors are disproportionately high compared to the amount invested. In turn, information asymmetries between investors and investees are especially pronounced in this financing form as investors often refrain from seeking full information about their investees (Piva and Rossi-Lamastra 2018). To bridge the informational gap, signals describe visible attributes which transfer information (Spence 1973) and are able to (at least partially) reduce uncertainty (e.g., Ahlers et al. 2015). Spence (2002, p. 434) describes signals to "carry information persistently in equilibrium from sellers to buyers, or more generally from those with more to those with less information". Applying this idea to this study, startups as the better-informed party strive to transfer information to (potential) investors via the crowdinvesting platform. In their empirical studies, Davila et al. (2003) and Courtney et al. (2017) confirm that signals from startups as well as from third parties decrease information asymmetries and increase startups' possibilities for success. Nitani et al. (2019) confirm signals on, e.g., firm and owner attributes, to influence the success probability of crowdinvesting campaigns.

In early studies on the effects of signaling, signals were considered costly, resulting from either the implementation of the signal or penalty costs in case of wrong signaling (Spence

[24] The same argument holds for *Hypothesis 3* when investigating the effects of likes.

1973). Spence (2002) states that the Internet has changed the informational structure of markets and economies as it has reduced transaction costs. Block et al. (2018) confirm that signals which are easier to interpret show higher effects on the crowd. Several researchers observe that likes, describing rationally observable "one-click cues" by former users, are a popular signal to use nowadays (e.g., Ahlers et al. 2015). Anecdotal evidence confirms this idea. More and more websites employ costless rankings based on users' likes, e.g., Amazon, Facebook, Netflix, or Tripadvisor. Likes are common in social media (Sumner et al. 2020) and indicate that individuals positively evaluate the content of a post, comment, or picture (Eranti and Lonkila 2015). Thus, they communicate individuals' "overall positive affect, or sentiment, toward the organization's message" (Saxton and Waters 2014, p. 287).

While one could argue that likes are only cheap talk and thus not relevant for investment decisions, in recent years, they have received increasing attention by the crowd and have shown higher importance in investors' decision-making process with the rising use of the Internet (e.g., Kleinert and Volkmann 2019; Di Pietro et al. 2020). Nitani et al. (2019) conclude that crowdfunding investors act rational and give strong weight to observable signals to compensate their informational disadvantage when taking investment decisions. This link is stronger for simple signals and non-expert private investors (Monti et al. 2014). Additionally, we know that former investors' behavior influences potential investors' decisions (e.g., Vismara 2018). This effect is driven by the idea to follow other investors who are supposed to know what they do and who are able to correctly evaluate a startup's probability of success (e.g., Welch 1992). Carr et al. (2018) reveal the importance of the quantity of likes on social media platforms, and Mochon et al. (2017) display that online likes positively influence customer behavior. Thus, we hypothesize:

Hypothesis 3: The received likes positively mitigate the effect of information asymmetries between investors and startups on the investment amount.

4.4 Data and Research Design

4.4.1 Data

The dataset for this study comprises data from the largest crowdinvesting platform in Mexico between 2015 and 2019. It includes information on startups and (potential) investors, as well as investors' individual decision (not) to invest into a particular startup. In contrast to the databases of many former studies, our dataset contains information on the exact investment amount per investor per startup as well as private details, e.g., investors' and startups' state of domicile. This information enables us to analyze factors influencing the concrete financial support provided while simultaneously looking at, e.g., the relationship between startups and investors and other investment-specific characteristics.

Mexico as our country of data provenance represents an ideal environment for crowdinvesting research for several reasons. First, Mexico appears to be a country with very heterogeneous states in terms of the macroeconomic surrounding (see, e.g., OECD 2022). Second, similar to blockchain technologies which might reduce Mexican problems of inefficient governance and corruption (Zbinden and Kondova 2019), crowdinvesting allows a direct money flow between lenders (= investors) and borrowers (= startups). Thus, the financial support provided depends entirely on the online presentation of the startup as there is no previous bilateral communication between investors and startups. At the same time, crowdinvesting decreases economic frictions (Cumming et al. 2021). In turn, crowdinvesting helps startups in a country of the size of Mexico to overcome financial constraints. Furthermore, Cordova et al. (2017, p. 1) state that financial inclusion in Mexico calls for greater attention, as financial inclusion allows "the access and use of financial services under an appropriate regulation that guarantees protection schemes for consumers and promotes financial education in order to improve financial capabilities in all population segments". The authors highlight the importance of accessing an effective and secure payment system.

Last, Mexico corresponds to other countries in terms of the development of crowdinvesting in the past couple of years. Since 2018, the transaction volume in Mexico has almost doubled, reaching USD 8.39 million in 2022. Experts of the business data platform "Statista" project the transaction volume in the Mexican crowdinvesting market to further grow by 4.75% per year in the short run (Statista 2022a). This fact underscores the importance of our analyses. It also makes results transferable to other countries as a similar positive development is expected, e.g., for Germany with an expected yearly growth rate of 4.49% (Statista 2022b) and the U.S. with 4.07% (Statista 2022c).[25] As crowdinvesting describes a modern form of financing, the results of this study are of high interest for the development of the financial sector. Additionally, both startups and investors benefit from our findings as we shed light on the factors influencing the money flow in entrepreneurial finance.

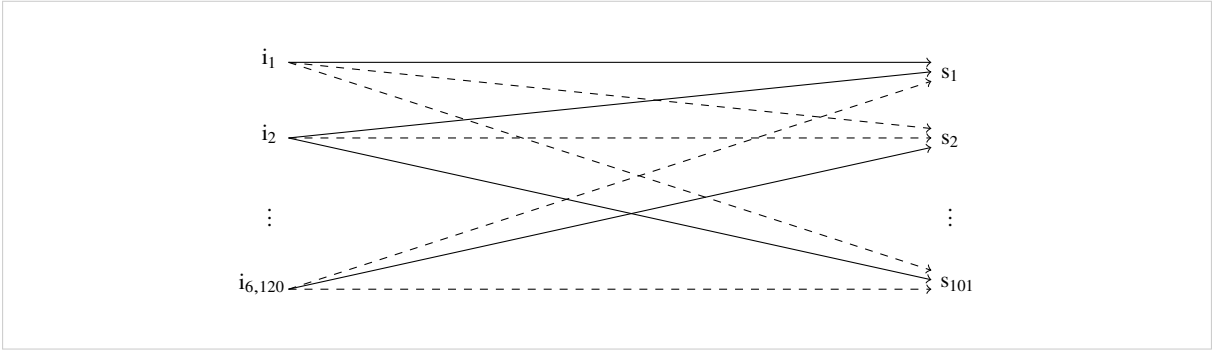
4.4.2 Sample

The dataset includes observations from the internal management system for which investees are characterized as "startups". We do not consider observations for which investees are registered as "SMEs", "revenue-based funding" or "real estate funding" as these categories did not exist throughout the whole sample period. Furthermore, we focus on startups' successful investment rounds, i.e., when the minimum financing goal was reached within the investment period, as it ensures the explanatory power of our results with regard to the investment success. Additionally, we do not have investor information from non-successful investment rounds, and thus refrain

[25] These markets are much larger in absolute numbers with a transaction volume of USD 42.64 million and USD 324.74 million in Germany (Statista 2022b) and in the U.S. (Statista 2022c), respectively, in 2022.

from including these observations to allow a detailed analysis. We also limit the database to investors and startups located inside Mexico to avoid biased results due to a different macroeconomic environment which might drive our results. We focus on the first investment within each particular bilateral investor-startup-combination. This restriction rests upon the idea that investors learn from former investments in a respective startup (e.g., Hornuf and Neuenkirch 2017). Furthermore, keeping these 26 subsequent investments would not allow additional meaningful analyses due to the low number of observations, and would on top bias our coefficient of the investor-startup-relationship as relationships and knowledge flows in the entrepreneurial market evolve over time (e.g., Whadwa and Kotha 2006).

Figure 4.4: *Construction of the Dataset*



After these selection decisions, we create all possible investor-startup-combinations.[26] *Figure 4.4* displays the construction of the dataset. Solid lines indicate that investor i has invested in startup s. We then create all imaginable investor-startup-combinations for which an investment could theoretically have taken place but has not in reality (= dashed lines). Exemplarily, investor 1 (i_1) has invested in startup 1 (s_1), but has not invested in startup 2 (s_2) and startup 101 (s_{101}). This procedure results in our initial database with 618,120 investor-startup-combinations (= observations) from 6,120 investors and 101 startups from the years 2015 to 2019.

[26] For reasons of coding programmability and efficiency in STATA, we conduct the described selection steps before creating all investor-startup-combinations. This does not affect the composition of the final sample.

As *Table 4.1* displays, we subsequently drop observations with illogical values in any of our variables of interest. Exemplarily, this involves observations with objectively wrong information on investors' date of birth (e.g., from investors characterized as born in the year 1887). This step decreases our sample by 5,454 observations (i.e., 54 investors). Furthermore, we do not include observations for which information on dates does not logically fit our analyses. Exemplarily, this restriction relates to observations for which a startup was funded before an investor profile was created virtually, which logically prevents a possible investment. This excludes 205,169 investor-startup-combinations from the sample. Overall, our final dataset for *Hypothesis 1a* in which we investigate the factors influencing the investment probability contains 407,497 observations. For the subsequent analyses of the investment amount (*Hypothesis 1b*, *Hypothesis 2*, and *Hypothesis 3*), we only include those observations where an investment has taken place. This results in a final sample of 11,054 individual investor-startup-combinations.

Table 4.1: *Sample Selection*

	Observations
Initial Sample	**618,120**
Illogical data	-5,454
Non-fitting data with regard to investment timing	-205,169
Final Sample for *Hypothesis 1a*	**407,497**
No investment	-396,443
Final Sample for *Hypotheses 1b, 2,* and *3*	**11,054**

This table displays the composition of the sample. The initial sample covers all observations retrieved from the crowdinvesting platform's management system throughout the years 2015 to 2019.

Figure 4.5 displays the distribution of investors in Mexico. Investors appear widely spread throughout the country. Still, Mexico City (CMX), the capital city of Mexico, encompasses by far the highest number with approximately one third of all investors in the dataset (2,047 of 6,066 investors). It is followed by the State of Mexico (MEX) with approximately half as many investors residing in this state (990), Jalisco (JAL, 473), and Nuevo Léon (NLE, 454).[27] *Figure 4.6* displays the distribution of startups throughout the Mexican states. We find a huge proportion of startups (61 of 101 startups) to be located in Mexico City. The other 50 startups in our dataset are distributed throughout the other states, with the maximum number of nine startups being located in Guanajuato (GUA). All values are reported in *Table A.4.1* of the Appendix.

[27] The State of Mexico describes the surrounding area of Mexico City. The capital cities of Jalisco and Nuevo Léon are Guadalajara and Monterrey, which are the second and third largest city in Mexico, respectively. Thus, this finding is not surprising.

Figure 4.5: *Local Distribution of Investors in Mexico*

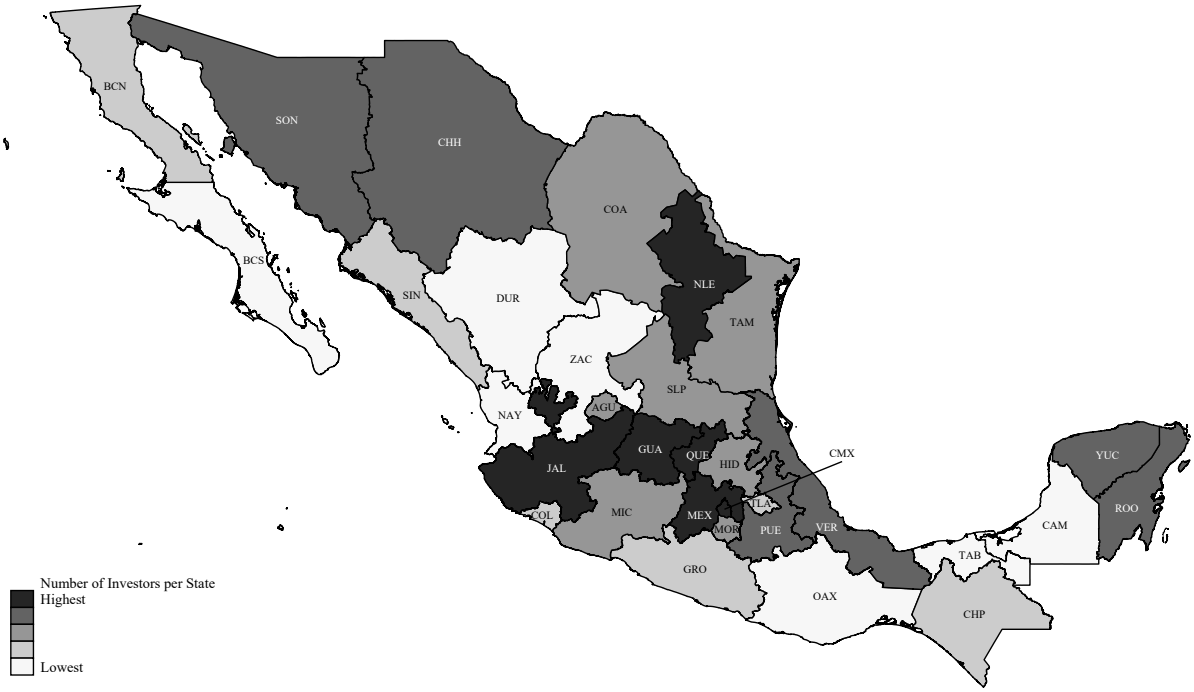
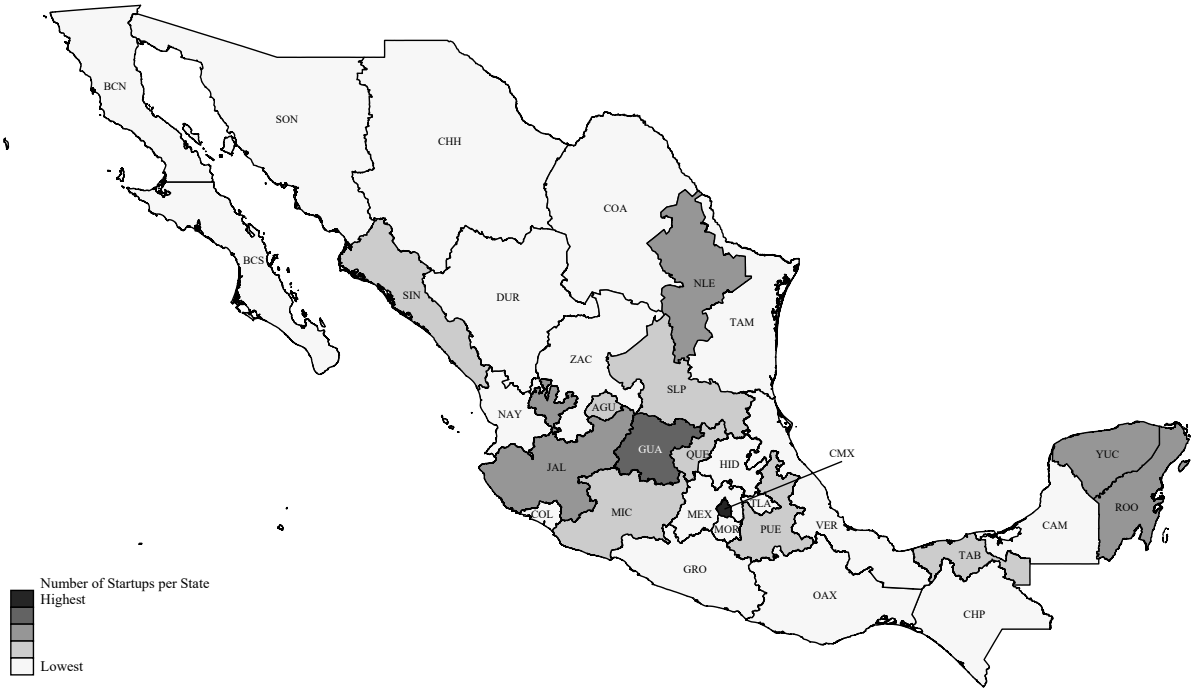


Figure 4.6: *Local Distribution of Startups in Mexico*



4.4.3 Variables

4.4.3.1 Investment Dummy

In *Hypothesis 1a*, we investigate the effects of distance between investors and startups (as a proxy for information asymmetries) on the investment probability. To measure the investment probability in crowdinvesting, we employ a dummy variable as dependent variable for whether an investment has taken place (= value of one) or not (= value of zero). An "investment" is characterized through the investor's decision to financially support a startup via the crowdinvesting platform, i.e., clicking "invest now", deciding on the investment amount, and entering all personal information on the platform.[28] This method is frequently used in the literature (e.g., Vulkan et al. 2016; Courtney et al. 2017; Guenther et al. 2018). We conduct a logit regression to assess the factors influencing investors' decisions. The logit model with a logistically distributed error term appears reasonable in our analyses as it combines all advantages of the cumulative distribution function for a standard logistic random variable. Additionally, it results in directly observable fitted probabilities between zero and one (Wooldridge 2016).

4.4.3.2 Investment Amount

In *Hypothesis 1b*, *Hypothesis 2*, and *Hypothesis 3*, we investigate factors influencing the investment amount per investor per startup. The investment amount is measured in Mexican Pesos, enabling us to immediately observe the real effects of the explanatory variables. As crowdinvesting is mostly conducted by private investors who do mental estimates in their local currency, we choose to include all financial variables in Mexican Pesos. We use the natural logarithm to deal with the heterogeneous distribution of the amount invested and to deal with outliers to secure the normality and homoscedasticity in the distribution.

We focus on the first investment of a particular investor in a particular startup within our analyses. Thereby, we abstract from learning effects and the evolution of the investor-startup-relationship in second and further investments which might bias our results.

4.4.3.3 Distance

Several researchers argue that "information asymmetry is not readily observable and, thus, is difficult to measure empirically" (Jiang and Kim 2004, p. 186). However, the effect of information asymmetries is particularly important in crowdinvesting (Kleinert and Volkmann 2019). We proxy the informational disadvantage of (potential) investors compared to the better

[28] We refer to Section 4.2 for further information on the investment process.

informed investees (= startups) using the variable *Distance* in logarithmic terms.[29] For investors located nearby, the access to information is easier as they can, e.g., talk to the investee's employees, customers, or competitors. Additionally, investors can get information on firm's current development through the local media, or might even have personal connections to the investee's management team (e.g., Coval and Moskowitz 1999; Bae et al. 2008). Thus, a higher physical distance refers to higher information asymmetries. Thereby, we follow many authors in the field of finance and entrepreneurship who employ the respective proxy (e.g., Malloy 2005; El Ghoul et al. 2013). The natural logarithm accounts for the fact that small changes in large distances do not matter as much as changes of the same size for small distances (compare, e.g., Wooldridge 2016).

We measure the physical distance between one specific startup and one specific investor using the midpoints of the startup's and the investor's state, rounded to full kilometers. This procedure is based on the non-availability of data regarding the exact place of residence of the investors. However, due to the large number of Mexican states (32) and the large size of Mexico (1,973,000 km^2), this proxy shows widely varying values. In turn, it appears reasonable to assume that the access to information, and thus information asymmetries, are highly heterogeneously distributed between more and less distant investor-startup-combinations.

4.4.3.4 Investor-Startup-Relationship

We also include the relationship between investors and startups into our regression analyses. Studies show that closer relationships, on average, lead to higher investment amounts (e.g., Angerer et al. 2017). Within the registration process on the crowdinvesting platform, investors must characterize their relationship to the startup into one of five groups: Customer, event, family/friends, maker network, or stranger. For the purpose of this study, we create a dummy variable which takes the value of one if the investor and startup have any kind of relationship, being it as family/friends, as customers or knowing each other from an event or maker network. In contrast, this variable takes the value of zero if investors denote themselves as strangers to the startup.

4.4.3.5 Likes

Within the analysis of *Hypothesis 3*, we take a closer look at the moderating effect of the startups' likes received on the platform on the link between information asymmetries and investment decisions. On the platform, registered users can "like" a startup if they support a

[29] We add one to the investor-startup-distance of all observations. Thereby, we keep investor-startup-combinations from the same state. We proceed similar for all other variables which are measured using the natural logarithm (investment amount, financing goal, investor experience, and startup likes).

startup's idea.[30] The current number of likes per startup is displayed on the platform as one characteristic feature on the list of potential investees presented. For each investment, we know the number of the respective startup's likes in this particular moment. Likes received represent an objectively observable signal to the less informed party, i.e., (potential) investors (e.g., Block et al. 2018). They might be seen as "a sense of community [...] who share a similar interest [...] that may result in increased positive attitudes towards the brand" (Coursaris et al. 2016, p. 2). We include this variable into the analyses using the natural logarithm to account for smaller effects of numerically equal changes for a larger compared to a smaller amount of likes.

4.4.3.6 Control Variables

As control variable, we first include the financing goal within a predefined crowdinvesting period set by startups into our analysis. The financing goal describes the minimum amount of financial resources which a startup strives to get within the respective investment period. It is measured in Mexican Pesos to directly observe the real effects of the respective variables. Including this variable, we follow several researchers (e.g., Ahlers et al. 2015; Vismara 2016; Kleinert et al. 2020). The presentation of a startup's financing target might influence investors in their decision-making with regard to providing financial support or not, and regarding size. By including this variable, we thus avoid biased results in this regard. We include this variable using the natural logarithm to account for smaller effects of the same change in this variable when looking at larger compared to smaller financing goals.[31]

Additionally, we account for three investor-specific characteristics within our analyses. First, we include a dummy for investors' gender. It takes a value of one for male and a value of zero for female investors. Including this variable accounts for the lower risk aversion of men compared to women (Rieger et al. 2015). In turn, it is of high relevance in the comparatively risky investment form of crowdinvesting. We also include investors' age grouped by decades into the regression. It results in seven dummy variables for investors under or equal to 30, between 31 and 40, between 41 and 50, between 51 and 60, between 61 and 70, between 71 and 80, and above 80 years of age. Thereby, we account for different stages of life that come with different financial needs and, thus, different savings or investment attitudes. The age group of investors under or equal to 30 serves as our reference group within the analyses and the interpretation of the results. Last, we employ the natural logarithm of investors' time on the crowdinvesting platform in days to account for the possibility to invest in other startups listed on the crowdinvesting platform.[32] We measure this experience as the time between the day of investors' registration on the crowdinvesting platform

[30] Unfortunately, we miss information by the crowdinvesting platform if users can also "dislike" a startup.

[31] One could also imagine taking the already collected proportion of the financing goal as control variable into the analysis. However, we miss information on the overall investment amount by all investors in each particular point in time. Additionally, we cannot sum up individual investments to get this amount as we only include first investments per bilateral investor-startup-combination into our analysis.

[32] This study concentrates on the first bilateral investor-startup-interaction. Thus, investors cannot collect experience from former investments into the same startup.

until the day when the investment is registered in the platform's system (= investment date). We assume that the change in investors' experience becomes lower with a longer personal history on the platform.

4.4.4 Descriptive Statistics

Table 4.2 displays the summary statistics on observation level for all variables. The average distance between investor and startup amounts to 451.66 km (and 355.26 km for the smaller sample in *Hypothesis 1b*, *Hypothesis 2*, and *Hypothesis 3*).[33] This mean value fits Mexico's size with approximately 3000 km north-south and 2000 km east-west extension. Considering the comparatively high standard deviation, our proxy for information asymmetries between investors and startups is very heterogeneously distributed. After creating all investor-startup-combinations, we find an investment in approximately 3% of our observations. The average investment amount which startups receive amounts to 16,126.53 MXN (equals approximately 800 USD) with individual investments ranging from 160 to 1,490,000 MXN. The number of likes received by one startup ranges from 21 to 4,194 likes with an average amount of 1,081 likes. In 72% of all observations, investors and startups show a relationship if an investment takes place.

Table 4.2: *Descriptive Statistics*

	N	Mean	StdDev	Min	p25	p50	p75	Max
Main Variables (H1a)								
ln(Distance)	407,497	4.49	2.72	0.00	3.89	5.56	6.54	8.00
InvestmentDummy	407,497	0.03	0.16	0	0	0	0	1
Main Variables (H1b, H2, H3)								
ln(Distance)	11,054	3.97	2.81	0.00	0.00	4.90	6.50	8.00
ln(InvestmentAmount)	11,054	8.94	1.14	5.08	8.41	8.92	9.62	14.21
ln(Likes)	11,054	6.30	1.23	3.09	5.52	6.25	7.17	8.34
Relationship	11,054	0.72	0.45	0	0	1	1	1
Control Variables								
ln(Experience)	11,054	3.57	2.37	0.00	1.10	4.16	5.58	7.55
Gender	11,054	0.84	0.37	0	1	1	1	1
ln(Goal)	11,054	14.7	1.22	11.61	13.60	14.90	15.80	16.31
InvestorAge	11,054	34.25	8.72	16	28	33	39	89

This table displays the descriptive statistics including all variables of the empirical analysis. N describes the number of observations (for sample selection criteria, see Section 4.4.1). The variable $InvestorAge$ constitutes the base for creating the dummy variables $AgeGroup_k$ included in the empirical analysis. Table A.4.4 of the Appendix displays the definitions of all variables.

[33] For understandability purposes, we describe absolute numbers in the text instead of the natural logarithms which are depicted in *Table 4.2*.

Looking at the control variables, 75% of the investors in our sample are equal or under 39 years of age.[34] Furthermore, 84% are male. This is in line with previous studies on the typical characteristics of crowdfunding investors (e.g., Hervé et al. 2019). The average investor in our sample has been registered on the platform for 195 days (i.e., approximately 0.5 years) before investing in a particular startup. The financing goal by startups ranges from 109,800 to 12,100,000 MXN (equals approximately 5,500 to 605,000 USD). *Table A.4.2* of the Appendix displays detailed descriptive statistics for all variables.

Demir (2009) and Berre and Le Pendeven (2021) state that the general macroeconomic situation matters for investment decisions in crowdinvesting. To review this relationship, we specify the following regression equation:

$$\begin{aligned} InvestmentDummy_{s,i} = \alpha &+ \beta_1 * GDP_k + \beta_2 * USBorder_k \\ &+ \beta_3 * SchoolDegree_k + \beta_4 * PopulationDensity_k \\ &+ \beta_5 * MalePopulation_k + \beta_6 * Internet_k \\ &+ \beta_7 * NewFirms_k + \beta_8 * FirmSurvival_k \\ &+ \beta_9 * GDP_l + \beta_{10} * USBorder_l \\ &+ \beta_{11} * SchoolDegree_l + \beta_{12} * PopulationDensity_l \\ &+ \beta_{13} * MalePopulation_l + \beta_{14} * Internet_l \\ &+ \beta_{15} * NewFirms_l + \beta_{16} * FirmSurvival_l + \epsilon_{s,i} \end{aligned} \tag{4.1}$$

where $InvestmentDummy_{s,i}$ measures if an investor i invests in startup s. We employ all subsequently described variables for all Mexican states with k for the startup's state of domicile and l for the investor's state of residence. We first include the GDP representing the gross domestic product of the respective Mexican state (in million MXN). $USBorder$ represents a dummy variable which takes the value of one if the state borders the U.S. $SchoolDegree$ represents the average school degree of the state's population (in years), $PopulationDensity$ measures the population density of the state (in inhabitants per km^2), and $MalePopulation$ represents the proportion of men (divided by 100 women per state). As suggested by, e.g., Bernoth and Colavecchio (2014) and Berre and Le Pendeven (2021), we additionally cover variables on the states' entrepreneurial environment. $Internet$ measures the proportion of firms selling their products online, $NewFirms$ the proportion of new firms, and $FirmSurvival$ the proportion of surviving firms, each divided by the total number of firms in the respective Mexican state.[35]

[34] *Table A.4.2* of the Appendix displays detailed descriptive statistics for the distribution of the created dummy variables for the different age groups.

[35] We assume these macroeconomic and entrepreneurial variables to be quite stable over time. Therefore, we include data from only one year into the regression even though investments have taken place between 2015 and 2019. For further information, we refer to *Table A.4.4* of the Appendix. This decision is also based on the limited availability of information for some of these variables.

Table 4.3: *Link between the Macroeconomic Environment and the Investment Probability*

Dependent Variable: InvestmentDummy	(1) With Mexico City	(2) Without Mexico City
Startup Environment		
GDP	0.0000	0.0000
	(0.2800)	(0.2829)
USBorder	**1.6759*** **	**1.6824*** **
	(<0.0001)	**(<0.0001)**
SchoolDegree	-0.6398	-0.6446
	(0.3835)	(0.3843)
PopulationDensity	0.3618	-
	(0.4957)	-
MalePopulation	-	-
	-	-
Internet	**2.1482** **	**2.1541** **
	(0.0175)	**(0.0182)**
NewFirms	**1.3971*** **	**1.4000*** **
	(<0.0001)	**(<0.0001)**
FirmSurvival	**0.7293***	**0.7314***
	(0.0822)	**(0.0844)**
Investor Environment		
GDP	0.0000	0.0000
	(0.9790)	(0.5897)
USBorder	0.0553	0.0641
	(0.4285)	(0.7763)
SchoolDegree	0.0140	-0.0959
	(0.8587)	(0.6920)
PopulationDensity	0.1351	-0.3566
	(0.5474)	(0.4675)
MalePopulation	0.0142	**0.4376** **
	(0.9134)	**(0.0273)**
Internet	-0.1065	0.0365
	(0.1505)	(0.8458)
NewFirms	0.0673	-0.0609
	(0.2499)	(0.6409)
FirmSurvival	-0.0548	0.1210
	(0.6028)	(0.6862)
Constant	Yes	Yes
Observations	407,497	129,088
Pseudo R^2	0.0160	0.0576

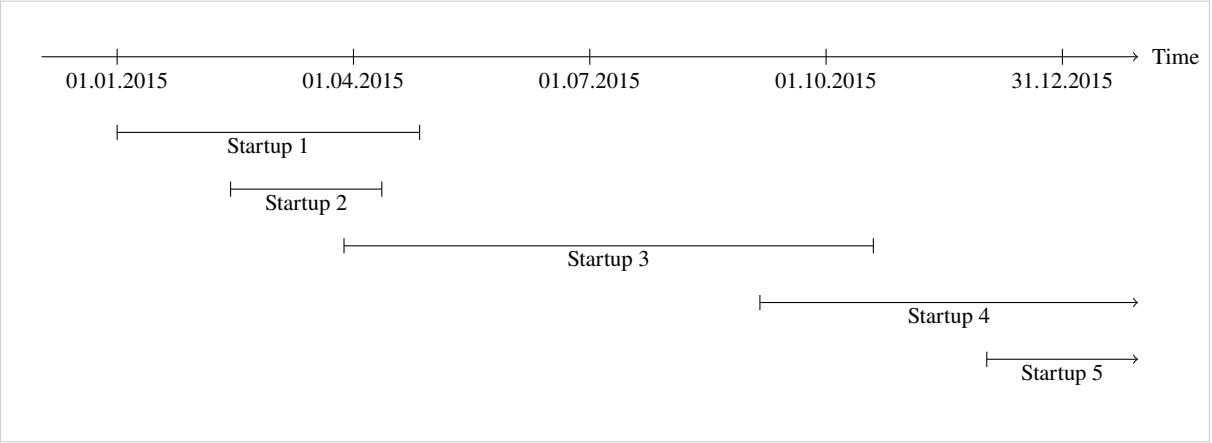
*This table displays the results of two logit regressions. Column (1) displays the results including all observations. Column (2) displays the results for observations from startups and investors from outside Mexico City. In a logit regression, there is no R-squared (= share of variance explained by the predictors) computable as, e.g., within an OLS regression. The Pseudo R-squared is calculated as McFadden's Pseudo R-squared (McFadden 1974). Robust standard errors are clustered at the startup level. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Table A.4.4 of the Appendix displays the definitions of all variables.*

Table 4.3 displays the regression results. We find a significant effect of most macroeconomic variables within the startups' states of domicile whereas the macroeconomic situation in the

investors' states does not seem to matter as much in investment decisions.[36] Being located in a state which borders the U.S. significantly increases startups' probability of receiving financial support from Mexican investors via crowdinvesting. Similarly, the higher the proportion of new firms and firm survival, the higher appears the probability of startup investments. This is in line with the idea that investors' willingness to support early-stage startups increases in regions which are perceived as more innovative (e.g., Grilli 2019; Ughetto et al. 2019).

As many observations show a relationship to Mexico City, being it on investor or startup side, we reconduct the analyses for all observations without this connection. In column (2) of *Table 4.3*, we find similar effects of the macroeconomic and entrepreneurial variables on the investment probability. Summing up, our data underscores that especially startups' environment seems to matter for investment decisions. In turn, crowdinvesting might in varying surroundings be differently able to offset the challenge of missing internal financial resources which startups often face in their early life. This finding leads us to include fixed effects for both investor and startup states into our subsequent analyses to capture all cross-sectional and time-invariant characteristics on both sides.

Figure 4.7: *Example on the Distribution of Investment Periods*



Our observation period covers the years 2015 to 2019. The duration of startups' individual investment period ranges between 41 and 243 days with a mean of 126 days. *Figure 4.7* exemplarily displays the distribution of five investment periods of different startups throughout the year 2015. We see that investment periods are differently long, and can terminate within a calendar year or continue beyond. We split all individual investment periods of our sample (from the years 2015 to 2019) in quintiles, i.e., five equivalently long time frames, to shed light on the investment timing.

[36] The variable *MalePopulation* which serves as a measure for the general risk preference of investors is dropped for reasons of multicollinearity.

Table 4.4 displays the descriptive statistics. The table depicts the absolute number of investments (N) per quintile as well as the average investment amount per investor per startup (mean, etc.). With 3,326 observations, we find a large number of crowdinvestors investing shortly before the end of the investment period. On average, the investment amount decreases in the mid of an investment period. Both findings suggest including fixed effects for investment timing into our further analyses to avoid biased results.

Table 4.4: *Distribution of Investments per Startup Investment Period*

	N	Mean	StdDev	Min	p25	p50	p75	Max
1st Quintile	2,102	21,409	55,828	300	5,100	9,900	18,000	1,000,000
2nd Quintile	1,689	17,332	38,292	300	5,000	9,900	18,000	500,000
3rd Quintile	1,835	12,973	25,759	300	4,700	7,500	11,100	500,000
4th Quintile	2,102	12,690	26,549	300	4,000	7,500	10,200	600,000
5th Quintile	3,326	16,086	51,281	160	4,000	7,500	12,500	1,490,000
Total	11,054	16,126	43,139	160	4,500	7,500	15,000	1,490,000

This table displays the distribution of investments and the investment amount within an investment period. The investment period per startup is split into five equivalently long time frames. The sample covers all observations for which an investment has taken place.

4.4.5 Research Design

4.4.5.1 Information Asymmetries in Investment Decisions and Investment Size Decisions

Hypothesis 1a and *Hypothesis 1b* focus on the differences in the access to information between startups and (potential) investors. We expect that *higher information asymmetries between investors and startups negatively influence investors' decision to invest* (*Hypothesis 1a*) as well as *the investment amount* (*Hypothesis 1b*). With these ideas, we follow several researchers in the field of finance and startup investments (e.g., Coval and Moskowitz 1999; Lutz et al. 2013; Niemand et al. 2018) who argue that distance is a suitable measure for information asymmetries, with a higher distance decreasing the access to information. For analyzing this relationship, we employ a logit regression followed by an OLS regression which we specify as follows:

$$InvestmentDummy_{s,i} = \alpha + \beta_1 * ln(Distance_{s,i}) + \rho_k + \tau_l + \epsilon_{s,i} \tag{4.2}$$

$$\begin{aligned} ln(InvestmentAmount_{s,i}) = \alpha &+ \beta_1 * ln(Distance_{s,i}) \\ &+ \beta_2 * ln(Experience_i) + \beta_3 * Gender_i + \beta_4 * ln(Goal_s) \\ &+ \sum_{j=1}^{6} \beta_{j+4} * AgeGroup_{i,j} + \rho_k + \tau_l + \omega_m + \theta_t + \epsilon_{s,i} \end{aligned} \tag{4.3}$$

where $InvestmentDummy_{s,i}$ in *Equation (4.2)* measures if an investor i invests in startup s. In turn, we can derive the probability for startup investments via crowdinvesting given certain criteria. The variable $ln(InvestmentAmount_{s,i})$ in *Equation (4.3)* describes the investment amount of investor i in startup s in Mexican Pesos. In both equations, $ln(Distance_{s,i})$ serves as the proxy for information asymmetries and is measured as the physical distance in kilometers between investor i and startup s. In *Equation (4.3)*, we add three investor characteristics to the regression equation to control for systematic differences in these regards. $ln(Experience_i)$ controls for the time of investor i on the crowdinvesting platform. $Gender_i$ takes the value of one for male investors and the value of zero for female investors. $AgeGroup_{i,j}$ measures the age of investor i using six dummy variables for the different decades j of age. The dummy variables are included for investors between 31 and 40, 41 and 50, 51 and 60, 61 and 70, 71 and 80, and over 80 years to account for biases due to differing individual financial usage. Investors under or equal to 30 years serve as the reference group. Additionally, we control for startups' financing goal using the variable $ln(Goal_s)$. In *Equation (4.2)*, we do not include these control variables as we cannot calculate, e.g., investors' age at the time of investment, when no investment has taken place. We also include fixed effects for startup states k (ρ_k) and investor states l (τ_l) to control for characteristics in the macroeconomic environment. In *Equation (4.3)*, we add fixed effects for investment timing (ω_m) and years (θ_t) to control for investment time-specific aspects.

4.4.5.2 Investor-Startup-Relationship

The relationship between investors and startups constitutes a crucial factor with regard to the financial support provided. Several researchers find that social connections increase the probability of receiving external funding and, in turn, the chances of startup success (e.g., Mollick 2014; Angerer et al. 2017). Therefore, we expect in *Hypothesis 2* that *an existing investor-startup-relationship positively mitigates the effect of information asymmetries between investors and startups on the investment amount*. We analyze this relationship using the following OLS regression equation:

$$\begin{aligned} ln(InvestmentAmount_{s,i}) = \alpha &+ \beta_1 * ln(Distance_{s,i}) + \beta_2 * Relationship_{s,i} \\ &+ \beta_3 * ln(Distance_{s,i}) * Relationship_{s,i} \\ &+ \beta_4 * ln(Experience_i) + \beta_5 * Gender_i \\ &+ \beta_6 * ln(Goal_s) + \sum_{j=1}^{6} \beta_{j+6} * AgeGroup_{i,j} \\ &+ \rho_k + \tau_l + \omega_m + \theta_t + \epsilon_{s,i} \end{aligned} \tag{4.4}$$

where $ln(InvestmentAmount_{s,i})$ again describes the individual investment amount of investor i in startup s, and $ln(Distance_{s,i})$ serves as the proxy for information asymmetries between

investor i and startup s. The variable $Relationship_{s,i}$ measures the investor-startup-relationship. The coefficient β_3 quantifies the moderating effect of this relationship on the effect of differing information between startups and investors on the investment amount (*Hypothesis 2*). We control again for investor characteristics ($ln(Experience_i)$, $Gender_i$, and $AgeGroup_{i,j}$) and the startups' financing goal ($ln(Goal_s)$), and include startup state (ρ_k), investor state (τ_l), investment timing (ω_m), and year (θ_t) fixed effects.

4.4.5.3 Startup Likes

We investigate the effects of signals, in this case, likes received on the crowdinvesting platform, on investment decisions. Startup likes are an objectively observable signal by a third party about the perceived quality of a startup. Following Mochon et al. (2017) and Carr et al. (2018), we expect that *the received likes positively mitigate the effect of information asymmetries between investors and startups on the investment amount* (*Hypothesis 3*). In this case, we employ the following OLS regression equation:

$$\begin{aligned} ln(InvestmentAmount_{s,i}) = \alpha &+ \beta_1 * ln(Distance_{s,i}) + \beta_2 * ln(Likes_s) \\ &+ \beta_3 * ln(Distance_{s,i}) * ln(Likes_s) \\ &+ \beta_4 * ln(Experience_i) + \beta_5 * Gender_i \\ &+ \beta_6 * ln(Goal_s) + \sum_{j=1}^{6} \beta_{j+6} * AgeGroup_{i,j} \\ &+ \rho_k + \tau_l + \omega_m + \theta_t + \epsilon_{s,i} \end{aligned} \tag{4.5}$$

where $ln(Likes_s)$ describes the number of likes that a startup s has received on the platform until the time of investment. β_3 captures the moderating effect of the likes of startup s on the link between informational asymmetries between investor and startup, and the investment amount (*Hypothesis 3*). All other variables are defined as above.

4.5 Empirical Results

4.5.1 Effects of Information Asymmetries

We expect that *higher information asymmetries between investors and startups negatively influence investors' decision to invest* (*Hypothesis 1a*) as well as *the investment amount* (*Hypothesis 1b*). We follow a large strand of studies in entrepreneurial research, showing that information asymmetries matter for investment decisions in crowdinvesting (e.g., Piva and Rossi-Lamastra 2018; Kleinert et al. 2020). In line with other researchers (e.g., Coval and Moskowitz 1999;

Lutz et al. 2013; Niemand et al. 2018), we proxy investors' informational disadvantage by the physical distance between investors and startups.

Column (1) of *Table 4.5* displays the regression results of a logit regression investigating the effect of distance on the investment probability. Columns (2) and (3) depict the results of an OLS regression for the effects on the investment amount. In line with our hypotheses and most studies in the research area of crowdfunding, we find informational disadvantages to decrease the investment probability (-0.1420, p-value: <0.0001) as well as the investment amount (-0.0413, p-value: 0.0005).

Table 4.5: *Link between Distance and Investment Decisions*

	(1)	(2)	(3)
Dependent Variable:	InvestmentDummy	ln(InvestmentAmount)	
ln(Distance)	**-0.1420*** **	**-0.0479*** **	**-0.0413*** **
	(<0.0001)	**(0.0001)**	**(0.0005)**
ln(Experience)			**-0.0213*** **
			(0.0001)
Gender			**0.2095*** **
			(<0.0001)
ln(Goal)			**0.4823*** **
			(<0.0001)
AgeGroup 31-40			**0.1795*** **
			(<0.0001)
AgeGroup 41-50			**0.3702*** **
			(<0.0001)
AgeGroup 51-60			**0.5058*** **
			(<0.0001)
AgeGroup 61-70			**0.8227*** **
			(<0.0001)
AgeGroup 71-80			**0.4757** **
			(0.0375)
AgeGroup 81+			0.2183
			(0.7476)
Constant	Yes	Yes	Yes
Investor-State FE	Yes	Yes	Yes
Startup-State FE	Yes	Yes	Yes
Investment-Timing FE	No	Yes	Yes
Time FE	No	Yes	Yes
Observations	407,497	11,054	11,054
(Pseudo) R^2	0.0241	0.2114	0.3369

*This table displays in Column (1) the results of a logit regression including all observations. Columns (2) and (3) display the results of OLS regressions which include only those observations in which an investment has taken place. Robust standard errors are clustered at the startup-state level. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on year level. Table A.4.4 of the Appendix displays the definitions of all variables.*

In contrast to researchers arguing that the rising use of the Internet diminishes the importance of geographic distance for investment decisions (e.g., Agrawal et al. 2015; Hornuf and Neuenkirch

2017), we find that distance still matters in crowdinvesting. A 10% increase in distance, measured in kilometers, decreases the investment probability by 1.42pp and the investment amount by 0.41%.[37] Both results are statistically significant at the 1% level. We explain this finding by information asymmetries which result in higher uncertainty for investors. Investors with a larger distance to a startup are neither able to easily observe the startup's progress nor can they directly gather soft personal information on or by the startup's management. Therefore, investors further apart have to rely on hard information and informational reports created by the startup, and published on the crowdinvesting platform. This hard information does not seem to have the same informative value for investors as soft information transferred with lower distance. The finding might be explained by the riskiness of startup investments which cannot easily be measured by hard facts (Carpenter and Petersen 2002).

A longer time being registered on the crowdinvesting platform appears to have a significantly negative effect on the investment amount. We explain this finding by the idea that more experienced investors show lower risk appetite, are less overconfident and diversify their portfolio more compared to less experienced investors (e.g., Morin and Suarez 1983; Goetzmann and Kumar 2008). These more experienced investors might be more cautious due to previous (unsuccessful) crowdinvesting activities and thus prefer to conduct a large number of small investments in different projects. Furthermore, we find that men invest, on average, 23.31% more compared to women.[38] As startup investments, and especially crowdinvesting activities, are usually characterized as a risky investment alternative, this is in line with Rieger et al. (2015) who state that men are less risk-averse than their female counterparts.

Additionally, we find that the investment amount is higher if the startup has published a larger financing goal. A 10% increase in the financing goal correlates with a 4.82% increase in the individual investment amount. Moreover, the results show an inverted u-shape for the link between investors' age and the investment amount. This finding appears reasonable due to different stages in life with different financial bases and financial needs. Investors under or equal to 30 years of age are often still in their educational phase or early start of work life, and thus possess lower savings to invest. Investors above the age of 30 usually show an increasing monetary base and current income which they can use. Investors with more than 70 years of age commonly do not fall into the working population anymore, which decreases their current available income again. In line with this idea, people of this age group show lower investment amounts. *Table A.4.3* of the Appendix confirms this finding with regard to investors' age. When controlling for this factor by using the variables Age and Age^2 instead of the categorical variables for the different age groups, we find a statistically significant negative coefficient of Age^2.

[37] Calculation of the investment probability: Marginal effects as displayed in *Derivation A.4.1* of the Appendix.

[38] Calculation: $(e^{0.2095} - 1) * 100$.

4.5.2 Effects of the Investor-Startup-Relationship

In the following step, we analyze the effect of an existing relation between investors and startups on the actual amount provided by investors via crowdinvesting. As for the whole study, we focus on the first investment of each bilateral investor-startup-combination. We distinguish between investors who are complete strangers to the startup, and investors who show some kind of relationship to the startup, i.e., who are characterized as family/friends, customers, or knowing the startup through an event or maker network in our dataset.

Table 4.6: *Link between Distance, the Investor-Startup-Relationship, and Investment Size*

Dependent Variable: ln(InvestmentAmount)	(1)	(2)
ln(Distance)	**-0.0374*** **	**-0.0351*** **
	(0.0009)	**(0.0016)**
Relationship	**0.0969*** **	**0.1173** **
	(0.0005)	**(0.0187)**
ln(Distance) × Relationship		-0.0061
		(0.5952)
ln(Experience)	**-0.0187*** **	**-0.0186*** **
	(0.0004)	**(0.0003)**
Gender	**0.2156*** **	**0.2156*** **
	(<0.0001)	**(<0.0001)**
ln(Goal)	**0.4803*** **	**0.4803*** **
	(<0.0001)	**(<0.0001)**
Age 31-40	**0.1806*** **	**0.1802*** **
	(<0.0001)	**(<0.0001)**
Age 41-50	**0.3731*** **	**0.3738*** **
	(<0.0001)	**(<0.0001)**
Age 51-60	**0.5041*** **	**0.5029*** **
	(<0.0001)	**(<0.0001)**
Age 61-70	**0.7940*** **	**0.7935*** **
	(<0.0001)	**(<0.0001)**
Age 71-80	**0.4157***	**0.4178***
	(0.0713)	**(0.0649)**
Age 81+	0.1763	0.1747
	(0.7928)	(0.7968)
Constant	Yes	Yes
Investor-State FE	Yes	Yes
Startup-State FE	Yes	Yes
Investment-Timing FE	Yes	Yes
Time FE	Yes	Yes
Observations	11,054	11,054
R^2	0.3382	0.3382

*This table displays the results of OLS regressions including observations in which an investment has taken place. Robust standard errors are clustered at the startup-state level. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on year level. Table A.4.4 of the Appendix displays the definitions of all variables.*

Hypothesis 2 suggests that *an existing investor-startup-relationship positively mitigates the effect of information asymmetries between investors and startups on the investment amount. Table 4.6* displays the estimation results for *Equation (4.4)*, depicting the coefficients from an OLS regression with and without the interaction of information asymmetries and an investor-startup-relationship. As above, we find a significantly negative coefficient for the distance between investors and startups (-0.0351, p-value: 0.0016). The coefficient is of similar size as in the previous analyses. As expected, we find a positive main coefficient of relationships on the investment amount (0.1173, p-value: 0.0187). Investor-startup-combinations with a relationship show an investment amount which is, on average, 12.45% higher compared to those without a relationship.[39] This result seems plausible as one can assume that investors with a relationship to a startup experience lower information asymmetries due to previous interactions with the startup. Overall, our findings display that both distance and the relationship between startups and investors matter for the investment amount.

In contrast to our expectations, the interaction coefficient of distance and relationship appears non-significant (-0.0061, p-value: 0.5952). Thus, we cannot say that investor-startup-relationships counteract the negative main effect of information asymmetries. Even though it might seem counter-intuitive at first glance, this finding is in line with the idea by Lee and Persson (2016). The authors claim that startups should not solely use funding by family and friends as, in times of trouble, "using family finance as risk capital undermines the preexisting familial insurance arrangement" (p. 2344). Hernández-Trillo et al. (2005) and Hill et al. (2021) underscore this idea. They show family and friends to serve as a "type of insurance" or "safety net", respectively, in financially difficult times.

We also find statistically significant results regarding investors' gender, experience, and all age groups except for the one with people of 80+ years of age. Similar as in the analyses above, male investors invest 24.06% more within their first investment in a startup compared to female investors (p-value: <0.0001).[40] We also observe again the inverted u-shaped relation between the investors' age and the investment amount. As above, a longer time period being registered on the platform shows a statistically negative coefficient of -0.0186 (p-value: 0.0003), which depicts that investors provide startups with smaller individual funds when they are more experienced in crowdinvesting.

4.5.3 Effects of Startup Likes

In the next step, we analyze the effect of signals on investment decisions via crowdinvesting. As one specific measurable signal, we employ the amount of likes received, which is published on the crowdinvesting website. Block et al. (2018) show that likes influence funding decisions

[39] Calculation: $(e^{0.1173} - 1) * 100$.
[40] Calculation: $(e^{0.2156} - 1) * 100$.

in startups. We assume a higher number of likes to be a positive signal for startups' future evolution and thus to reduce the negative effect of information asymmetries on investment decisions. Consequently, *Hypothesis 3* suggests that *the received likes positively mitigate the effect of information asymmetries between investors and startups on the investment amount*.

Table 4.7: *Link between Distance, Startup Likes, and Investment Decisions*

	(1)	(2)	(3)	(4)
Dependent Variable:	InvestmentDummy		ln(InvestmentAmount)	
ln(Distance)	**-0.1457*** **	-0.1137	**-0.0405*** **	**-0.0900*** **
	(<0.0001)	(0.2030)	**(<0.0001)**	**(<0.0001)**
ln(Likes)	**0.8093*** **	**0.8284*** **	**-0.0809*** **	**-0.1095*** **
	(<0.0001)	**(<0.0001)**	**(<0.0001)**	**(<0.0001)**
ln(Distance) × ln(Likes)		-0.0052		**0.0081** **
		(0.7262)		**(0.0056)**
ln(Experience)			**-0.0214*** **	**-0.0215*** **
			(<0.0001)	**(<0.0001)**
Gender			**0.2106*** **	**0.2115*** **
			(<0.0001)	**(<0.0001)**
ln(Goal)			**0.5487*** **	**0.5490*** **
			(<0.0001)	**(<0.0001)**
Age 31-40			**0.1760*** **	**0.1756*** **
			(<0.0001)	**(<0.0001)**
Age 41-50			**0.3649*** **	**0.3625*** **
			(<0.0001)	**(<0.0001)**
Age 51-60			**0.4967*** **	**0.4948*** **
			(<0.0001)	**(<0.0001)**
Age 61-70			**0.8179*** **	**0.8140*** **
			(<0.0001)	**(<0.0001)**
Age 71-80			0.4241	0.4132
			(0.1772)	(0.1868)
Age 81+			0.1786	0.1702
			(0.7345)	(0.7490)
Constant	Yes	Yes	Yes	Yes
Investor-State FE	Yes	Yes	Yes	Yes
Startup-State FE	Yes	Yes	Yes	Yes
Investment-Timing FE	No	No	Yes	Yes
Time FE	No	No	Yes	Yes
Observations	407,497	407,497	11,054	11,054
(Pseudo) R^2	0.0954	0.0954	0.3388	0.3393

*This table displays in Columns (1) and (2) the results of logit regressions including all observations. Columns (3) and (4) display the results of OLS regressions including only those observations in which an investment has taken place. Robust standard errors are clustered at the startup-state level. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on year level. Table A.4.4 of the Appendix displays the definitions of all variables.*

Table 4.7 displays the estimation results for *Equation (4.5)*. In columns (3) and (4), we find negative coefficients for a higher distance between investor and startup, and the investment amount. In contrast to our expectations that more likes lead to a higher investment amount,

we find a statistically significant negative main coefficient (-0.1095, p-value: <0.0001). This is surprising at first sight. We explain this finding with the idea that projects with a high number of likes are seen as comparatively safe to be financed in the short run. Therefore, investors hop on to these projects with a small amount of money to benefit from investments by other investors. At the same time, these investors seem to keep risk diversification in mind. Thereby, they exploit the indirect support from other investors and can still split their total investment amount on several projects, reducing their individual risk.

The interaction coefficient between distance and likes counteracts the negative main effects of these variables. With a value of 0.0081, the interaction effect is small but statistically significant (p-value: 0.0056). As our measure for information asymmetries, it is still of economic significance. For the mean distance in our sample, a one percent increase in the number of likes leads to an increase in the investment amount of approximately 3.2pp.[41] As in our previous analyses, the results with regard to investors' gender are positive and statistically significant. Male investors invest 23.55% more than female investors (p-value: <0.0001).[42] The inverted u-shape for investors' age persists. Investor experience shows a statistically significant negative coefficient of -0.0215 (p-value: <0.0001) which is of similar size as above.

Columns (1) and (2) support our idea of an existing link between likes and investment decisions. We find a substantially larger main coefficient for likes (0.8093, p-value: <0.0001) compared to distance (-0.1457, p-value: <0.0001). Thus, a higher number of likes seems to have a significantly positive effect on the investment probability, which additionally by far dominates the negative effect of higher information asymmetries. It indicates that investors rely on other investors' experience in their decision-making. This is in line with the literature (e.g., Coursaris et al. 2016). The positive main effect of likes persists when including the interaction between distance and likes. In contrast, the negative main coefficient of distance turns non-significant (-0.1137, p-value: 0.2030) which displays that the interaction term captures part of the initial main effect. However, the interaction does not seem to explain sufficiently much of the effect on our dependent variable as the coefficient of this interaction term is also non-significant (0.0052, p-value: 0.7262). Summing up, our results suggest a link between information asymmetries, likes, and investment decisions. However, future studies should investigate these links again in more detail.

[41] Calculation: $0.1095 - (0.1095 - 0.0081 * 3.9733)$.

[42] Calculation: $(e^{0.2115} - 1) * 100$.

4.6 Robustness Tests

We first repeat the analyses from above only for observations with investors from outside Mexico City which is by far the largest city of Mexico with approximately 22 million inhabitants.[43] 66.25% of our investors are from outside the capital city. Thereby, we account for differences in the general mindset of investors living in urban versus more rural areas. Bhayani et al. (2019, p. 3775) confirm that "there is considerable difference observed in investment behavior of urban and rural investors, with respect to the choice of investment". While the authors observe this fact within India, also for American investors it appears to exist (Copeland 2022). Sachan and Chugan (2020) go even further and explain that information processing is more limited for rural investors. Thus, it is of main importance to further investigate the differences in investment decisions between rural and urban investors, leading us to our first robustness test.

Table 4.8: *Results Excluding Observations with Investors from Mexico City*

Dependent Variable:	(1) Investment Dummy	(2) ln(Investment Amount)	(3) ln(Investment Amount)	(4) Investment Dummy	(5) ln(Investment Amount)
ln(Distance)	**-0.2079*** **	**-0.0604*** **	**-0.0458** **	-0.0983	**-0.1142*** **
	(<0.0001)	**(0.0004)**	**(0.0379)**	(0.5942)	**(0.0018)**
Relationship			0.2058		
			(0.2280)		
ln(Distance) × Relationship			-0.0158		
			(0.5570)		
ln(Likes)				**0.8963*** **	**-0.1293*** **
				(<0.0001)	**(0.0005)**
ln(Distance) × ln(Likes)				-0.0197	0.0093
				(0.5266)	(0.1170)
Investor Controls	No	Yes	Yes	No	Yes
Startup Controls	No	Yes	Yes	No	Yes
Constant	Yes	Yes	Yes	Yes	Yes
Investor-State FE	Yes	Yes	Yes	Yes	Yes
Startup-State FE	Yes	Yes	Yes	Yes	Yes
Investment-Timing FE	No	Yes	Yes	No	Yes
Time FE	No	Yes	Yes	No	Yes
Observations	268,747	7,385	7,385	268,747	7,385
(Pseudo) R^2	0.0265	0.3629	0.3649	0.0932	0.3650

*This table includes only observations from investors outside Mexico City. Columns (1) and (4) display the results of logit regressions including all observations meeting the criteria. Columns (2), (3), and (5) display the results of OLS regressions including only those observations in which an investment has taken place. Robust standard errors are clustered at the startup-state level. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on year level. Table A.4.4 of the Appendix displays the definitions of all variables.*

[43] The second and third largest cities of Mexico, i.e., Guadalajara (Jalisco) and Monterrey (Nuevo Léon), show a population of approximately one fourth of the population of Mexico City each. We refer to Section 4.4.2 for further details on the local distribution of investors and startups.

As above, we find negative coefficients for distance in *Table 4.8*, showing that higher information asymmetries decrease the investment probability as well as the investment amount. In contrast to the results above, we find a different importance of relationships in this sample. Whereas in the case when including all investors from inside and outside Mexico City the main coefficient of the dummy variable for relationship is significantly positive, it turns non-significant when reconducting the analyses for investors only from outside Mexico City (0.2058, p-value: 0.2280).

Several studies show that people living in rural areas give higher weight to the bonding to family and friends (e.g., House et al. 1988; Sørensen 2016). We additionally know that it is recommendable for early-stage firms to keep family and friends to the greatest extent possible as fallback option when following risky business ideas (Hernández-Trillo et al. 2005). While we find that investors from rural areas seem to be aware of and consider this concept in their decision on the investment amount, investors from urban areas seem to ignore this argument. The main coefficients for the effects of likes on the investment probability and investment amount, are similar to above. We again find a significantly positive coefficient (0.8963, p-value: <0.0001) for the effect of likes on the investment probability and a significantly negative coefficient (-0.1293, p-value: 0.0005) for the effect on the investment amount. The interaction term in column (5) of *Table 4.8* turns non-significant but remains of same size and direction (0.0093, p-value: 0.1170). This finding has to be interpreted with caution but hints towards the idea that likes are more important for urban investors compared to investors living in rural areas.

In the following, we further investigate the effects induced by higher distance between investors and startups. For this purpose, we exclude investments within the same state (99,450 and 3,387 observations, respectively).[44] In *Table 4.9*, we find more negative coefficients for distance compared to the analyses above. This seems reasonable when excluding observations with zero distance between startup and investor. Interestingly, the main coefficient for relationship turns from significantly positive to significantly negative (-0.2519, p-value: 0.0109). For investors who are not located in the same state as the investee, having a relationship to the startup negatively influences the investment amount. This finding underscores the idea that these investors are aware of the thought that related parties should not be the exclusive supporters of an affiliated startup but rather be kept as fallback options as far as possible (Hernández-Trillo et al. 2005). In contrast, investors from the same state as the startup, do not seem to keep this idea in mind. The interaction term of distance and relationship (0.0548, p-value: 0.0103) changes from non-significantly negative to significantly positive. This change seems reasonable for information purposes. If both parties are located in states which are far apart from each other, the information flow is not as easy as in the case of spatial proximity. A relationship decreases information asymmetries and allows a smoother information flow. In particular, relationships offset opportunity costs for seeking information (e.g., Agrawal et al. 2008). The main coefficients for likes are similar as

[44] Unreported evidence shows that 87.63% of these zero-distance-observations describe investments within Mexico City. This equals 95.04% of the observations in our larger sample for the analysis of *Hypothesis 1a*.

in the main analyses. The coefficient of the interaction term turns again non-significant, but remains of the same direction as above.

Table 4.9: *Results Excluding Observations with Investors and Startups from the Same State*

Dependent Variable:	(1) Investment Dummy	(2) ln(Investment Amount)	(3) ln(Investment Amount)	(4) Investment Dummy	(5) ln(Investment Amount)
ln(Distance)	**-0.2010*** (<0.0001)**	**-0.0813** (0.0303)**	**-0.0902** (0.0226)**	0.1430 (0.4788)	**-0.1274** (0.0265)**
Relationship			**-0.2519*** (0.0109)**		
ln(Distance) × Relationship			**0.0548** (0.0103)**		
ln(Likes)				**1.1026*** (<0.0001)**	**-0.0995** (0.0330)**
ln(Distance) × ln(Likes)				-0.0550 (0.1074)	0.0073 (0.3543)
Investor Controls	Yes	Yes	Yes	Yes	Yes
Startup Controls	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes
Investor-State FE	Yes	Yes	Yes	Yes	Yes
Startup-State FE	Yes	Yes	Yes	Yes	Yes
Investment-Timing FE	No	Yes	Yes	No	Yes
Time FE	No	Yes	Yes	No	Yes
Observations	308,047	7,667	7,667	308,047	7,667
(Pseudo) R^2	0.0271	0.2352	0.3572	0.0924	0.3574

*This table includes only observations in which investors and startups are from different states. Columns (1) and (4) display the results of logit regressions including all observations meeting the criteria. Columns (2), (3), and (5) display the results of OLS regressions including only those observations in which an investment has taken place. Robust standard errors are clustered at the startup-state level. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on year level. Table A.4.4 of the Appendix displays the definitions of all variables.*

Instead of including the natural logarithm of the investor-startup-distance into the regression analyses, we now include dummy variables for each quintile as independent variables. The lowest quintile, which serves as reference group in the analysis, contains only zero-distance-observations (99,450 observations).[45] The highest quintile comprises all investor-startup-combinations with a distance of equal to or more than 897 km. Thereby, we strive to look at which distances exactly matter in investment decisions.[46]

[45] It is alike in the smaller sample in *Hypothesis 1b*, *Hypothesis 2*, and *Hypothesis 3* with 3,387 observations in the lowest quintile.

[46] *Table A.4.2* of the Appendix displays further details on the descriptive statistics.

Table 4.10: *Results Dividing Distance Into 20%-Quantiles*

Dependent Variable:	(1) Investment Dummy	(2) ln(Investment Amount)	(3) ln(Investment Amount)	(4) Investment Dummy	(5) ln(Investment Amount)
$\ln(\text{Distance})_{Q2}$	**-0.3253*** **	-0.0106	0.0305	**-0.8707*** **	0.0198
	(0.0001)	(0.9103)	(0.7491)	**(0.0054)**	(0.9080)
$\ln(\text{Distance})_{Q3}$	**-0.8168*** **	**-0.1651** **	-0.0762	-0.3879	**-0.7116*** **
	(<0.0001)	**(0.0196)**	(0.3680)	(0.1803)	**(<0.0001)**
$\ln(\text{Distance})_{Q4}$	**-0.7958*** **	**-0.2655*** **	**-0.1868*** **	-1.1310	**-0.5209*** **
	(<0.0001)	**(<0.0001)**	**(0.0016)**	(0.3381)	**(0.0007)**
$\ln(\text{Distance})_{Q5}$	**-1.1528*** **	**-0.4776*** **	**-0.3489*** **	-0.5027	**-0.5790*** **
	(<0.0001)	**(0.0019)**	**(0.0061)**	(0.2228)	**(0.0004)**
Relationship			**0.1444** **		
			(0.0111)		
$\ln(\text{Distance})_{Q2} \times$ Relationship			**-0.1535*** **		
			(0.0089)		
$\ln(\text{Distance})_{Q3} \times$ Relationship			-0.1119		
			(0.2785)		
$\ln(\text{Distance})_{Q4} \times$ Relationship			-0.0614		
			(0.6050)		
$\ln(\text{Distance})_{Q5} \times$ Relationship			-0.0047		
			(0.9627)		
ln(Likes)				**0.8096*** **	**-0.1045*** **
				(<0.0001)	**(<0.0001)**
$\ln(\text{Distance})_{Q2} \times$ ln(Likes)				**0.0854** **	-0.0060
				(0.0453)	(0.7977)
$\ln(\text{Distance})_{Q3} \times$ ln(Likes)				**-0.0742* **	**0.0975*** **
				(0.0855)	**(0.0001)**
$\ln(\text{Distance})_{Q4} \times$ ln(Likes)				0.0499	**0.0462** **
				(0.7908)	**(0.0439)**
$\ln(\text{Distance})_{Q5} \times$ ln(Likes)				**-0.1160* **	0.0333
				(0.0625)	(0.1826)
Investor Controls	Yes	Yes	Yes	Yes	Yes
Startup Controls	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes
Investor-State FE	Yes	Yes	Yes	Yes	Yes
Startup-State FE	Yes	Yes	Yes	Yes	Yes
Investment-Timing FE	No	Yes	Yes	No	Yes
Time FE	No	Yes	Yes	No	Yes
Observations	407,497	11,054	11,054	407,497	11,054
(Pseudo) R^2	0.0244	0.2131	0.3396	0.0962	0.3410

*This table includes the variable for measuring information asymmetries using quintiles instead of a discrete variable. Columns (1) and (4) display the results of logit regressions including all observations. Columns (2), (3), and (5) display the results of OLS regressions including only those observations in which an investment has taken place. Robust standard errors are clustered at the startup-state level. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on year level. Table A.4.4 of the Appendix displays the definitions of all variables.*

Columns (1) and (2) of *Table 4.10* confirm that the investment probability and investment amount decrease with higher distance. Compared to investor-startup-combinations from the

lowest-distance-quintile, the probability to invest decreases by 1.15pp[47] and the investment amount decreases by 43.95%[48] for investors with the largest distance to their investees.

The results show that there is no threshold above which an increase in distance does not influence the investment decision more negatively anymore. This contradicts Zook (2002) who state that investors do not invest if they cannot drive to the startup. They find this limit in the investor-startup-distance to be around 100 km. In our study, the threshold of 100 km is allocated within the second quintile. Thus, investor-startup-combinations in the third, fourth, or fifth quintile should show similar coefficients regarding the effects on the investment probability and investment size. We cannot confirm this idea as coefficients become more negative with increasing quintiles. Compared to the main analyses above, the coefficients measuring the effect of distance appear relatively large. This can be explained by the fact that the dummy variables in this part of the analyses measure the effect compared to the base group of investor-startup-pairs with a very low distance.

Table 4.11: *Results Only Qualifying Family/Friends as not Being Strangers to the Startup*

Dependent Variable: ln(InvestmentAmount)	(1)
ln(Distance)	**-0.0299***** **(0.0023)**
Relationship	**0.4175***** **(0.0012)**
ln(Distance) × Relationship	0.0055 (0.7018)
Investor Controls	Yes
Startup Controls	Yes
Constant	Yes
Investor-State FE	Yes
Startup-State FE	Yes
Investment-Timing FE	Yes
Time FE	Yes
Observations	11,054
R^2	0.3454

*This table characterizes only family and friends as not being strangers to the startup. It displays the results of an OLS regression including observations in which an investment has taken place. Robust standard errors are clustered at the startup-state level. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on year level. Table A.4.4 of the Appendix displays the definitions of all variables.*

Last, we investigate if the level of social proximity within a relationship matters for investment decisions. We now qualify only those investors as having a relationship to a startup when they are marked as "family/friends" in the platform's managerial system. Investors knowing the startup as customers, from a fair, or through a maker network are now considered as having no relationship,

[47] Calculation: Marginal effects as displayed in *Derivation A.4.1* of the Appendix.

[48] Calculation: $(e^{-0.5790} - 1) * 100$

i.e., being strangers to the startup. Crowdinvesting describes a form of financing which startups usually choose in a very early development stage. In this stage, they often use mainly family and friends as financing source (e.g., Angerer et al. 2017) even though it might not be optimal (Lee and Persson 2016).

We know that strangers as well as family members with a close relationship to the investee use crowdinvesting platforms as they do not always live nearby the startup. In this case, crowdinvesting platforms represent a convenient way to transfer money for a given purpose. Additionally, any party can thereby participate in startup success as shareholders of the firm without being involved in internal decisions. As *Table 4.11* displays, we find a negative main coefficient for distance and a positive main coefficient for relationship. While the size and significance of the coefficient of distance stay similar as in the main analyses above, the main coefficient for the relationship strongly increases, indicating that a close relationship correlates with a high individual investment amount. Being family or friends seems to foster the investment amount by 51.82%.[49]

4.7 Possible Limitations and Implications for Future Research

Several aspects constitute possible limitations to our analyses and call for future research. First, there are limitations regarding the dataset. The analyses are based on data stemming from one individual crowdinvesting platform which depicts the largest one in Mexico. This might lead to a self-selection bias with regard to the fact that this specific platform might attract certain participants of the financial sector more than others. Exemplarily, this might be startups or private investors who are relatively new in crowdinvesting and thus have simply searched for an online platform offering this type of investment, and received our data-providing platform as the first result in their search query. Additionally, our sample, by construction, only constitutes of investors having access to the Internet and being open-minded regarding innovative investment opportunities. However, the large size of our platform enables us to exploit a large heterogeneity in our variables of interest. Exemplarily, we find this heterogeneity, e.g., in the investment amount, which shows values ranging from 160 to 1,490,000 MXN. Furthermore, we control for investor-specific and startup-specific characteristics. Due to the specificity of the investment process in crowdinvesting and a differing presentation of startups searching for financial support on different platforms, using data from one crowdinvesting platform allows in-depth analyses and reliable results.

Second, we include investor and startup information only from the first investment of each bilateral investor-startup-combination. We openly acknowledge this point of criticism with regard to the fact that, in turn, we are not able to investigate the effects of our explanatory variables

[49] Calculation: $(e^{0.4175} - 1) * 100$

on investment decisions over time. The reason for not using time-related information is that crowdinvestors usually invest in varying investees throughout their investment history for diversification purposes (Hornuf et al. 2022). Additionally, we strive to abstract from learning effects and the evolution of an investor-startup-relationship through several investments in the same startup within this study. The situation that startups and investors provide and enter information themselves might also be criticized. To tackle this challenge, we conducted interviews with employees from the firm managing the platform, who confirm that investor and startup data is checked in detail before being published online (for startups) or being able to invest (for investors).

Furthermore, we know about potential endogeneity within our data. Endogeneity among the observations with regard to the investment probability, the investment amount as well as our independent variables might lead to biased results. Exemplarily, this might be the risk-return-profile of a particular startup, the time horizon of startups' dividend payments, or state-specific regulation of the financial sector. We control for this issue by including startup-state and investor-state fixed effects, as well as year and investment timing fixed effects. The idea of measuring investor experience using investors' time being registered on the platform might also not be the ideal proxy. We argue that crowdinvesting activities are not comparable to any other equity investment alternative as, e.g., the access to information is much easier for stock investments in multinational firms, leading to a different situation with regard to information asymmetries between investors and startups. This leaves space for future research, employing other proxies for measuring investor experience.

We additionally address potential limitations with regard to the country of origin of our data. We know that economic activities in Mexico often show some kind of relation to Mexico City, which is also reflected by the local distribution of observations within our dataset. We control for that by reconducting our main analyses in the robustness section of this paper excluding observations with investors from Mexico City. As Section 4.6 depicts, we receive similar results. Still, the question remains whether other crowdinvesting platforms, their investors, and startups show similar characteristics as those included in this study. As crowdinvesting is a quite new form of financing, we argue that it attracts firstly participants with, on average, similar characteristics worldwide.

One minor limitation consists in the fact that we include all financial variables in Mexican Pesos instead of converting them into a more common currency, e.g., U.S. Dollars. This idea allows us to directly observe the real effects of our independent variables. However, we know that many studies convert variables to U.S. Dollars. In our case, a conversion would make an immediate interpretation harder as the coefficients would not reveal, e.g., the Mexican purchasing power and the people's general financial situation.[50] Additionally, private investors, as the main group of investors in crowdinvesting, usually think about their investment decisions in their

[50] To evaluate the effective purchasing power of the Mexican population, inflation rates must also be considered. In our observation period (2015 to 2019), the inflation rate varies between 2.72% in 2015 and 6.04% in 2017 (World Bank 2023).

home currency. Another minor argument might be related to Goethner et al. (2021) who show that different factors and signals influence crowdinvestors differently. Hence, they claim that it is difficult to measure the impact of a certain signal on a heterogeneous group of investors. This concern is not of major importance in our study as our database contains in-depth information on investors as well as startups. However, this topic leaves space for future research following Piva and Rossi-Lamastra (2018) who call for deeper analyses with regard to the effect of signals on different types of investors.

4.8 Discussion and Conclusion

In this study, we compile detailed information on investor and startup characteristics to reveal the factors influencing investment decisions in crowdinvesting. Specifically, we look at the effect of information asymmetries between investors and startups on the investment probability and investment amount. We investigate the moderating effect of relationships and signals in this context. Recent studies show that the physical distance as the proxy for information asymmetries correlates with a lower investment probability and a lower investment amount (e.g., Bae et al. 2008; Dejean 2020). In crowdinvesting, information costs are comparatively high as individual investments are usually small and little contact between investors and startups precedes the investment. Thus, it is of special interest to look at the effect of the informational disadvantage of crowdinvestors as it represents a major factor influencing investment decisions. In those cases where investor and startup already have some kind of relationship (e.g., through connections as family or friends, through meetings at a fair, etc.), uncertainty and information asymmetries decrease, which might lead investors to support startups in a different way (Mollick 2014; Angerer et al. 2017). Furthermore, objectively observable signals which a startup has received on a platform, influence investors' decision-making (Courtney et al. 2017).

Our sample consists of 407,497 investor-startup-combinations including 11,054 investments. We use data from the largest Mexican crowdinvesting platform and investigate the characteristics influencing investors' decisions with regard to information asymmetries, relationships, and signals. First, we find that informational disadvantages negatively influence the investment probability and the investment amount. A 10% increase in distance decreases the investment probability by 1.42pp and the investment amount by 0.41%. In contrast, lower investor experience, male gender, and a higher financing goal increase the individual investment amount.

Second, we find that an existing relationship between the investor and startup influences investors' decisions in terms of the amount invested. Investors with a relationship to the startup, on average, invest more than those not having any kind of connection to the investee. However, relationships are not able to counteract the negative main effect of higher information asymmetries in any case. While rural investors seem to be aware of the idea of startups keeping

people with a relationship, especially family and friends, as fallback options for the case of a negative development of the startup (e.g., Hernández-Trillo et al. 2005; Lee and Persson 2016), investors from urban areas do not seem to consider this idea. In the final part of this paper, we measure signals through likes on the crowdinvesting platform. We observe that signals positively influence the investment probability but have a significantly negative effect on the investment amount. This is in line with the idea that private investors care about the opinion from other investors but also consider the concept of risk diversification.

Investigating the effects of information asymmetries, relationships and signals on investment decisions is of main importance for researchers, politicians as well as all participants of the financial sector. Crowdinvesting represents a new and modern form of financing. It constitutes a more and more important investment alternative for non-professional investors. With an expected increase in market transactions of 4-5% in the upcoming years in the U.S., Mexico, and Germany, crowdinvesting is currently experiencing a boom in its evolution. Few years ago, policymakers have identified crowdfunding as a possibility to overcome geographic boundaries (Guenther et al. 2018). Thus, this study complements existing literature revealing the effect of information asymmetries in investors' decision-making. We extend the literature by uncovering the interaction effects of information asymmetries, relationships, and likes on investment decisions in crowdinvesting. Given the currently rising inflation rates and still low interest rates on traditional investment opportunities, traditional equity investments but also non-traditional investment opportunities, e.g., crowdinvesting, have become an almost inevitable way for private investors to think about when deciding about their investment alternatives. As equity investments occupy a more and more relevant part of the financial market, understanding its functionality and the factors influencing its development is of high interest for all participants of the financial system.

Additionally, even though entrepreneurs are aware of the informational differences between investors and themselves, information on the concrete effects and interactions is scarce. It is widely known that family and friends serve as first financial support in the very early stage of startups' existence (e.g., Angerer et al. 2017). However, in order to receive sufficient funding for future development, other financing sources should be taken into account (e.g., Lee and Persson 2016). Understanding the interplay between information asymmetries and the investor-startup-relationship is thus of main importance for startups. As likes on social media platforms describe an objectively observable signal nowadays, looking at the interaction with this variable is also of main interest for the development of this sector. Crowdinvesting still describes a quite new form of financing and, just recently, researchers have started investigating the factors influencing decision-making in crowdinvesting. Future research should thus be conducted to investigate more details regarding startup and investor characteristics as well as factors influencing investment decisions in crowdinvesting based on the findings of this study.

A Appendices

Tables

Table A.4.1: *Local Distribution of Investors and Startups*

		Initial Sample				Analyses			
	Code acc.	Investors		Startups		Investors		Startups	
State	ISO 3166-2	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Aguascalientes	AGU	82	1.34	1	0.99	82	1.35	1	0.99
Baja California	BCN	37	0.60	0	0.00	37	0.61	0	0.00
Baja California Sur	BCS	25	0.41	0	0.00	25	0.41	0	0.00
Campeche	CAM	24	0.39	0	0.00	23	0.38	0	0.00
Chiapas	CHP	35	0.57	0	0.00	35	0.58	0	0.00
Chihuahua	CHH	110	1.80	0	0.00	110	1.81	0	0.00
Coahuila de Zaragoza	COA	70	1.14	0	0.00	70	1.15	0	0.00
Colima	COL	38	0.62	0	0.00	38	0.63	0	0.00
Distrito Federal (Mexico City)[51]	CMX	2,060	33.66	61	60.40	2,047	33.75	61	60.40
Durango	DUR	31	0.51	0	0.00	31	0.51	0	0.00
Estado de México	MEX	1,005	16.42	0	0.00	990	16.32	0	0.00
Guanajuato	GUA	185	3.02	9	8.91	183	3.02	9	8.91
Guerrero	GRO	36	0.59	0	0.00	36	0.59	0	0.00
Hidalgo	HID	84	1.37	0	0.00	82	1.35	0	0.00
Jalisco	JAL	478	7.81	6	5.94	473	7.80	6	5.94
Michoacán de Ocampo	MIC	88	1.44	1	0.99	88	1.45	1	0.99
Morelos	MOR	64	1.05	0	0.00	64	1.06	0	0.00
Nayarit	NAY	14	0.23	0	0.00	14	0.23	0	0.00
Nuevo León	NLE	458	7.48	5	4.95	454	7.48	5	4.95
Oaxaca	OAX	14	0.23	0	0.00	14	0.23	0	0.00
Puebla	PUE	182	2.97	3	2.97	181	2.98	3	2.97
Querétaro de Arteaga	QUE	241	3.94	1	0.99	240	3.96	1	0.99
Quintana Roo	ROO	92	1.50	6	5.94	90	1.48	6	5.94
San Luis Potosí	SLP	86	1.41	2	1.98	86	1.42	2	1.98
Sinaloa	SIN	65	1.06	1	0.99	65	1.07	1	0.99
Sonora	SON	97	1.58	0	0.00	97	1.60	0	0.00
Tabasco	TAB	29	0.47	1	0.99	29	0.48	1	0.99
Tamaulipas	TAM	73	1.19	0	0.00	72	1.19	0	0.00
Tlaxcala	TLA	35	0.57	0	0.00	33	0.54	0	0.00
Veracruz	VER	150	2.45	0	0.00	145	2.39	0	0.00
Yucatán	YUC	111	1.81	4	3.94	111	1.83	4	3.94
Zacatecas	ZAC	21	0.34	0	0.00	21	0.35	0	0.00
Total		6,120	100.00	101	100.00	6,066	100.00	101	100.00

This table displays the local distribution of startups and investors throughout the Mexican states for the initial sample (618,120 observations) and the sample used within the analyses (407,497 observations).

[51] "Distrito Federal" is synonymous with the capital city of Mexico (Mexico City; Ciudad de México). It is an individual federal entity and does not belong to any of the 31 Mexican states. Thus, we treat it as an individual state.

Table A.4.2: *Detailed Descriptive Statistics*

	N	Mean	StdDev	Min	p25	p50	p75	Max
Main Variables (H1a)								
ln(Distance)	407,497	4.49	2.72	0.00	3.89	5.56	6.54	8.00
InvestmentDummy	407,497	0.03	0.16	0.00	0.00	0.00	0.00	1.00
Main Variables (H1b, H2, H3)								
ln(Distance)	11,054	3.97	2.81	0.00	0.00	4.90	6.50	8.00
ln(InvestmentAmount)	11,054	8.94	1.14	5.08	8.41	8.92	9.62	14.21
ln(Likes)	11,054	6.30	1.23	3.09	5.52	6.25	7.17	8.34
Relationship	11,054	0.72	0.45	0.00	0.00	1.00	1.00	1.00
Control Variables								
ln(Experience)	11,054	3.57	2.37	0.00	1.10	4.16	5.58	7.55
Gender	11,054	0.84	0.37	0.00	1.00	1.00	1.00	1.00
ln(Goal)	11,054	14.70	1.22	11.61	13.60	14.90	15.80	16.31
InvestorAge	11,054	34.25	8.72	16.00	28.00	33.00	39.00	89.00
Variables Included in the Analyses but without the Natural Logarithm								
Distance	407,497	451.66	491.02	0.00	48.00	258.00	689.00	2987.00
Distance	11,054	355.26	441.21	0.00	0.00	133.00	663.00	2987.00
InvestmentAmount	11,054	16,126	43,139	160	4,500	7,500	15,000	1,490,000
Likes	11,054	1,081	1,295	21.00	249.00	515.00	1,305.00	4,194.00
Experience	11,054	195.05	292.05	0.00	2.00	63.00	264.00	1,898.00
Goal	11,054	4,163,737	3,859,619	109,800	800,000	3,000,000	7,000,000	12,100,000
Information on the Variable $AgeGroup_j$								
$AgeGroup_1$ (InvestorAge $\leq$ 30)	4325	26.50	2.73	16.00	25.00	27.00	29.00	30.00
$AgeGroup_2$ (31 $<$ InvestorAge $\leq$ 40)	4408	34.81	2.75	31.00	32.00	35.00	37.00	40.00
$AgeGroup_3$ (41 $<$ InvestorAge $\leq$ 50)	1742	44.46	2.81	41.00	42.00	44.00	47.00	50.00
$AgeGroup_4$ (51 $<$ InvestorAge $\leq$ 60)	467	54.32	2.78	51.00	52.00	54.00	56.00	60.00
$AgeGroup_5$ (61 $<$ InvestorAge $\leq$ 70)	95	63.58	2.41	61.00	62.00	63.00	65.00	70.00
$AgeGroup_6$ (71 $<$ InvestorAge $\leq$ 80)	9	76.22	3.38	71.00	74.00	77.00	79.00	79.00
$AgeGroup_7$ (InvestorAge $\geq$ 81)	8	85.88	1.55	84.00	85.00	85.00	86.00	89.00
Information on the quintiles of the Variable $Distance$ **(H1a)**								
$Distance_{Q1}$	99,450	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$Distance_{Q2}$	67,099	71.56	36.43	29.00	48.00	48.00	111.00	133.00
$Distance_{Q3}$	96,918	345.60	123.17	141.00	250.00	320.00	495.00	495.00
$Distance_{Q4}$	62,791	687.18	76.84	498.00	683.00	689.00	710.00	893.00
$Distance_{Q5}$	81,239	1262.99	319.36	897.00	1,045.00	1,170.00	1,350.00	2,987.00
Information on the quintiles of the Variable $Distance$ **(H1b, H2, H3)**								
$Distance_{Q1}$	3,387	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$Distance_{Q2}$	2,153	68.03	34.37	48.00	48.00	48.00	66.00	133.00
$Distance_{Q3}$	2,317	337.20	123.06	141.00	218.00	320.00	495.00	495.00
$Distance_{Q4}$	1,786	682.44	72.92	508.00	671.00	689.00	689.00	893.00
$Distance_{Q5}$	1,411	1261.87	323.67	897.00	1,045.00	1,170.00	1,350.00	2,987.00

This table displays detailed descriptive statistics including all variables of the empirical analysis. N describes the number of observations (for sample selection criteria, see Section 4.4.1). The variable $InvestorAge$ *constitutes the base for creating the dummy variables* $AgeGroup_j$ *included in the empirical analysis. Table A.4.4 of the Appendix displays the definitions of all variables.*

Table A.4.3: *Results Employing Age and Age^2 as Control Variables*

Dependent Variable: ln(InvestmentAmount)	(1)
ln(Distance)	**-0.0417*** **
	(0.0005)
ln(Experience)	**-0.0226*** **
	(0.0001)
Gender	**0.2078*** **
	(<0.0001)
ln(Goal)	**0.4804*** **
	(<0.0001)
Age	**0.0380*** **
	(<0.0001)
Age^2	**-0.0002*** **
	(0.0120)
Constant	Yes
Investor-State FE	Yes
Startup-State FE	Yes
Investment-Timing FE	Yes
Time FE	Yes
Observations	11,054
R^2	0.3382

*This table displays the results including Age and Age^2 as control variables (instead of including investors' age as categorical variable through the different variables for AgeGroup). It displays the results of an OLS regression including observations in which an investment has taken place. Robust standard errors are clustered at the startup-state level. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on year level. Table A.4.4 of the Appendix displays the definitions of all variables.*

Derivations

Derivation A.4.1: *Marginal Effects*

This part displays the mathematical approach on the calculation of marginal effects. As the dependent variable in logit regressions is a dummy variable, one must interpret the coefficients using marginal effects.

As a starting point, we use the general formulation of a logistic regression with x being the log-specified regressor of interest and **z** being a vector of covariates:

$$Pr[y = 1 \mid x, \mathbf{z}] = p = \frac{e^{\alpha+\beta \ln x+\mathbf{yz}}}{1 + e^{\alpha+\beta \ln x+\mathbf{yz}}}$$

Taking the partial derivative with respect to x, we obtain

$$\begin{aligned}
\frac{\partial Pr[y = 1 \mid x, \mathbf{z}]}{\partial x} &= \frac{\frac{\beta}{x} * e^{\alpha+\beta \ln x+\mathbf{yz}} * (1 + e^{\alpha+\beta \ln x+\mathbf{yz}}) - e^{\alpha+\beta \ln x+\mathbf{yz}} * \frac{\beta}{x} * e^{\alpha+\beta \ln x+\mathbf{yz}}}{(1 + e^{\alpha+\beta \ln x+\mathbf{yz}})^2} \\
&= \frac{\frac{\beta}{x} * e^{\alpha+\beta \ln x+\mathbf{yz}} * (1 + e^{\alpha+\beta \ln x+\mathbf{yz}})}{1 + e^{\alpha+\beta \ln x+\mathbf{yz}})^2} - \frac{e^{\alpha+\beta \ln x+\mathbf{yz}} * \frac{\beta}{x} * e^{\alpha+\beta \ln x+\mathbf{yz}}}{(1 + e^{\alpha+\beta \ln x+\mathbf{yz}})^2} \\
&= \frac{\beta}{x} * \frac{e^{\alpha+\beta \ln x+\mathbf{yz}}}{(1 + e^{\alpha+\beta \ln x+\mathbf{yz}})} - \frac{\beta}{x} * \frac{(e^{\alpha+\beta \ln x+\mathbf{yz}})^2}{(1 + e^{\alpha+\beta \ln x+\mathbf{yz}})^2} \\
&= \frac{\beta}{x} * p - \frac{\beta}{x} * p^2 \\
&= \frac{\beta}{x} * p * (1 - p).
\end{aligned}$$

This is approximately equivalent to

$$\frac{\Delta p}{\Delta x} = \frac{\beta}{x} * p * (1 - p).$$

Thus, we obtain

$$\frac{\Delta p}{100\frac{\Delta x}{x}} = \frac{\beta}{100} * p * (1 - p).$$

The average marginal effect thus reads

$$\frac{1}{N} \sum_{i=1}^{N} \frac{\beta}{100} * p_i * (1 - p_i).$$

Variable Definitions

Table A.4.4: *Variable Definitions*

All "explanatory and dependent variables" and the "control variables: investor and investment characteristics" are based on information retrieved from the internal management system of the crowdinvesting platform. "Control variables: macroeconomic and entrepreneurial environment" are retrieved from different sources (see details below).

Explanatory and Dependent Variables

Variable	*Definition*
ln(Distance)	Variable for measuring information asymmetries between (potential) investors and startups. The proxy is measured as the natural logarithm of the physical distance between the investor and startup. It is measured between the midpoints of the investor's and the startup's state, and rounded to full kilometers. Higher values refer to higher information asymmetries.
ln(InvestmentAmount)	Variable for measuring the investment amount per investor per startup. It is measured in the natural logarithm of the investment amount in Mexican Pesos (MXN). Higher values refer to a higher investment amount.
InvestmentDummy	Dummy variable for investments having taken place. It takes the value of one if an investment has taken place, and zero otherwise. It serves as the base for the calculation of the investment probability.
ln(Likes)	Variable for measuring signaling effects from former users of the crowdinvesting platform to (potential) future investors. The proxy is measured as the natural logarithm of the number of likes which a startup has received on the platform.
Relationship	Dummy variable for an existing investor-startup-relationship. It takes the value of one if the investor and startup show any kind of relationship, e.g., as family, friends, or a previous meeting at a fair. It takes a value of zero otherwise.

Control Variables: Investor and Investment Characteristics

Variable	*Definition*
AgeGroup	Dummy variables for investors' age. One dummy variable is created per decade, i.e., for investors under or equal to 30, between 31 and 40, between 41 and 50, between 51 and 60, between 61 and 70, between 71 and 80, and above 80 years of age (see variable $InvestorAge$). It takes a value of one if an investor falls into a certain age group.
ln(Experience)	Variable for measuring investors' experience. The proxy is measured as the natural logarithm of the time span between the registration on the platform and the investment, and measured in days.
Gender	Dummy variable for measuring investors' risk preference. The proxy is measured as investors' gender, as men usually invest more risky than women. It takes the value of one for male investors, and the value for zero otherwise.
ln(Goal)	Variable for measuring the minimum financing goal set by startups within a predefined investment period. It is measured in the natural logarithm of the startups' goal in Mexican Pesos (MXN). Higher values refer to higher financing goals.
InvestorAge	Variable for measuring investors' age. It is measured in years between the year of birth and the year of investment. Higher values refer to a higher age. In the empirical analysis of *Table A.4.3* of the Appendix, it is denoted as the variable *Age*.

Control Variables: Macroeconomic and Entrepreneurial Environment

Variable	*Definition*
FirmSurvival	Variable for measuring the success probability of entrepreneurial activities. The proxy is measured as the survival rate of firms per Mexican state. It is measured as the proportion of surviving firms divided by the total number of firms. Higher values refer to higher success probabilities of entrepreneurial activities. It is included with data on 2018. It is retrieved from INEGI, and the Mexican Economic Census 2019.
GDP	Variable for measuring the industrial power. The proxy is measured as the gross domestic product per Mexican state. It is measured in million Mexican Pesos (MXN). Higher values refer to a higher industrial power. It is included with data from 2019. It is retrieved from INEGI, and the Mexican National System of Accounts 2020.
Internet	Variable for measuring the (potential) access to crowdinvesting. The proxy is measured as the proportion of firms selling their products online divided by the total number of firms per Mexican state. Higher values refer to better access to crowdinvesting. It is included with data on 2018. It is retrieved from INEGI, and the Mexican Economic Census 2019.
MalePopulation	Variable for measuring the risk preference. The proxy is measured as the proportion of men divided by 100 women per Mexican State. Higher values refer to a higher risk preference of investors and founders (e.g., Rieger et al. 2015). It is included with data on 2020. It is retrieved from INEGI, and the Mexican Census and Count of Population and Housing 2021.
NewFirms	Variable for measuring the entrepreneurial activity. The proxy is measured as the proportion of new firms divided by the total number of firms per Mexican state. Higher values refer to higher entrepreneurial activity. It is included with data on 2018. It is retrieved from INEGI, and the Mexican Economic Census 2019.
PopulationDensity	Variable for measuring financial development. The proxy is measured as the population density per Mexican state. It is measured in inhabitants per km^2. Higher values refer to higher financial development of the state (e.g., Beck et al. 2008). It is included with data on 2020. It is retrieved from INEGI, and the Mexican Census and Count of Population and Housing 2021.
SchoolDegree	Variable for measuring financial literacy of the population. The proxy is measured as the average school degree per Mexican State. It is measured in years. Higher values refer to higher financial literacy. It is included for the year 2015. It is retrieved from INEGI, and the Mexican Census and Count of Population and Housing 2016.
USBorder	Dummy Variable for measuring spillover effects into Mexican states from the United States. The proxy is measured as states bordering the U.S. It takes the value of one in case of a common border (i.e., for the states of Baja California, Chihuahua, Coahuila, Nuevo Leon, Sonora, and Tamaulipas), and the value of zero otherwise.

Chapter 5
The Effects of a Reform in Corporate Tax Law on Startup Investments

Abstract A country's tax system directly affects startups' gains. Additionally, it indirectly influences startups' access to external financing as tax policy affects financial incentives for current and potential investors. We examine the effects of a tax reform in the German corporate tax law on investor decisions as startups strongly depend on external financial resources in their early life. The tax reform has increased startups' possibilities to disclose a loss carry forward and deduct losses in future years when investor shares change. This impacts investors' ex ante considerations. First, we compare investors' behavior in Germany to a synthetic control group made up of eight comparable European countries. Afterwards, we analyze the specific characteristics of the German startup market. Combining data on 8,251 investment rounds from 2010 to 2019 and the startups' annual reports, we find higher loss carry forwards disclosed correlating with higher startup investments after the tax reform. Still, the investment amount in startups does not automatically increase after such a tax reform. We observe a positive effect on early-stage investments while later-stage investments remain unchanged. Findings suggest that public policy makers can influence investor anticipations and, in turn, their investment behavior. We underscore the importance of public perception when estimating the real effects of a tax reform, and the importance of the usability of losses for early-stage startups.

We contend that for a nation to try to tax itself into prosperity is like a man standing in a bucket and trying to lift himself up by the handle.

– Winston Churchill, former British Prime Minister

Acknowledgments This chapter is adapted from my working paper "The Effects of a Reform in Corporate Tax Law on Startup Investments". It was joint work with Ferdinand Springer from the Eberhard Karls University of Tübingen. We would like to thank Michael Hinz, Alina Schmidt, and Amelie Wulff for their excellent research assistance. Moreover, we gratefully thank Patrick Kompolsek, Markus Merz, Werner Neus, Jan Riepe, Martin Ruf, Moritz Sefried, and the participants of the internal research seminar for their valuable comments and insights.

5.1 Introduction

On March 29, 2017, the German Federal Constitutional Court ruled the Sections 8c / 8d German Corporation Tax Act ("KStG") to be adjusted. With the implementation of the new legislation, additional loss carry forwards can be disclosed and thus losses can still be deducted from future earnings when firms sell large parts of their shares[52] in a short period of time. This deduction has been prohibited before which has ignored the principle of equality (Article 3 of the German Constitutional Law) between all firms. Anecdotal evidence underscores the importance of declaring loss carry forwards for firms. In 2016, roughly 46.7% of all corporations liable for corporation tax in Germany reported loss carry forwards in their annual statements (Statistisches Bundesamt 2021). To comply with the economic principle of investment neutrality, taxation must not influence investors' decisions. Therefore, either immediate loss compensation or carrying losses forwards or backwards is necessary to fulfill the idea of neutral cash flow taxation. With the tax reform, the German government strived to equalize the different treatment of losses compared to profits as well as the unequal treatment of firms with and without a change in the shareholder structure from a tax perspective.

We conduct an empirical study investigating the effects of the German tax reform in the Sections 8c / 8d KStG in 2017. Specifically, we analyze the effects on the investment behavior of investors who support startups with new external financial capital. Anticipation effects are particularly important to consider when investigating the effects of a change in tax policy as "rational beliefs about changes in future tax rates [...] may result from proposed or anticipated legislation" (De Simone et al. 2019, p. 3106). We use data on 5,200 startups with 8,251 investment rounds from the Thomson Reuters EIKON database and the Bundesanzeiger. The introduction of the Sections 8c / 8d KStG as a fundamental public policy intervention constitutes a quasi-natural experiment. As taxation research has a significant influence on public policy making, we give insights into the relation between the fiscal treatment of startups' losses and investors' behavior. By now, the effects of the structure of tax systems on startup investments have been insufficiently covered (Henrekson and Sanandaji 2011). Cooper and Knittel (2006) find that a substantial number of small firms does not immediately subtract their losses from earnings but at a later time. Thus, to comply with the principle of investment neutrality, a tax system allowing the deductibility of losses in the future for all firms is inevitable. The tremendous number of tax consultants publicly questioning the effects of the tax reform in the Sections 8c / 8d KStG on startup investments underscores the importance of this study.

Our results show a clear positive trend in the relation between startups' loss carry forward disclosed and the investment amount in German startups over time. Before 2017, the point estimates of the interaction terms indicate a negative correlation between these two variables. After the tax reform, the point estimates become positive. The significantly positive correlation

[52] In this study, the term "sale of share" includes the sale of existing shares as well as the issuance of new equity capital.

in 2018 and 2019 can be led back to the possibility to disclose loss carry forwards and deduct losses from earnings in future years due to the tax reform in the Sections 8c / 8d KStG in 2017.

In the years before the reform, the total investment amount in German startups increased from EUR 0.4 billion in 2010 to EUR 1.7 billion in 2017. After the tax reform, the investment amount further increased up to EUR 2.6 billion in 2019 which is equivalent to a 52.94% increase within two years.[53] However, when using the synthetic control method, we do not find a significantly different investment behavior in real versus synthetic Germany after the announcement of the tax reform. A possible explanation might be investors' anticipations regarding the final implementation of the Sections 8c / 8d KStG in the short run. This non-reaction of investors to the tax reform in 2017 was probably fostered by imprecise wording of the respective tax law.

When applying the synthetic control method on startups' first investment rounds, we find a sharp decrease in the total investment amount in 2018 which reverses to a sharp increase in 2019. One reason might be that especially first round investors changed their investment behavior after the tax reform had been publicly announced on March 29, 2017, i.e., that Section 8c KStG must be reframed by the German government until January 1, 2019. Additionally, first round investments might have become more attractive for investors after the implementation of the new tax legislation. By increasing the threshold of the cumulative sale of shares up to which disclosing loss carry forwards is allowed, investors are now able to acquire a larger proportion of shares while startups are still able to offset losses against future years' profits. As investments in early-stage startups usually imply high risk for investors, the sharp increase in first round investments in 2019 shows investors' increased risk appetite after the tax reform. One possible reason might be that investors' expected return on these investments is higher after the tax reform which provokes investors to focus on early-stage startups.

This study relates to different strands of the literature. First, the study fills the gap in the research area on the relation between startups' loss carry forwards and startup investments. As startups usually incur high losses in the beginning of their operations, they are more affected by the non-deductibility of losses in future years (e.g., Cooper and Knittel 2006; Haufler et al. 2014). Investigating the effects of the tax reform in the Sections 8c / 8d KStG in Germany enhances the understanding of the interplay between both areas which has been under-investigated to date.

Second, we relate to the tax literature which shows that startups are affected by the tax system in several ways. Overall, investors increase their investment activity with lower tax rates (Swenson 1994) leading to higher firm growth and increasing rates of success (e.g., Carroll et al. 2000). Several research papers as well as statements from institutions and politicians confirm that startup investments have gained in importance and size in the past decade. In general, investors perceive Germany as a favorable investment location but, at the same time, corporate taxation in Germany is a main disadvantage (EY 2019). For governments, changing tax regulations seems to be an easy way to promote startup investments. Still, little is known

[53] All data is extracted from the Thomson Reuters EIKON database. We refer to Section 5.4.1 for further details.

about changes in startup investments if the tax system is modified (Hellmann and Puri 2002; Hanlon and Heitzman 2010; Henrekson and Sanandaji 2011). Due to limited data access, the few existing studies use aggregate data, data following an IPO or data on large public firms (e.g., Guenther and Willenborg 1999; Edwards and Todtenhaupt 2020). Henrekson and Sanandaji (2011, p. 168) conclude that "simple cost of capital formulas have a tendency to underestimate the distortions caused by taxing entrepreneurial firms".

Third, we relate to the principles of decision and investment neutrality which are the two basic concepts in tax policy making (Boadway and Bruce 1984; Devereux and Freeman 1991). These theoretical constructs were originally developed on frictionless markets but seem to be kept in mind also in the real world, i.e., incomplete markets (e.g., Deutscher Bundestag 2007a). Decision neutrality describes the idea that taxes should not systematically influence economic decisions while investment neutrality refers to investment decisions in particular. Overall, taxes must not affect investors' decisions.

Last, we contribute to the literature on startups' access to external financing. In 2019, the yearly investment amount in German startups increased by 36% compared to the year before (EY 2020). Still, almost 40% of startups face raising capital as one of their main challenges (Kollmann et al. 2019). In their early life, startups often lack internal monetary resources and thus rely on external financial support (e.g., Levine 2005). However, as they are characterized by high uncertainty (e.g., McMullen and Shepherd 2006) and lacking information on past performance (e.g., Gompers et al. 2020), they do not have access to traditional financing. Venture capitalists as major supporters of startups help with financial and non-financial resources which ultimately fosters countries' economic development (e.g., Keuschnigg and Nielsen 2004).

One main challenge of this paper comprises to single out the effects of the tax reform in the Sections 8c / 8d KStG. To overcome this concern, we control for possible distorting factors, e.g., tax reforms in the control countries within the observation period. This procedure ensures that our results are not biased by other events which coincidentally occur at the same time. Nonetheless, future research has to be conducted to verify the effects. Furthermore, the German startup environment might be special in certain aspects so that our results might not be easily transferable to other countries. This fact enables us to go into detail in our analyses for Germany but conclusions on investors' behavior might not be applicable elsewhere. One also has to be aware of the situation that data in EIKON is probably not all-embracing. Hand-collected data as well as the fact that, e.g., the publication of the balance sheet is not mandatory for all startups in Germany, might make our database miss out on some investment events. We use EIKON as it is widely recognized as one of the main information systems in entrepreneurial research. Furthermore, through the incorporation of the former venture capital database "Venture Xpert", EIKON is nowadays one of the largest databases containing information on startup investments. Still, these points of criticism call for future research to remove existing concerns and further fill the gap in the literature in this research area.

The paper proceeds as follows. Section 5.2 introduces the examined tax reform in the Section 8c / 8d KStG in Germany and its effects on investor anticipations. In Section 5.3, we evolve the hypotheses based on the literature related to tax effects and anticipation effects in entrepreneurship. Section 5.4 describes the sample, the methodology and the research design before we discuss the empirical results in Section 5.5. Section 5.6 tests the robustness of the results and Section 5.7 presents the limitations and implications of this study for future research. This study closes with a discussion and conclusion of the findings in Section 5.8.

5.2 Institutional Background

5.2.1 Changes in the German Tax Law in the Sections 8c / 8d KStG

In 2007, the German government implemented a fundamental corporate tax reform with the aim to foster growth and employment, and to increase the attractiveness and competitiveness of Germany as investment location for both national and international investors (Deutscher Bundestag 2007a). Among others, they introduced Section 8c KStG.[54] This regulation is based on the principle of equality and, following from this, the principles of the ability to pay and of net income (Thees and Zajons 2017).[55] With the introduction, the German government strived to prevent the misuse of losses in tax planning, e.g., through "Mantelkäufe" (compare, e.g., Hey 2007). Section 8c KStG enables corporations to disclose a lower tax base and reduce their tax payments in future years.[56] Section 8c(1) KStG determines the partial non-usability of a firm's loss carry forward if between 25% and 50% of the share capital is directly or indirectly transferred to an acquirer within a time period of five years. Furthermore, losses are completely non-usable in future years if more than 50% are sold within five years. Thereby, Section 8c KStG ensures that future loss deductions are only possible if a corporation stays legally and economically unchanged (Thees and Zajons 2017).[57]

However, adding investors through venture capital (VC) and, thereby, selling large parts of a firm's shares in a short period of time is a common way to grow in entrepreneurship (e.g., Deutscher Bundestag 2016; Leibner and Dötsch 2020). Therefore, Section 8c KStG particularly negatively affects startups which usually experience negative earnings in their early life. Even though the German government already expressed this unequal treatment of firms with

[54] This tax reform also contained, e.g., a reduction in the corporate tax rate from 25% to 15% (Section 23(1) KStG) and introduced the interest barrier ("Zinsschranke", Section 8a KStG in conjunction with Section 4h German Income Tax Act ("EStG")). For an overview on all changes, see Homburg (2007).

[55] One can argue that the German tax law regarding the treatment of losses does still not fully coincide with the principle of investment neutrality. Interest calculations are not considered when looking at the effect of future loss deductions (Ernst 2011). As public policy makers usually abstract from this theoretical construct (e.g., Sachverständigenrat 2016), we also do in this study.

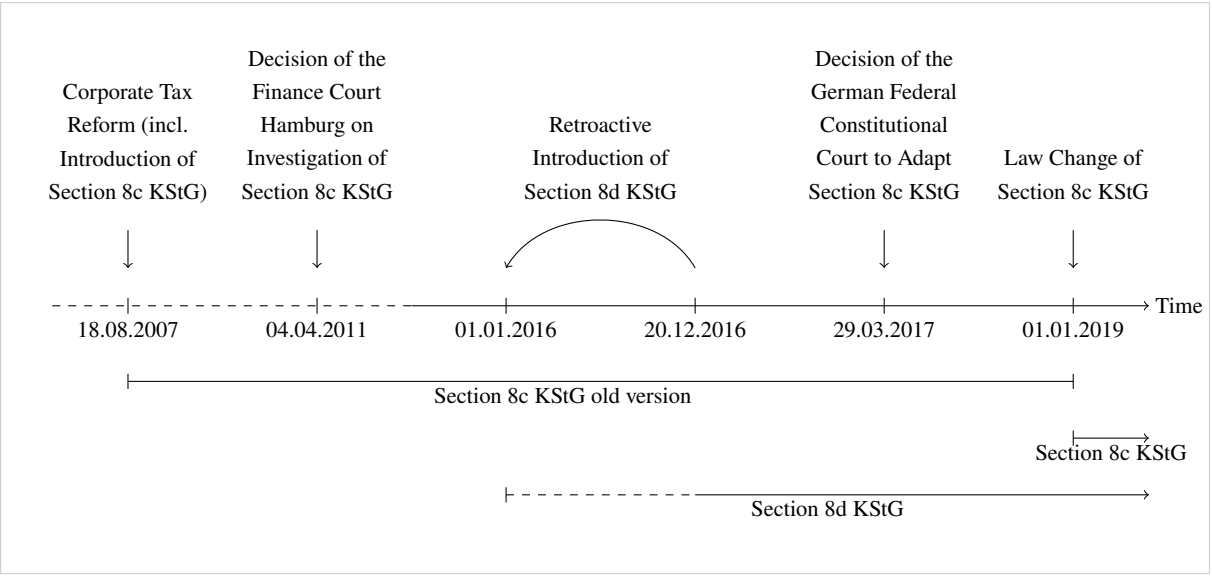
[56] According to Section 8(1) KStG in conjunction with Section 10d(2) EStG, losses in German corporations can generally be carried forward indefinitely.

[57] As soon as an individual investor owns more than 50% of a firm's shares, the investor could change the fundamental orientation of the firm without considering the opinion of other investors or the firm's focus in the past.

and without a change in firm structure before the introduction of Section 8c KStG in 2007 (Deutscher Bundestag 2007b), the European Commission ex ante stopped the idea of a differing treatment of firms (European Commission 2009). Thus, this tax law was introduced with the goal of decreasing tax barriers to foster investments (Deutscher Bundestag 2007b) but without considering startup-specific characteristics.

In 2011, the Finance Court Hamburg decided the tax law from 2007 to be examined by the German Federal Constitutional Court due to its high relevance regarding the violation of the principle of equality (Finanzgericht Hamburg 2011, Case: 2 K 33/10). Reacting to this decision, the German government introduced Section 8d KStG in December 2016 retroactively by January 1, 2016 to decrease the fiscal barriers for small corporations. Since then, firms can disclose a loss carry forward in a separate position in their tax balance sheets even if Section 8c(1) KStG declares these losses as non-deductible.

Figure 5.1: *Chronological Overview on the Development of the Sections 8c / 8d KStG*



On March 29, 2017, the German Federal Constitutional Court recognized the unequal treatment of firms which have sold between 25% and 50% of their shares within the last five years and those with no change in their shareholder structure (Bundesverfassungsgericht 2017, Case: 2 BvL 6/11). The justification is based on the economic capacity of a firm which is decisive for taxation according to the principle of separation. Overall, they judge Section 8c(1) KStG as being too restrictive, especially affecting startups which commonly sell a high proportion of the firm's shares. According to the court's decision, the taxation of profits compared to a non-deductibility of losses violates the principle of investment neutrality and the principle of equality.

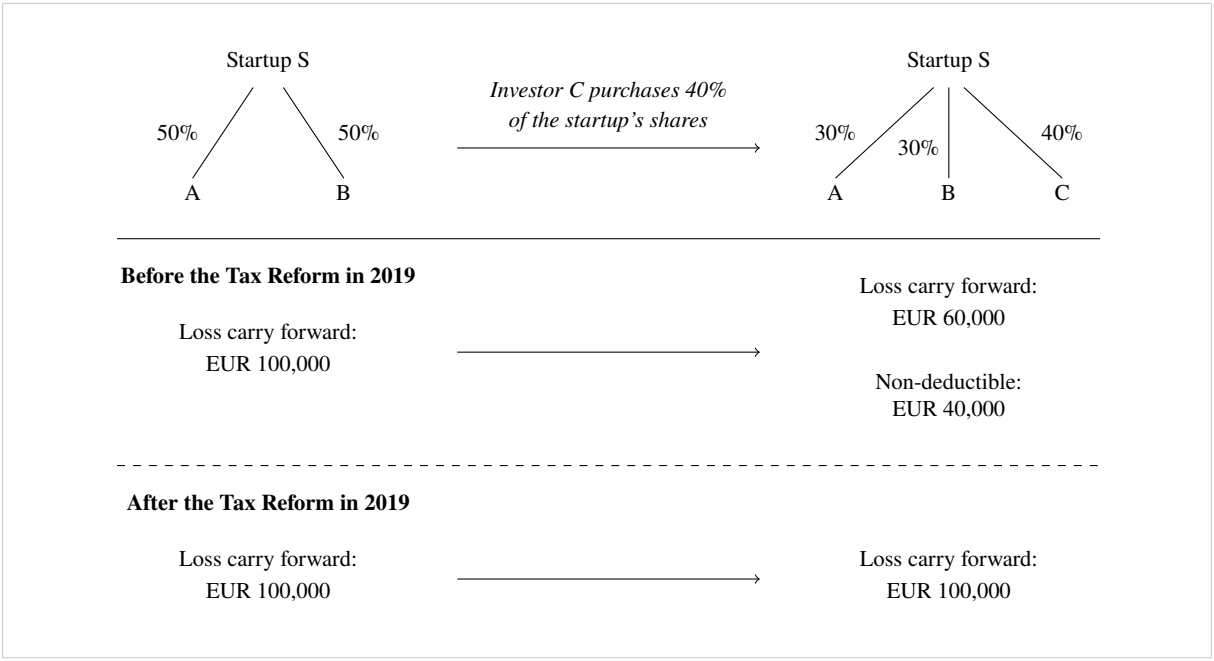
The German Federal Constitutional Court requested the German government to change the tax law accordingly by January 1, 2019. Section 8d KStG remained in force so that firms were still able to deduct losses within this time period even if Section 8c KStG did not allow to do

so. With the new Section 8c(1) KStG, the hurdle of a partial non-usability of losses in case of an owner change between 25% and 50% was repealed on January 1, 2019. From that point on, only in case of a sale of shares of more than 50% within five years, losses must not be deducted from future earnings anymore to reduce tax obligations.

Figure 5.1 displays the chronological order of events related to the introduction and subsequent changes in the Sections 8c / 8d KStG. Additionally, it shows the time periods in which the different versions of Section 8c KStG and Section 8d KStG have been in force.

Figure 5.2 shows the effects of the tax reform in the Sections 8c / 8d KStG on a startup's loss carry forward disclosed if an outside investor purchases 40% of a startup's shares.[58] We assume that two investors A and B own an equal proportion (50%) of shares of startup S which is created in the legal form of a corporation. Investor C purchases 40% of these shares so that the proportion of A and B in S decreases to 30% per person. Before the tax reform in the Sections 8c / 8d KStG which was announced in 2017 and implemented in 2019, a proportionate amount of the hypothetical loss carry forward of EUR 100,000 which startup S disclosed in its preceding annual statement was lost. Thus, these EUR 40,000 could not be deducted from subsequent earnings anymore which increased the startup's tax obligations in future years. Since the respective tax reform, startup S is allowed to disclose the full loss carry forward of EUR 100,000 despite the sale of shares.

Figure 5.2: *Example 1 on the Effects of the Tax Reform in the Sections 8c / 8d KStG*

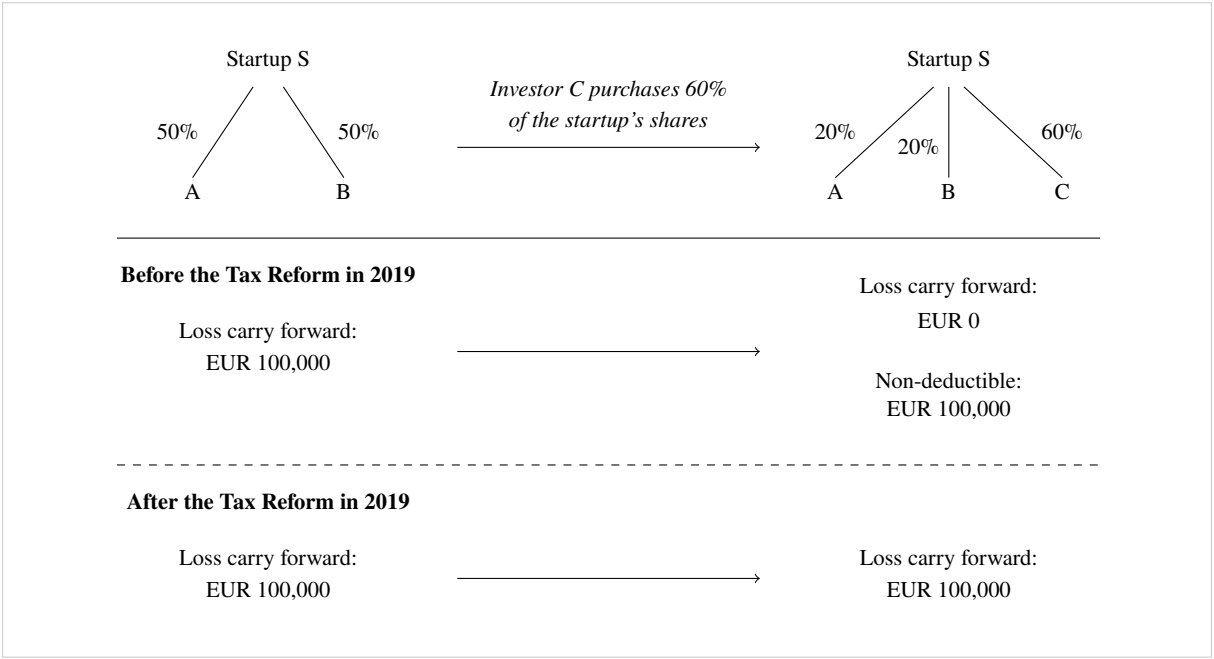


[58] For the applicability of the Sections 8c / 8d KStG, the number of investors from whom the shares are purchased does not matter. Only the total proportion of shares and the acquisition period is of interest.

Figure 5.3 displays the effects on a startup's loss carry forward in case of a sale of shares amounting to 60% of a startup's shares. This example holds if Section 8d KStG applies.[59] Again, two investors A and B initially own 50% of shares per person. Investor C now purchases 60% of these shares so that the proportion of A and B in S decreases to 20% per person. Before the tax reform in the Sections 8c / 8d KStG which was announced in 2017 and implemented in 2019, the entire loss carry forward of EUR 100,000 of startup S was lost and the startup would not have been able to decrease its future tax obligations. Since the respective tax reform, startups are now still allowed to disclose the former loss carry forward if Section 8d KStG applies. For an explanation on the applicability of Section 8d KStG, see Section 5.2.2 of this paper.

Figure A.5.1 and *Figure A.5.2* of the Appendix display the changes in the shareholder structure and the effects on the disclosable loss carry forward before and after the tax reform when new shares are issued (instead of a sale of shares).

Figure 5.3: *Example 2 on the Effects of the Tax Reform in the Sections 8c / 8d KStG*



5.2.2 The Role of Anticipations in Investment Behavior

Anticipation effects regarding tax policy are "rational beliefs about changes in future tax rates that may result from proposed or anticipated legislation" (De Simone et al. 2019, p. 3106). This statement underscores that investors adjust their activities based on their beliefs in order to take advantage of a possible but uncertain future tax benefit. Anticipation appears even more

[59] If Section 8d KStG does not apply at the time of the sale of shares or if it does not apply at any time within the three years thereafter (Section 8d(1) KStG), the loss carry forward of EUR 100,000 is completely non-deductible.

relevant in investors' decision making when they consider investments whose return is expected far in the future, which is often the case in the entrepreneurial environment (e.g., Lumpkin and Brigham 2011). Mertens and Ravn (2011) confirm that an anticipated tax cut results in a decline of economic activity of firms in the years between the announcement and implementation, and an increase of activity thereafter. However, the latter effect often seems not to occur immediately after the implementation of the reform but to lag behind approximately two years (Christofzik et al. 2022).

Hence, anticipation effects are crucial to consider when examining the effects of a change in tax policy. In the concrete case of this paper, new investors' anticipation and ultimately their investment behavior might have been influenced by numerous statements from experts in the field. Overall, experts agree that tax law changes favoring startup investments are reasonable. However, tax consultants in Germany also questioned the effect on startup investments following from the tax reform in the Sections 8c / 8d KStG (e.g., Bauernschmitt and Kraus 2017; Dreßler 2017; Engelen and Heider 2020). They argue that the implementation of the new Sections 8c / 8d KStG has been perceived as very strict regarding, e.g., the definition of a firm's business operations remaining unchanged (Section 8d(2) KStG). Furthermore, the evaluation of the applicability of Section 8d KStG by the German tax authorities has been based on qualitative criteria which are not easily transparent to each investor. Tax consultants also doubted the idea of a constant business model in the startup sector as entrepreneurs often operate several businesses over time when developing new products. This would result in the non-applicability of the Sections 8c / 8d KStG. Finally, they criticized the different rules regarding the non-usability of losses in future years in Section 8c KStG compared to Section 8d KStG. Whereas the future deductibility of losses according to Section 8c(1) KStG is determined directly after the sale of shares, Section 8d(2) KStG might lead to a non-usability of losses retroactively within three years after the sale of shares.

Besides these uncertainties, the development of Section 8d KStG probably influenced investors' anticipations. Section 8d KStG was put into force in December 2016. The first draft of this section was published in September 2016. Since then, investors could anticipate a new law to be passed but they did not know when exactly this would happen, how it would exactly look like and when it would come into force. Once introduced, Section 8d KStG contained several imprecise passages regarding, e.g., the "qualitative criteria" named in Section 8d(2) KStG. To give the public a guide on the concrete interpretation, the German Federal Ministry of Finance needed until August 2020, i.e., approximately 3.5 years, to publish a draft letter describing the applicability of this section (Bundesministerium der Finanzen 2020). Bauernschmitt and Kraus (2017) state that if tax authorities apply a narrow interpretation of Section 8d KStG, it might still result in a disadvantageous situation for startups due to the new regulation. Summing up, investors remained (at least to a certain degree) unsure between 2016 and 2020 whether startups qualify at all or continuously maintain the qualification criteria listed in Section 8d KStG. Even

to date, this legal uncertainty has not been fully erased as the imprecise wording in this section is still in force and the final version of the draft letter has still not been published.

The lengthy procedure in the implementation of the reform in Section 8c KStG has additionally influenced investors' anticipations and thus their behavior. As described in Section 5.2.1 of this paper, the lawsuit on Section 8c KStG was forwarded to the German Federal Constitutional Court in 2011. Thereafter, this highest German court needed until March 29, 2017 to judge Section 8c KStG to be changed (by January 1, 2019). Thus, between 2011 and 2017, investors could not be sure when the German Federal Constitutional Court would publish their judgment and how it exactly would look like. Furthermore, until the final implementation of the tax reform in the Section 8c KStG on January 1, 2019, investors could anticipate the tax reform to take place. However, they could again not be sure when and how exactly the German government would implement the new Section 8c KStG.

Additional space for investor anticipations about future returns from startup investments existed between 2017 and 2019 due to Section 165(2) German Fiscal Code ("AO"). It allows a retrospective change of firms' tax obligations in case that the German Federal Constitutional Court demands the national lawmakers to modify an existing section in tax law. Section 165(2) AO does not automatically imply a tax law change but as the German Federal Constitutional Court demanded a tax law change with regard to Section 8c KStG in 2017, investors could envision a change in tax law allowing the partial usability of losses. By law, this change in Section 8c KStG could have been enforced retrospectively by 2007 when Section 8c KStG was originally introduced (Dreßler 2017).

Summing up, there was much uncertainty and possibilities for investor anticipations. Investors could neither be sure regarding the exact point in time when the tax law change in the Sections 8c / 8d KStG could be expected, nor the concrete effects on their return from startup investments. Since the recognition of the German Federal Constitutional Court in 2017, however, investors could anticipate that a "positive" change would be made with regard to the usability of losses in case of a sale of shares of more than 25%. In turn, investors could expect startup investments leading to higher payouts in future periods as startups face lower tax obligations due to higher losses deductible.

5.3 Literature Review and Hypotheses Development

Startups typically incur high losses in the beginning of their operations. One prominent international example is the ride-hailing firm Uber, which was founded in 2009. Even though Uber generated revenues of USD 14.14 billion in 2019, it has still lacked in becoming profitable (Uber 2020). In Germany, startups face the same situation. The N26 Group, a German FinTech and neobank founded in 2013, reported a net loss of EUR 73.15 million in 2018 (N26 2019).

While more mature firms can immediately offset these losses against existing profits, startups usually cannot. Therefore, startups are more affected by the non-deductibility of losses and, in turn, higher tax duties (e.g., Cooper and Knittel 2006; Mirrlees and Adam 2011; Haufler et al. 2014). In the empirical literature, studies confirm that the deductibility of losses encourages business startups (Hansson 2012) while it does not induce them to lower their risk-taking in an inefficient way (Haufler et al. 2014). In its 2011 report, the German Expert Commission for Research and Innovation (EFI 2020) described the German tax policy regarding the possibilities to offset losses as hostile for innovation. The German tax law including Section 8c / 8d KStG and the non-usability of losses in case of a significant shareholder change, specifically negatively affected venture capital funded industries. In turn, it strongly impeded finding investors for young innovative firms (Haufler et al. 2014).

We strive to investigate the effects of a higher loss carry forward disclosed[60] on the development of additional external capital received.[61] As not only startups but also investors benefit from the tax reform through potentially higher payouts in future periods, we hypothesize:

Hypothesis 1: Startups' loss carry forward disclosed positively correlates with the investment amount received after the tax reform in the Sections 8c / 8d KStG in 2017.

According to the literature, taxes affect startups and entrepreneurs in many ways. Carroll et al. (2000) find tax rates to have a statistically significant influence on firm growth. Going further, Burman and Randolph (1994) observe that due to their effects on capital-gains realizations, tax changes directly affect shareholders' investment decisions. Specifically, Swenson (1994) confirms lower tax rates to having fostered startup investments after the U.S. Tax Reform Act of 1986. Henrekson and Sanandaji (2011, p. 168) confirm that "a new entrepreneurial venture can rarely rely on external debt financing or on already taxed [...] equity to eliminate the costs of taxation". Da Rin et al. (2006) show that decreased capital gains tax rates incentivize venture capitalists to invest in early-stage ventures. Keuschnigg and Nielsen (2004) argue that tax reliefs induce venture capitalists to increase active engagement in startups, which increases startups' probability of success. Recently, Bock and Watzinger (2019) find that higher capital gains tax rates result in fewer startups being able to secure venture capital funding.

Ideally, we would be able to estimate real effects of the tax reform using a comparable group of German startups in a difference-in-difference research design. However, as all German startups created as corporations according to Section 1 KStG are affected by the changes in the Sections 8c / 8d KStG in 2017, this empirical method is not realizable in this study. Thus, we compare the development of startup investments in Germany to the development of investments in a

[60] More precisely, the still disclosable loss carry forward instead of a forfeiture of these losses.

[61] As we cannot observe the exact amount of shares which an existing shareholder owns, we cannot investigate the effects of the tax reform on the individual selling and buying behavior. Therefore, we focus on the behavior of investors undertaking additional investments in startups.

synthetic control group made up of startup investments in comparable European countries. We hypothesize:

Hypothesis 2: The tax reform in the Sections 8c / 8d KStG in 2017 leads to a higher increase in the absolute investment amount in German startups compared to its synthetic control group.

Among all forms of external investments, venture capital plays a crucial role in startup development. Venture capitalists provide startups with financial as well as non-financial resources (e.g., Timmons and Bygrave 1986; Hellmann and Puri 2002). They often support highly successful new ventures which strongly fosters economic development (e.g., Sapienza 1992; Keuschnigg and Nielsen 2004). Nowadays, the typical investment proportion of a first round venture capital investment constitutes up to 25% of startups' equity. About 15% of investors acquire a proportion larger than 25%, from which again about 50% purchase more than half of a firm's equity (BVK 2020; Honold et al. 2020). The European venture capital landscape is heavily dominated by the United Kingdom, Germany, and France (e.g., Teare and Kunthara 2020). Especially Germany has recently become increasingly attractive for both entrepreneurs and investors. Since 2012, the German venture capital market has experienced a positive trend (Gottschalk et al. 2016; Roberts and Naydenova 2019; EY 2020).

Undoubtedly, the risk of startup failure decreases with time and the number of preceding investment rounds. Several studies show that investors incorporate their anticipations on the potential risk taken into their investment decision-making (e.g., Fried and Hisrich 1994; Virlics 2013). The tax reform in the Sections 8c / 8d KStG allows startups to disclose a loss carry forward and deduct these losses in future periods which decreases their tax obligations. In turn, it results in lower risk of losses (and, in the extreme case, the risk of default) especially for early-stage startups which show a high probability of accumulating losses. We suppose that investors include these considerations into their decision-making so that their willingness to support early-stage startups financially increases after the tax reform. Thus, we hypothesize:

Hypothesis 3: Investors' risk appetite increases after the tax reform in the Sections 8c / 8d KStG in 2017.

5.4 Data and Research Design

5.4.1 Data and Sample

In this study, we use data from the Thomson Reuters EIKON database (short: EIKON), specifically the section "Venture Capital Deals" as part of the section "Private Equity".[62] It contains over 30 years of firm data on investors and their investees, i.e., the startups. This part of the database originated from and is powered by "Venture Xpert", a former database specialized on detailed information on venture capital investments both on startup and investor side. Therefore, using EIKON within this study is highly reasonable as it provides reliable data on various startup characteristics, e.g., the firms' location and financing rounds. Furthermore, we follow several researchers in entrepreneurship who have recently used this database as the foundation of their studies (e.g., Hornuf et al. 2018; Granier et al. 2019).

For conducting analyses on investments in German startups, we manually complement data from EIKON with information from the startups' annual reports. Data is matched by the startups' full legal name and the respective year. Balance sheets from German startups falling under Section 1 KStG are available online via the "Bundesanzeiger". The website is managed by the German Federal Ministry of Justice, and responsible for publishing all financial statements required by German law. We manually extract the startups' fixed assets, current assets, equity capital, liabilities, and total assets.

We employ startup data from the years 2010 to 2019. This choice is based on the temporal proximity to the intervention event, i.e., the tax reform in the Sections 8c / 8d KStG in 2017, as well as the idea of evaluating recent developments only, and not having biased coefficients due to few observations from years before 2010. We refrain from including startup investments from 2020 and 2021 into our analyses due to the specificity of the COVID-19 pandemic. The term "investment" in this study describes additional external financial resources which startups receive from investors in several investment rounds throughout their life, i.e., it does not include the capital contribution of owners and investors at startups' foundation. We choose the German Federal Constitutional Court's decision in 2017 as the intervention event for the synthetic control method in this study as, at this point in time, the German government got the instruction to reframe Section 8c KStG due to its unequal treatment of firms with different shareholder structures (see Section 5.2.1 for further details). This highly affected investors' anticipations on their future profits, and thus their upcoming investment decisions as they could anticipate a different tax treatment in the short run.

[62] We refrain from including data on mergers and acquisitions into our analysis as EIKON enables us to explicitly concentrate on venture capital investments. Furthermore, startups face high losses and high default risks at the beginning of their operations (e.g., Cooper and Knittel 2006; Haufler et al. 2014) and thus the tax reform in the Sections 8c / 8d KStG strongly affects early-stage startups. In contrast to that, M&As are one specific exit type which typically take place in later stages and after several funding rounds (e.g., Pisoni and Onetti 2018).

With the tax reform in the Sections 8c / 8d KStG, the German government introduced a tax relief especially directed at startups. This public policy change constitutes a quasi-natural experiment regarding investors' anticipations and ultimately the effects on their investment behavior. It similarly affected all startups which enables us to exploit exogenous variation in the explanatory and dependent variables even though we do not observe a random assignment of startups to the treatment. Additionally, quasi-natural experiments in the real world usually "provide [...] relatively robust measures of the counterfactual" (Dean 2016, p. 140) and thus allow enhanced generalizability and relevance for public policy and individual decision-making (Meyer 1995). For analyzing the effects of the tax reform, we compare investors' behavior in Germany with investors' behavior in a synthetic control group made up of comparable startup investments in other European countries.[63] This choice is based on the fact that there is no comparable group of startups in Germany which is not affected by this intervention. Furthermore, the tax reform constitutes a macroeconomic event which makes a matching procedure on macro level more reasonable than on micro level.

The initial control sample in this process consists of those European countries which have not been affected by a similar tax event as Germany between 2000 and 2019.[64] This excludes, e.g., Denmark and Spain from the sample. Additionally, we assume that macroeconomic shocks within our observation period hit European countries similarly. In contrast to that, idiosyncratic shocks which affected our outcome of interest (= the investment amount in startups) in the given time period lead to the exclusion of further countries from the donor pool. This involves, e.g., Greece which experienced an extraordinary government debt crisis following the financial crisis of 2007/2008. Third, we restrict the control group to those European countries that show generally similar macroeconomic characteristics to Germany. Therefore, we exclude, e.g., all Eastern European countries from the donor pool as startups in these countries act under fairly disparate economic conditions. Additionally, donor pool countries have to show a sufficiently high number of observations in our dataset, including especially a sizeable number of pre-intervention periods. This decision rests upon the credibility of the synthetic control method which depends on how accurate the untreated donor pool can imitate the treated unit (= Germany) in the time period prior to the treatment event (= the tax reform). This excludes, e.g., Austria from the control group. Summing up, our donor pool consists of observations from the following eight European countries: Finland, France, Ireland, Italy, the Netherlands, Sweden, Switzerland, and the United Kingdom.

We extract raw data on these countries from EIKON including startup information on 6,928 startups with 10,468 investment rounds. We exclude startups and their investment rounds from

[63] Taxation in these countries does not matter for evaluating the effects of the German tax reform on startup investments in Germany as the countries composing the synthetic control group imitate the development of startup investments in Germany without the reform based on the chosen criteria (see Section 5.4.2).

[64] For this study, the United States as the largest startup market is not suited as control group due to the Small Business Jobs Act in 2010. This tax reform introduced a full exemption from federal capital gains taxes when selling shares of small businesses. Hence, the coefficients within this study would be biased and could not completely be led back to the tax reform in the Sections 8c / 8d KStG in Germany.

the sample which do not fulfill the requirements for German corporations of Section 1 KStG (16 investment rounds). For observations from foreign countries, we manually search for the existing corporate legal forms in these countries and restrict our sample to those investment rounds which involve startups in a corporate legal form comparable to the legal form of a "corporation" in Germany.[65] This procedure is necessary to ensure that sample startups are either covered by the tax reform in Germany or, within the synthetic control group, are of similar nature as German corporations. Thereby, we are able to analyze investors' behavior before and after the reform and evaluate the effects of the policy tax change in the Sections 8c / 8d KStG.[66] Furthermore, we exclude outliers in terms of age from the sample resulting in excluding all startups with more than 25 years of existence (excludes 1,749 investment rounds).[67] By doing so, we ensure that, e.g., wrongly classified VC investments in EIKON, are excluded from the analysis and, at the same time, there are startups from all time periods within the development of the current tax policy in our sample. Additionally, as "the financial instrument used by the majority of [startups requesting venture capital is] pure equity (70%)" (Bascha and Walz 2007, p. 222), we exclude those investment rounds from the sample which name debt or similar investment types as the financing method (partially) employed (452 investment rounds). This results in our final sample of 8,251 investment rounds from 5,200 startups.

Table 5.1: *Local and Temporal Distribution of Observations*

	Investment Rounds			Investment Rounds	
	Freq.	%		Freq.	%
Finland	323	3.91	2010	764	9.26
France	2,660	32.24	2011	750	9.09
Germany	1,002	12.14	2012	737	8.93
Ireland	289	3.50	2013	713	8.64
Italy	148	1.79	2014	749	9.08
Netherlands	247	2.99	2015	775	9.39
Sweden	328	3.98	2016	915	11.09
Switzerland	370	4.48	2017	964	11.68
United Kingdom	2,884	34.95	2018	926	11.22
			2019	958	11.61
Total	8,251	100.00		8,251	100.00

This table displays the distribution of observations. It is split by country and year. Countries are sorted alphabetically, years are sorted in ascending order.

[65] A list of corporate legal forms in European countries relevant for this study and their German equivalent is displayed in *Table A.5.7* of the Appendix.

[66] A list of tax reforms in the countries of the synthetic control group, which are all of minor importance and thus do not bias the results of this study, is displayed in *Table A.5.6* of the Appendix. We assume that subsidy programs for startups occur apart from law changes, throughout all sample countries, and address all types of firms similarly. Additionally, we assume that they especially target firms in their very early stage which are usually not (yet) created as corporations (e.g., "INVEST" introduced in Germany in 2013).

[67] We know that some might doubt that firms with 25 years of age are still specified as "startups". As we use data from the section "Venture Capital Deals" in EIKON and venture capital investments typically focus on startup investments (e.g., Sahlman 1990; Block et al. 2019; Gompers et al. 2020), one could argue to include all observations into the analyses. Still, we strive to exclude extreme outliers from the sample, and thus we restrict the analysis to firms with 25 years or younger which includes 97.40% of the observations into our analyses.

Table 5.1 displays the local and temporal distribution of observations (= investment rounds). The majority of sample firms operates in the United Kingdom and France, followed by Germany. With approximately 80%, observations from these three countries form the main part of the sample. This finding matches the distribution of investment rounds nowadays throughout Europe. Most startup investment rounds take place in these three countries (EY 2022b). On the contrary, Italy is described as not being an attractive country for startup foundation (e.g., Treibenreif 2022), which is also reflected in the low number of observations from Italy in our sample. The bias in the number of observations towards the United Kingdom, France, and Germany does not appear to be a problem for this study as observations from foreign countries are weighted within the synthetic control method according to how similar to Germany these countries develop before the chosen intervention event.

5.4.2 Synthetic Control Group

In comparative studies, all observations within the sample act in the same macroeconomic environment, but only a subsample of observations is hit by the intervention, e.g., a law change, and all other observations remain untreated. This allows researchers to draw conclusions on the impact of the treatment. In our setting, all German startups in the legal form of a corporation have been affected by the changes in the German tax law through the Sections 8c / 8d KStG in 2017. In turn, there is no untreated unit of German startups which could be used as comparison group in the following empirical analysis.

To overcome this empirical challenge and evaluate the effects of this tax reform in Germany, we apply the synthetic control method. It was developed by Abadie and Gardeazabal (2003) and refined by Abadie et al. (2010) and Abadie et al. (2015). The synthetic control method is a systematic way to create a comparison group by selecting comparison variables in comparable observations. Ideally, the created synthetic control group behaves exactly the same as the group of treated units with regard to these variables before the intervention event so that any difference in the dependent variable thereafter can be attributed to the intervention. This method allows an accurate reproduction of the treated observations by combining the characteristics of several untreated units. It describes a more enhanced empirical method than considering only one control unit or one control variable. Summing up, the synthetic control method offers the possibility to precisely specify quantitative inference without precluding qualitative concepts to the same data (Langenmayr 2017; Dörr et al. 2019).

Table 5.2: *Macroeconomic Variables to Create the Synthetic Control Group*

Variable	*Definition*
DomesticCreditToThe PrivateSector	Variable for measuring the financial resources which financial corporations (monetary authorities, deposit money banks, and other financial corporations) provide to the private sector through loans, purchases of non-equity securities, trade credits and other accounts receivable. It is measured as the proportion of credits divided by the GDP. Higher values refer to better financial endowment. It is retrieved from the World Bank Database (variable code $FS.AST.PRVT.GD.ZS$).
EconomicFreedom	Variable for measuring countries' economic freedom. It is measured on a scale from 0 to 100 as an equally weighted score of rule of law, government size, regulatory efficiency, and market openness. Higher values refer to higher economic freedom [100 = highest economic freedom possible; 0 = virtually no economic freedom]. It is retrieved from the "Index of Economic Freedom" from the Heritage Foundation (variable $Economic\ Freedom\ (Overall\ Score)$).
EffectiveAverageTaxRate	Variable for measuring the average tax burden of a startup initiating an investment project. It is measured on a scale from 0 to 1, corresponding to the tax rates in percentage terms. Higher values refer to a higher tax burden. It is retrieved from Steinmüller et al. (2019).
GDPPerCapita	Variable for measuring the GDP per capita. It is measured in (current) USD. Higher values refer to a higher GDP per capita. It is retrieved from the World Bank Database (variable code $NY.GDP.PCAP.CD$).
Inflation	Variable for measuring the price change in the economy. It is measured in percentage terms as the annual growth rate of the GDP implicit deflator. Higher values refer to higher inflation. It is retrieved from the World Bank Database (variable code $NY.GDP.DEFL.KD.ZG$).
PerceivedCapacity ForInnovation	Variable for measuring countries' capability to innovate. It is measured on a scale from 1 to 7 based on the categories "diversity and collaboration", "research and development" and "commercialization" within the Executive Opinion Survey by the World Economic Forum. Higher values refer to higher innovative capacity [7 = very high approval regarding the statement; 1 = very low approval]. It is retrieved from the World Competitiveness Index by the World Economic Forum (variable $EOSQ119$).
PerceivedFearOfFailure	Variable for measuring the chances of business failure. It is measured as the proportion of the population between 18 and 64 years who agrees that they see good opportunities but would not start a business for fear it might fail. It is retrieved from the Global Entrepreneurship Monitor (variable $Fear\ Of\ Failure$, column 6).
PerceivedOpportunities	Variable for measuring the chances for firm foundation. It is measured as the proportion of the population between 18 and 64 years who agrees to see good opportunities to start a business in the area where they live. It is retrieved from the Global Entrepreneurship Monitor (variable $Perceived\ Opportunities$, column 4).
PerceivedVCAvailability	Variable for measuring the difficulty of obtaining equity funding for start-up entrepreneurs with innovative but risky projects. It is measured on a scale from 1 to 7 within the Executive Opinion Survey by the World Economic Forum. Higher values refer to better chances for getting external funding via venture capital [7 = extremely easy; 1 = extremely difficult]. It is retrieved from the World Competitiveness Index by the World Economic Forum (variable $EOSQ089$).

This table displays the definitions of all macroeconomic variables used for creating the synthetic control group. Variables are sorted alphabetically. This table is an extract of Table A.5.8 of the Appendix.

We construct the synthetic control group by using a weighted average of several European countries based on the countries' similarity to Germany in the years prior to the intervention event

(2010-2016) regarding certain macroeconomic variables.[68] *Table 5.2* displays the definitions of these variables. Variables used for creating the "synthetic Germany" are the countries' GDP per capita, inflation, domestic credit given to the private sector, the effective average tax rate, countries' economic freedom, the perceived venture capital availability, perceived capacity for innovation, perceived fear of failure, and the perceived opportunities. The first five variables account for the countries' general macroeconomic situation, complemented by several variables assessing the countries' startup environment (access to finance, innovativeness, and existing hurdles) and people's openness to entrepreneurial activities. Data is retrieved from the World Bank, a research study on corporate taxes around the world, the World Economic Forum, the Heritage Foundation, and the Global Entrepreneurship Research Association. Following Abadie et al. (2010), we additionally employ five years of the lagged total investment amount (2010, 2013-2016) to control for the fact that no structural or country-level differences exist prior to the intervention event. We include more years the closer they are to our intervention event.

Mathematically, we construct the synthetic control group by calculating an (8×1) vector of weights $\mathbf{W}$ for the countries in the donor pool. The calculation is based on the idea of obtaining the best match between the control group and Germany regarding the above mentioned variables throughout all periods before the intervention event in 2017. The weights for each country j within the control group are calculated by minimizing the mean squared prediction error of the following function:

$$\min_{\mathbf{w}} \quad (\mathbf{X_1} - \mathbf{X_0} * \mathbf{W})' \mathbf{V} (\mathbf{X_1} - \mathbf{X_0} * \mathbf{W}) \tag{5.1}$$

$$\text{Subject to } \mathbf{W} \geq \mathbf{0} \text{ and } \mathbf{W}'\mathbf{1} = 1$$

In *Equation (5.1)*, $\mathbf{X_1}$ describes a (14×1) vector containing the values for each macroeconomic variable as well as the dependent variable $ln(InvestmentAmount)$ for the years 2010 and 2013-2016 for Germany. $\mathbf{X_0}$ describes a (14×8) matrix containing the values for the same 14 variables for the eight control countries. $\mathbf{V}$ describes a (14×14) diagonal positive semidefinite weighting matrix showing the predictive power of the variables included in $\mathbf{X_0}$ and $\mathbf{X_1}$ for the dependent variable $ln(InvestmentAmount)$. The weights in $\mathbf{V}$ affect the optimization problem of *Equation (5.1)* and thus the weighting vector of the countries $\mathbf{W}$. In line with Abadie and Gardeazabal (2003) and Abadie et al. (2010), $\mathbf{V}$ is chosen such that the mean squared prediction error of the dependent variable $ln(InvestmentAmount)$ is minimized for the pre-intervention periods.

A detailed explanation on the derivation and the construction of the synthetic control group as well as the vectors are displayed in *Derivation A.5.1* of the Appendix.

[68] For information on the countries, see Section 5.4.1 of this paper.

Table 5.3 displays the weights of the different countries within the synthetic control group (= **W**). It displays that observations from the Netherlands and the United Kingdom with a weight of 36.1% and 63.9%, respectively, form the control group. **W** is calculated given the optimization problem in *Equation (5.1)*, i.e., using the described macroeconomic variables and the investment amount in the years before the tax reform so that the control group behaves the most similar to Germany before the intervention event in 2017. The significantly higher number of observations from the United Kingdom compared to the Netherlands (2,884 and 247, respectively; compare *Table 5.1*) does not influence the composition of the synthetic control group as all observations from one country are weighted according to *Table 5.3*.

Table 5.3: *Composition of the Synthetic Control Group*

	%
Finland	0.0
France	0.0
Ireland	0.0
Italy	0.0
Netherlands	36.1
Sweden	0.0
Switzerland	0.0
United Kingdom	63.9

This table displays the share of each country within the synthetic control group. Countries are sorted alphabetically. Derivation A.5.1 of the Appendix describes the detailed mathematical approach for creating the synthetic control group.

In our analysis, we compare the development of the investment amount in German startups with the investment amount in startups from the synthetic European control group after the intervention event. Thereby, the control group approximates how startup investments in Germany would have evolved without the respective tax reform. Thus, we are able to reveal the effects of the change in tax law in the Sections 8c / 8d KStG in Germany on startup investments.

5.4.3 Variables

5.4.3.1 Investment Amount

In their early life, startups need external financial support to survive and grow (e.g., Gompers and Lerner 1999; Hellmann and Puri 2002). We measure the amount of financial resources which a startup receives by the investment amount per year in logarithmic terms. This proxy is given per startup through the variable “Equity raised” in the section “Venture Capital Deals” in the EIKON database.[69] To deal with the heterogeneous distribution in the investment amount, we use the natural logarithm of this variable within our analysis. Thereby, outliers are balanced out

[69] In turn, our sample does not include other investments, e.g., from business angels, family, or friends.

more easily which secures normality and homoscedasticity in the distribution of this variable. Additionally, using the natural logarithm allows the convenient interpretation of the estimates as elasticities in percentage terms. This method is frequently used in the literature (e.g., Kortum and Lerner 2001; Hellmann and Puri 2002).

5.4.3.2 Loss Carry Forward

The new Sections 8c / 8d KStG allow startups to deduct losses from future earnings even if startups sell a large part of their shares to new investors. Accumulating losses is common among startups as they face high expenses, especially to conduct research and development, in their early life (e.g., Achleitner and Braun 2018). In Germany, firms' loss carry forward is a mandatory position in the balance sheet (Section 266(3) German Commercial Code). It describes a stock item, i.e., the accumulated losses from former years. We get access to this balance sheet data through the Bundesanzeiger where firms' annual reports are published.

5.4.3.3 Risk Appetite

Of special interest in this study is also investors' risk appetite. We measure the effect of the tax reform on investors' risk appetite by investigating the development of the investment sum in startups' first investment rounds. We assume that investors show higher risk appetite when they invest in startups' very early investment rounds compared to later-stage investments due to the high risk of losses and, in turn, potential failure of early-stage startups. For this part of our analysis, we use again the synthetic control method to create a reference group which approximates how startup investments in first investment rounds would have evolved in Germany without the tax reform.

5.4.3.4 Control Variables

For evaluating the effects of startups' loss carry forward disclosed on the investment amount, we include several control variables measuring startup-specific characteristics in the analyses. First, we employ startups' age at financing (measured in the natural logarithm of the number of months since foundation) to control for startups' maturity and their current situation.

Additionally, we include the investment round number as a proxy for the startups' past success and investors' investment risk. We argue that startups reaching higher investment rounds must have shown (at least to a certain degree) success in recent years. Therefore, the investment risk decreases with higher investment rounds. The variable is measured in integers starting with one.

Last, we include two variables extracted from the startups' balance sheets into the regression. Startups' equity capital and their total assets serve as proxies for the startups' internal financial resources and startup size, respectively. They are both included in form of the natural logarithm.

5.4.4 Descriptive Statistics

Table 5.4 displays the summary statistics of the main variables on observation level.[70] Throughout the whole observation period (2010-2019) and all countries (Germany and eight European control countries), our sample consists of 8,251 observations (including 439 full observations from Germany). Before the tax reform in 2017, we include seven years into the analysis, which results in 63 country-year-combinations. We find sample startups to be on average 3.98 years old. This is in line with the typical startup age of less than ten years (e.g., Hellmann and Puri 2002; Kollmann et al. 2019). Additionally, the average investment round number of 2.75 is consistent with the focus of venture capital investments on young and high-risk startups. We find startups in our sample to receive an investment amount per investment round starting at EUR 1,967. The maximum amount sums up to EUR 1.15 billion. It is collected by a startup from the communication infrastructure sector. The average investment amount per investment round is EUR 9.49 million. The average loss carry forward of German startups in our sample is EUR 4.43 million.

In our sample countries, we observe an effective average tax rate between 10.86% and 30.10% with a mean of 21.44%. This is in line with the public observation of substantial differences in the European tax landscape (European Commission 2020). In the startup environment, the perceived opportunities by entrepreneurs vary widely with results between 17.34 and 78.50 on a scale from 0 to 100. The venture capital availability is seen as medium high throughout all countries within our sample with an average of 3.39 on a seven-point-scale. These findings are in line with anecdotal evidence that the European venture capital market is still in a fairly early development stage compared to, e.g., the U.S. venture capital market (e.g., Teare and Kunthara 2020). *Table A.5.8* of the Appendix displays the definitions of all variables.

[70] *Table A.5.1* and *Table A.5.2* of the Appendix display detailed descriptive statistics for all variables.

Table 5.4: *Descriptive Statistics*

	N	Mean	StdDev	Min	Max
Startup Level					
ln(InvestmentAmount)	8,251	14.90	1.51	7.58	20.87
ln(AgeAtFinancing)	439	3.72	0.62	0	4.95
ln(EquityCapital)	439	8.90	6.82	0	19.74
InvestmentRoundNumber	439	2.75	1.84	1	12
ln(LossCarryForward)	439	12.71	4.00	0	18.71
ln(TotalAssets)	439	14.37	2.13	0	20.05
Macroeconomic Level					
(a) All Countries					
DomesticCreditToThePrivateSector	63	112.60	31.18	48.13	185.36
EconomicFreedom	63	72.32	6.16	58.80	81.90
EffectiveAverageTaxRate	63	0.21	0.05	0.10	0.30
ln(GDPPerCapita)	63	10.80	0.25	10.32	11.39
Inflation	63	1.06	1.14	-1.14	3.86
PerceivedCapacityForInnovation	63	5.21	0.60	3.74	6.12
PerceivedFearOfFailure	61	37.06	6.35	23.76	57.68
PerceivedOpportunities	61	40.65	13.88	17.34	78.50
PerceivedVCAvailability	63	3.39	0.71	1.84	4.63
(b) Germany					
DomesticCreditToThePrivateSector	7	82.01	4.03	77.47	88.49
EconomicFreedom	7	72.61	1.34	71.00	74.40
EffectiveAverageTaxRate	7	0.26	0.00	0.26	0.26
ln(GDPPerCapita)	7	10.69	0.06	10.62	10.78
Inflation	7	1.23	0.65	0.49	2.10
PerceivedCapacityForInnovation	7	5.69	0.10	5.60	5.88
PerceivedOpportunities	7	34.94	3.69	28.48	38.27
PerceivedFearOfFailure	7	39.92	3.05	33.69	42.29
PerceivedVCAvailability	7	3.27	0.33	2.78	3.78
(c) Synthetic Control Group (Netherlands & United Kingdom)					
DomesticCreditToThePrivateSector	14	133.32	24.23	111.60	185.36
EconomicFreedom	14	74.71	0.98	73.30	76.50
EffectiveAverageTaxRate	14	0.22	0.02	0.19	0.26
ln(GDPPerCapita)	14	10.74	0.10	10.58	10.90
Inflation	14	1.75	1.04	0.32	3.86
PerceivedCapacityForInnovation	14	5.11	0.25	4.65	5.44
PerceivedOpportunities	14	40.25	7.40	29.24	54.25
PerceivedFearOfFailure	14	34.13	3.73	23.76	37.93
PerceivedVCAvailability	14	3.64	0.28	3.02	4.18

This table displays the descriptive statistics including all variables of the empirical analysis. N describes the number of observations (for sample selection criteria, see Section 5.4.1). The number of observations for the macroeconomic variables comprises 63 country-year-combinations (nine countries × seven years). For Italy 2011 and France 2015, data is missing within the databases for startups' perceived fear of failure and startups' perceived opportunities, which results in 61 observations for these variables. Section 5.4.2 describes the approach for creating the synthetic control group. Table A.5.8 of the Appendix displays the definitions of all variables.

Venture capital constitutes one of the main providers of financial resources for early-stage startups. The investment amount depends, among others, on the given tax environment (e.g., Da

Rin et al. 2006; Bock and Watzinger 2019). In 2017, the German government implemented a fundamental tax reform, removing substantial barriers for the deductibility of losses for startups. *Table 5.5* displays the development of the yearly investment amount of all investors in German startup corporations from 2010 to 2019. After the tax reform, we find a tremendous increase in the absolute investment amount of EUR 905 million (= 52.16%) from 2017 to 2019.

These findings coincide with the introduction of the tax law change in Section 8c KStG on January 1, 2019. They underscore the timely reaction of the market to changes in tax law (e.g., Shackelford 2000; Li et al. 2008). Furthermore, they correspond to the two-year reaction gap found by Christofzik et al. (2022) which could be observed, in this case, between the German Federal Constitutional Court's decision in March 2017 and the increase in the investment amount in 2019.

Table 5.5: *Development of the Investment Amount in Germany*

	Absolute Investment Amount (in million EUR)	Average Investment Amount per Investor per Investment Round (in million EUR)
2010	415.82	1.72
2011	468.80	2.38
2012	681.03	4.03
2013	515.76	2.71
2014	1,278.92	4.47
2015	2,073.84	6.64
2016	1,367.80	4.91
2017	1,735.32	8.50
2018	1,762.09	5.93
2019	2,640.21	6.78

This table displays the development of the investment amount throughout the observation period.

To get further information on the composition of our sample, we proxy the individual investor's financial support by dividing the aforementioned total investment amount by the number of investors and investment rounds. All figures are extracted from EIKON. We openly acknowledge that the individual investment amount throughout all investors is most likely not similarly high. However, with this approximation, we reveal the average amount of financial resources that startups receive from investors. *Table 5.5* shows that, between 2010 and 2019, the average absolute investment amount per investor per investment round increases from approximately EUR 1.72 million to EUR 6.78 million. This is equivalent to an increase of 294% within ten years (equals approximately 11.39% annually) which is in line with the increasing interest in startup investments and the VC market. Comparing the development between 2017 and 2019, we find a higher absolute investment amount and a lower average investment amount per investor per investment round. Unreported evidence shows that both the number of investment rounds and the number of investors increase within these two years.

5.4.5 Research Design

5.4.5.1 Effects of Tax Reforms on Startup Investments

In this study, we investigate the effects of a reform in tax law on investors' anticipations and their behavior. Specifically, we focus on the change in the Sections 8c / 8d KStG in Germany in 2017. Researchers in the past often used data either on larger firms or following an IPO (e.g., Guenther and Willenborg 1999; Edwards and Todtenhaupt 2020). In contrast to that, we combine startup data from the Thomson Reuters EIKON database with information from the German Bundesanzeiger. This data compilation enables us to match information provided by startups themselves with objective data from the startups' balance sheets. In turn, we can reveal the effects of a profound intervention in the tax environment on startup investments in Germany.

First, we examine if a changing investment behavior directly relates to the loss carry forwards disclosed in the startups' balance sheets. We conduct this analysis for German startups. We hypothesize that *startups' loss carry forward disclosed positively correlates with the investment amount received after the tax reform in the Sections 8c / 8d KStG in 2017* (*Hypothesis 1*). To test this hypothesis, we conduct the following OLS regression:

$$\begin{aligned} ln(InvestmentAmount_{i,t}) = \alpha &+ \beta_1 * ln(LossCarryForward_{i,t}) \\ &+ \sum_{p=1}^{13} [\beta_{p+1} * ln(LossCarryForward_{i,p}) * CompareYear_p] \\ &+ \beta_{15} * ln(AgeAtFinancing_{i,t}) \\ &+ \beta_{16} * ln(EquityCapital_{i,t}) \\ &+ \beta_{17} * InvestmentRoundNumber_i \\ &+ \beta_{18} * ln(TotalAssets_{i,t}) + \kappa_n + \theta_t + \epsilon_{i,t} \end{aligned} \tag{5.2}$$

where $ln(InvestmentAmount_{i,t})$ represents the proxy for the investment amount of all investors in startup i in year t and refers to the natural logarithm of the received financial resources. As main independent variables, we include the natural logarithm of startup i's loss carry forward $ln(LossCarryForward_{i,t})$ and a vector of interactions between startups' loss carry forwards disclosed ($ln(LossCarryForward_{i,p})$) and the years of observation excluding 2017 ($CompareYear_p$). $CompareYear_p$ describes dummy variables for the years 2006 to 2019 excluding the year of the announcement of the tax reform (2017), which serves as our reference year. The interaction coefficients capture the correlation between startups' loss carry forward and the investment amount in the respective year compared to the reference year 2017 (*Hypothesis 1*). We expect this interaction term to be positive after 2017.

To control for startup-specific characteristics which might drive their responses, we include four control variables into the regression: $ln(AgeAtFinancing_{i,t})$, $ln(EquityCapital_{i,t})$,

$InvestmentRoundNumber_i$, and $ln(TotalAssets_{i,t})$. We additionally include fixed effects for the industries n (κ_n) and years t (θ_t). Thereby, we are able to control for industry-specific and year-specific effects while simultaneously standardizing the effects to the reference year 2017 in which the tax reform in the Sections 8c / 8d KStG took place.

5.4.5.2 Comparison to the Synthetic Control Group

Comparing the effects only within Germany would limit the explanatory power and external validity of this study. Thus, we additionally compare the development of startup investments in Germany to the development of investments in a synthetic control group made up of a weighted group of comparable European countries. This synthetic Germany matches the development of startup investments in real Germany as close as possible before the intervention event and thus simulates the development of startup investments in Germany after the reform if the tax reform would not have occurred. In turn, we can lead back any difference in startup investments between real and synthetic Germany after the tax reform to the tax reform itself.

The synthetic control method enables us to deal with the empirical challenge of not having a control group of German startups which has not been affected by the changes in the German tax law.[71] We hypothesize that *the tax reform in the Sections 8c / 8d KStG in 2017 leads to a higher increase in the absolute investment amount in German startups compared to its synthetic control group* (*Hypothesis 2*).

For this study, the creation of a synthetic control group appears the most suitable empirical research method due to the analysis on macroeconomic level and the low number of observations. We admit that the synthetic control method might be seen as a "second best option" in empirical research after, e.g., a difference-in-difference research design. In order to evaluate the significance of observed differences, subsequently, we follow the literature (e.g., Abadie and Gardeazabal 2003; Abadie et al. 2015) and conduct placebo studies. Thereby, we aim to foster the credibility of the results investigating investors' response to the intervention event, i.e., the tax reform in the Sections 8c / 8d KStG.

5.4.5.3 Further Analyses in Germany

After investigating if the tax reform in the Sections 8c / 8d KStG fosters startup investments in general, we aim to further study the effects on different investor groups in Germany. We expect that *investors' risk appetite increases after the tax reform in the Sections 8c / 8d KStG in 2017* (*Hypothesis 3*). We suppose that early-stage startup investments imply higher risk than later-stage investments. We specify first round investments as being of higher risk compared to investments within later investment rounds. Thus, we test the hypothesis of a higher risk appetite

[71] Partnerships ("Personengesellschaften") are not appropriate due to large differences in their legal treatment, e.g., with regard to owners' liability, the non-availability of public data, and the situation that venture capitalists mostly focus on corporations.

of investors in a very early stage by splitting the sample to provide evidence on the causes of the observed overall effects.

5.5 Empirical Results

5.5.1 Effects of the Tax Reform

First, we look at the correlation between startups' loss carry forward disclosed and the investment amount received throughout the years. *Hypothesis 1* suggests that *startups' loss carry forward disclosed positively correlates with the investment amount received after the tax reform in the Sections 8c / 8d KStG in 2017*. The number of investment rounds in German startups included in this part of the analysis consists of 439 investment rounds. We openly acknowledge that the limited size of this sample might reduce the external validity of the results. Nonetheless, the following analyses give valuable insights into the German startup market and related investments. In turn, our results are of main interest not only for researchers in entrepreneurship but also public policy makers to develop tax laws and regulations in the future that show the desired effect.

Figure 5.4: *Correlation between Startups' Loss Carry Forwards and Startup Investments*

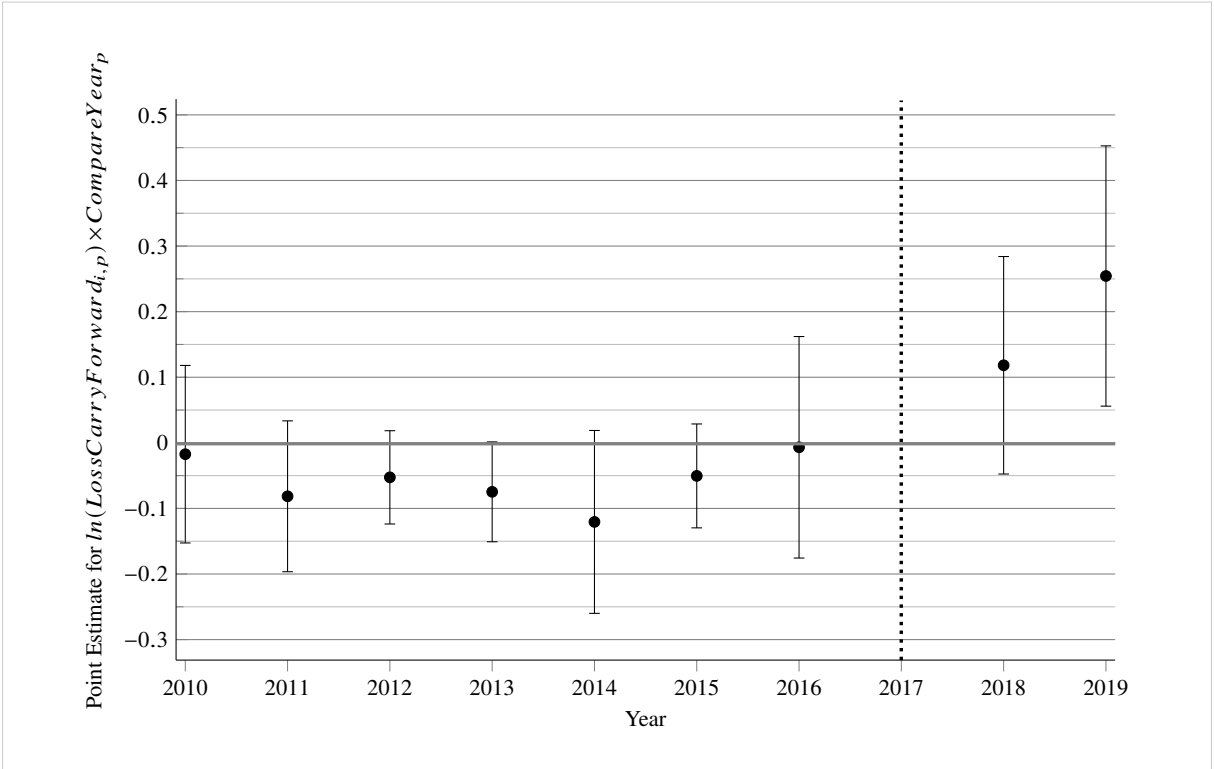


Figure 5.4 displays the development of startups' loss carry forward disclosed and the investment amount received from 2010 to 2019 with point estimates and 90% confidence intervals. We define

2017, the year of the announcement of the tax reform, as the reference year for the interaction between startups' loss carry forward disclosed and the respective year. The correlation appears negative before the reform and positive thereafter.

Table 5.6 confirms the negative correlation in the years before the reform. In the most extreme case, in 2014, a 1% increase in startups' loss carry forward disclosed correlates with a 0.12% decrease in the investment amount compared to the reference year 2017. This effect is significant at the 10% level. It might be explained by the idea that startups' loss carry forwards do not generally represent a positive signal to investors. Loss carry forwards describe losses in former years which might decrease investors' willingness to financially support the respective startups. On the contrary, in 2019, a 1% increase in startups' loss carry forward correlates with a 0.25% increase in the investment amount in startups compared to the reference year 2017. This effect is statistically significant at the 5% level and relatively large in its absolute size compared to the negative correlation in pre-intervention years.

These findings indicate a relation between startups' loss carry forward disclosed and investors' financial support before and after the tax reform in the Sections 8c / 8d KStG. A possible explanation might be investors' positive anticipations on their earnings with the new tax legislation in the Sections 8c / 8d KStG. Before 2017, investors "paid" for loss carry forwards reported in the balance sheets as former losses were not deductible from profits in future years. Thus, investors were not willing to invest and a loss carry forward reported in the balance sheet was rather a burden for startups since neither startups nor investors could use these losses if more than certain specified proportions of shares were sold. Since the tax reform in 2017, startups' losses can still be deducted from future earnings which decreases future tax payments. Therefore, investors might now see loss carry forwards as intangible assets and are now more attracted to startup investments. They seem more willing to accept losses from early-stage startups in return for future tax savings. This enables startups to get access to additional external finances.

Table 5.6: *Link between Startups' Loss Carry Forwards and Startup Investments*

Dependent Variable: ln(InvestmentAmount)	(1)
ln(LossCarryForward)	**0.0652*** **
	(0.0015)
2006 × ln(LossCarryForward)	**-0.0869***
	(0.0695)
2007 × ln(LossCarryForward)	**-0.1210***
	(0.0758)
2008 × ln(LossCarryForward)	**-0.1040***
	(0.0685)
2009 × ln(LossCarryForward)	0.0127
	(0.8170)
2010 × ln(LossCarryForward)	-0.0173
	(0.8010)
2011 × ln(LossCarryForward)	-0.0815
	(0.1640)
2012 × ln(LossCarryForward)	-0.0526
	(0.1460)
2013 × ln(LossCarryForward)	**-0.0747***
	(0.0544)
2014 × ln(LossCarryForward)	**-0.121***
	(0.0899)
2015 × ln(LossCarryForward)	-0.0504
	(0.2120)
2016 × ln(LossCarryForward)	-0.00678
	(0.9370)
2018 × ln(LossCarryForward)	0.1180
	(0.1620)
2019 × ln(LossCarryForward)	**0.2540** **
	(0.0121)
ln(AgeAtFinancing)	0.0426
	(0.7290)
ln(EquityCapital)	**0.0212*** **
	(0.0082)
InvestmentRoundNumber	0.0572
	(0.1870)
ln(TotalAssets)	**0.2820*** **
	(<0.0001)
Constant	Yes
Industry FE	Yes
Time FE	Yes
Observations	439
R^2	0.518

*This table displays the results of an OLS regression including all startup investments in Germany. For the interaction, 2017 serves as the reference year. P-values are displayed in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively. Time fixed effects are included on year level. Table A.5.8 of the Appendix displays the definitions of all variables.*

5.5.2 Comparison to the Synthetic Control Group

We further investigate the effects of the tax reform in the Sections 8c / 8d KStG in Germany in 2017 by implementing a proxy for the development of startup investments in German startups without the tax reform through a synthetic control group. The control group is made up of startup investments in several European countries so that it behaves the most similar to the development of startup investments in real Germany before the tax reform in 2017. We then compare the development between real and synthetic Germany. With the tax reform, the German government enforced a measure to decrease the unequal treatment of losses in firms with and without a change in the shareholder structure, especially targeting small firms. Thereby, they strived to remove implicit fiscal barriers for startup investments (Deutscher Bundestag 2016). *Hypothesis 2* suggests that *the tax reform in the Sections 8c / 8d KStG in 2017 leads to a higher increase in the absolute investment amount in German startups compared to its synthetic control group.*

Figure 5.5: *Development of Startup Investments in Germany and in the Synthetic Control Group*

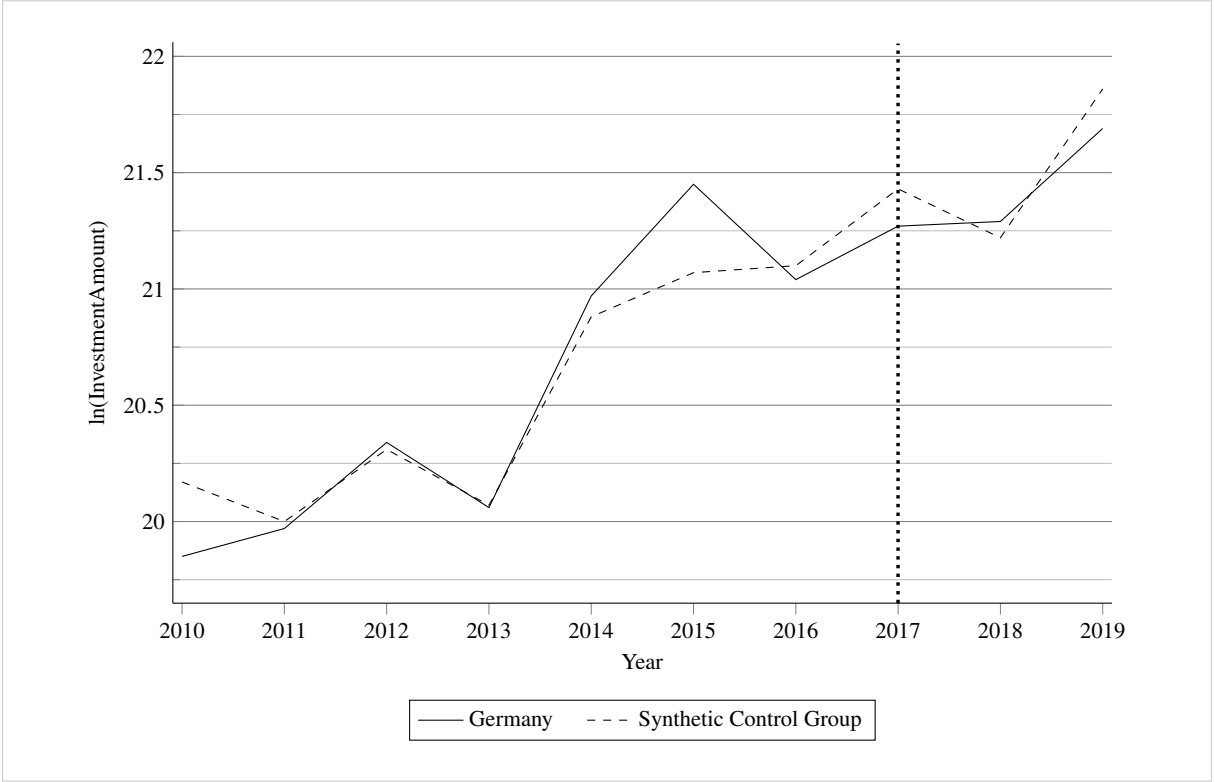


Figure 5.5 displays the results of the synthetic control method. The mean squared prediction error amounts to 0.0376. Between 2017 and 2019, we find an increase in the investment amount of 1.97% in Germany compared to 2.01% in the synthetic control group (measured in the natural logarithm). In contrast to our hypothesis, we do not find a strongly different increase in the total investment amount in German startups compared to the investment amount in startups in

synthetic Germany. After the tax reform in 2017, we find startup investments in real Germany to be even slightly lower than investments in synthetic Germany. Summing up, we cannot confirm the positive effect of the tax reform on startup investments which we expected in *Hypothesis 2*. All values are reported in *Table A.5.3* of the Appendix.[72]

A possible explanation for this finding might be the legal uncertainty for investors regarding the applicability of Section 8d KStG. If Section 8c KStG did not allow startups to disclose a loss carry forward, Section 8d KStG gave them the chance to do so since its implementation in December 2016. However, the "qualitative criteria" (Section 8d(2) KStG) were nowhere explicitly listed. Due to the anticipation of the publication of an explanatory letter by the German government (which is usually published between one or two years after a tax law change), investors might have refrained from changing their investment behavior immediately after the introduction. The same argumentation applies to Section 8c KStG. After the German Federal Constitutional Court's decision to adapt this section in March 2017, investors might have waited for the tax reform itself to exploit the new legislation instead of investing immediately. This idea is suggested by higher investments in 2019. It is in line with the predictions of tax consultants regarding this specific fundamental tax reform (e.g., Engelen and Heider 2020). The literature also confirms the idea of uncertainty increasing the option value of waiting (e.g., Bernanke 1983). Furthermore, Bloom et al. (2007) show that tax legislation fails to have the desired effects if lawmakers do not introduce tax laws with precise wording and practical application examples to ensure legal certainty.

5.5.3 Effects on Investors' Risk Appetite

When searching for investment alternatives, investors unquestionably include the investment risk into consideration (e.g., Fried and Hisrich 1994; Virlics 2013). First round investments represent investment alternatives with higher risk compared to later-stage investments. As the tax reform in the Sections 8c / 8d KStG enables startups to deduct losses in future periods, we suppose that investors might be more willing to invest in early-stage startups as this decreases startups' risk of failure. Therefore, *Hypothesis 3* suggests that *investors' risk appetite increases after the tax reform in the Sections 8c / 8d KStG in 2017*.

The composition of countries within the synthetic control group changes compared to former analyses in order to match the development of the investment amount in first investment rounds in real Germany before the tax reform the most closely. A mathematical explanation on the derivation of the country weights is provided in Section 5.4.2 of this paper and *Derivation A.5.1* of the Appendix. *Table 5.7* displays the weights of the synthetic control group for observations from startups' first investment rounds.

[72] Due to changes in the variables available within the Thomson Reuters EIKON database and potentially different dynamics during the COVID-19 pandemic, we restrict our analyses in this study to the years 2010 to 2019. For the sake of completeness, *Table A.5.4* of the Appendix still displays the development of startup investments in real and synthetic Germany in 2020 and 2021.

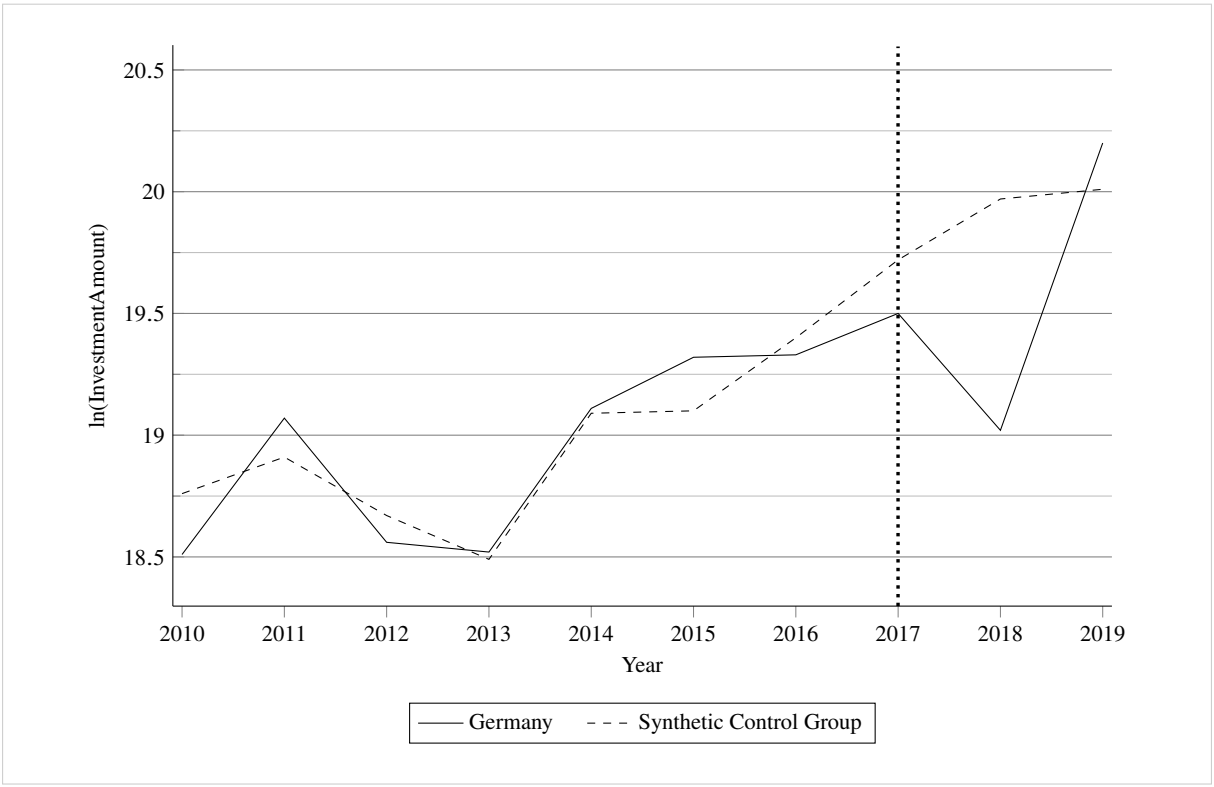
Table 5.7: *Composition of the Synthetic Control Group for First Investment Rounds*

	%
Finland	0.0
France	0.0
Ireland	9.6
Italy	20.6
Netherlands	7.1
Sweden	2.0
Switzerland	0.0
United Kingdom	60.7

This table displays the share of each country within the synthetic control group. Countries are sorted alphabetically. Derivation A.5.1 of the Appendix describes the detailed mathematical approach for creating the synthetic control group.

Figure 5.6 displays the development of first round startup investments throughout our observation period. The restricted sample consists of 4,034 investment rounds, the mean squared prediction error in this specification amounts to 0.0225. With a decrease of 2.46% in the natural logarithm of the investment amount, findings suggest that early-stage startup investments in real Germany strongly decrease after the tax reform in 2017 before increasing in 2019 (by 6.20%).

Figure 5.6: *Startup Investments in the First Investment Rounds*



In contrast, we find a yearly increase for the synthetic control group of 1.27% and 0.20%, respectively, between 2017 and 2019. We again relate this difference between real and synthetic

Germany to investors' anticipations and the legal uncertainty between the German Federal Constitutional Court's decision in March 2017 and the final introduction of the tax reform in Section 8c KStG by the German government in January 2019. In 2019, after the final implementation of the new Section 8c KStG, the results suppose that investors engage more often in risky early-stage startups compared to later-stage startups. This supports the idea of their higher risk appetite after the implementation of the tax reform, however, not immediately after the announcement in 2017. Summing up, these findings partially back *Hypothesis 3*. All values are reported in *Table A.5.3* of the Appendix.

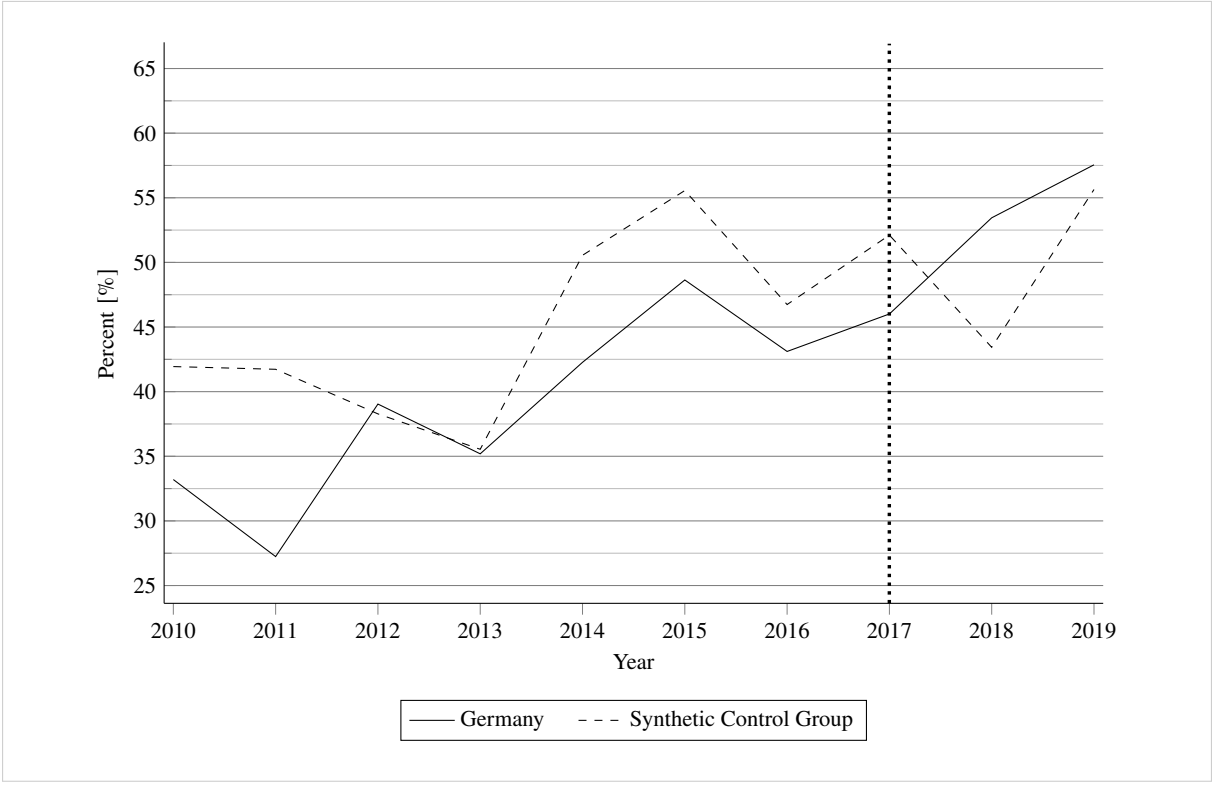
5.6 Robustness Tests

To test the robustness of our findings, we first investigate if results are driven by a different investment behavior of foreign and domestic investors. Cumming and Dai (2010) show that VCs are strongly biased towards geographically proximate investments, since distance increases information asymmetry and the costs of monitoring. Schertler and Tykvová (2012) suggest that a country with an insufficient tax and legal environment for venture capital intermediation will have a lower gross inflow of venture capital than a country with a better environment for venture capital intermediation. Investigating the effects of cross border taxation on the extent of home bias for international equity flow, Mishra and Ratti (2013, p. 168) show that a "relatively high foreign tax rate that cannot be offset by tax credits is found to significantly increase home bias". For this study, these findings translate to domestic investors being better informed about the current tax policy and law changes than foreign investors. To rule out that our findings are driven by a different reaction of domestic and foreign investors, we first look at the shares of these investors regarding the total investment amount in Germany over time.

Figure 5.7 displays the proportion of foreign investors in Germany and in the synthetic control group imitating Germany over time. The composition of synthetic Germany corresponds to the weights determined for the full sample (see Section 5.4.2). We measure the proportion of foreign investors as the number of foreign investors divided by all investors. We refrain from approximating the individual investment amount via the absolute investment amount divided by the number of investors for this in-depth analysis as the calculation would rest upon the strong underlying assumption that every investor invests the same absolute amount of equity capital in a startup. We find that after the tax reform in 2017, the share of foreign investors (and vice versa of domestic investors) does not substantially differ between the real development in Germany and the synthetic control group. One could suppose an informational disadvantage of foreign investors with regard to the tax reform, however, we find increasing shares of foreign investors. This result suggests the on-going internationalization of investments. It also underscores that our

findings regarding the investment behavior are not driven by information asymmetries stemming from differing investors' origins. All values are reported in *Table A.5.3* of the Appendix.

Figure 5.7: *Share of Foreign Investors*



In a second robustness test, we look at different types of investor groups. Independent Venture Capitalists (IVCs) professionally manage funds and therefore place substantial importance on the economic potential of a startup. They are mainly interested in financial gains (Block et al. 2019). In contrast to that, corporate venture capitalists (CVCs) usually fund startups on behalf of a corporate parent, aiming at realizing synergies with their main business (Hellmann and Puri 2002). Governmental venture capitalists (GVCs) mainly support the growth of the local VC market. They are "funds that are managed by a company that is entirely possessed by governmental bodies" (Grilli and Murtinu 2014, p. 1524).

As the tax reform of the Sections 8c / 8d KStG led to higher expected gains for investors through lower future tax obligations for startups, we strive to rule out that the results are biased due to different reactions to the tax reform by IVCs versus other investors. We measure the share of IVC investors as the number of IVC investors divided by the number of all investors. *Figure 5.8* displays the proportion of IVC investors in startups in real versus synthetic Germany throughout our observation period.[73] We find a quite volatile share of IVC investors which suggests some caution in the interpretation of the results.

[73] Unreported evidence shows that IVCs make up for the largest share of investors which is in line with the Report on Global Corporate Venture Research Data (Eckblad et al. 2019).

Figure 5.8: *Share of IVC Investors*

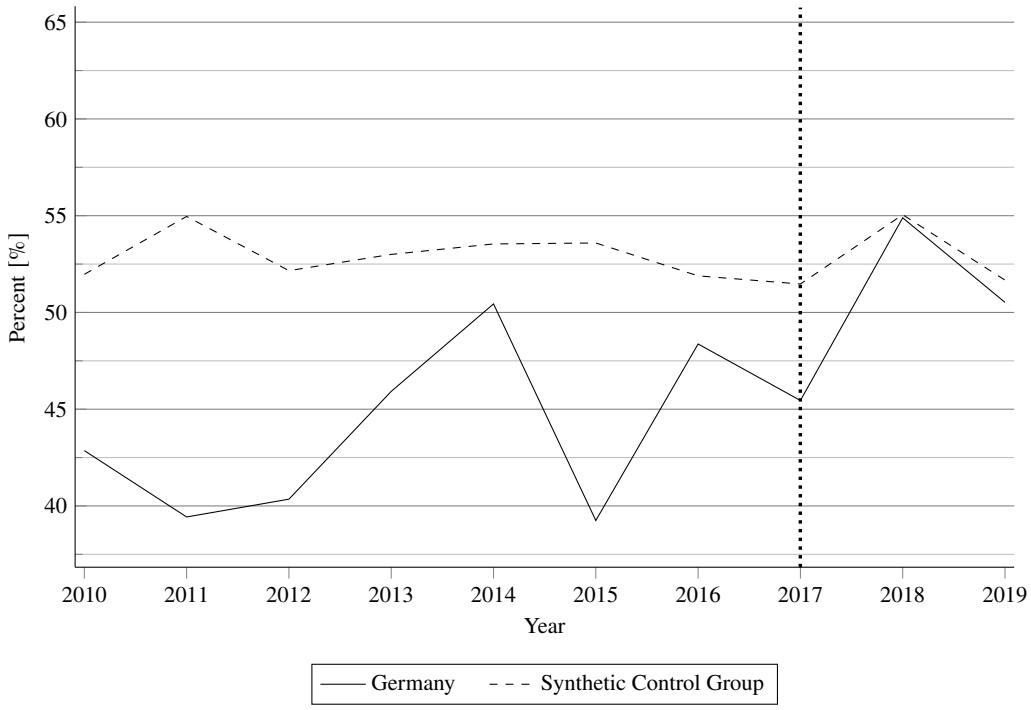


Figure 5.8 shows that the proportion of IVC investors increases from 42.86% in 2010 to 50.52% in 2019 in our sample in real Germany. After the tax reform, we see a different development when comparing the share of IVC investors in real versus synthetic Germany. The synthetic control group shows a quite constant trend over time. In contrast, we find an increase of 20.77% from 2017 to 2018 and a decrease of 7.92% from 2018 to 2019 in the proportion of IVC investments in real Germany. The development in real and synthetic Germany resemble one another in the years 2018/2019 which shows that the short-term positive reaction of IVC investors between 2017 and 2018 diminishes again quickly. Due to the high volatility, however, these results should be replicated in future studies to get reliable results and interpretations. All values are reported in *Table A.5.3* of the Appendix.

To detect hidden biases in our results, we additionally conduct a placebo study. The idea of a placebo test is to apply the synthetic control method to each country within the control group (e.g., Abadie et al. 2010). Thereby, one assumes that the simulated country experiences a comparable tax reform as Germany at the time of the chosen intervention event (2017) even though in reality it does not. In turn, one can conclude whether the effects observed in Germany are significantly different compared to the respective control country. If the differences in the variable of interest, i.e., the investment amount, between the real and the synthetically created countries from the control group are similar to the difference found in the foregoing analyses

for Germany, one cannot lead back the changes in investors' behavior in German startups to the intervention event, i.e., the tax reform in the Sections 8c / 8d KStG in this study.

Figure 5.9: *Placebo Study for All Investment Rounds*

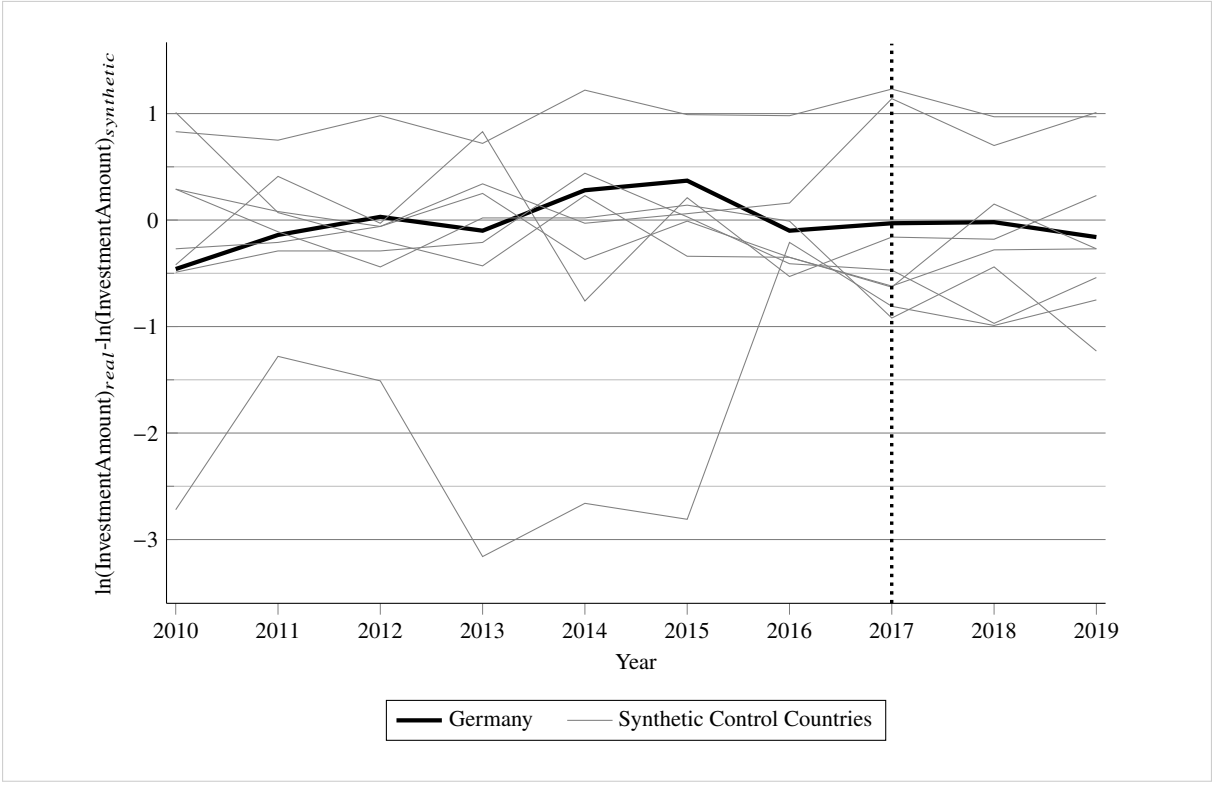


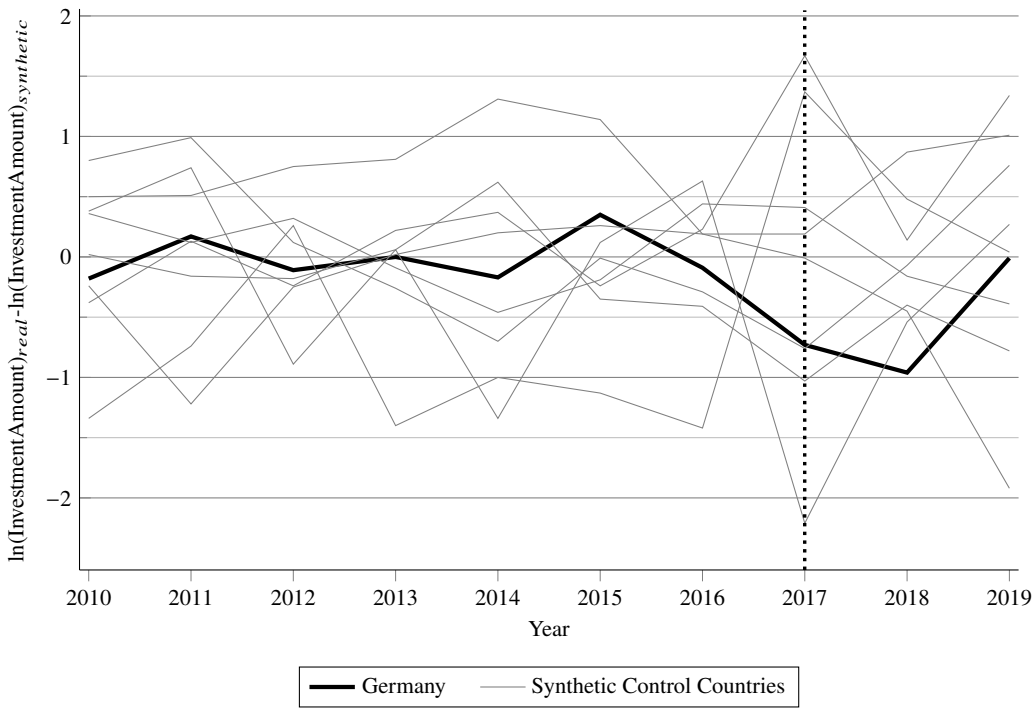
Figure 5.9 displays the results. The bold black line displays the difference in the natural logarithms of the investment amount for real Germany and its synthetic control group throughout our observation period. The thinner grey lines show these differences for each country of the donor pool. We find that the difference in Germany develops quite constantly around zero (= results depicted in *Figure 5.5*) and, similarly, the differences do for the control countries.[74] In turn, our main findings of this paper seem to be robust as there is no country within the synthetic control group which shows a significant deviation after the intervention event in 2017.

Figure 5.10 shows the results of a placebo study including only the first investment rounds within our sample. In this specification, we find the difference in the investment amount between real and synthetic Germany to be stable around zero before the tax reform in 2017 but quite strongly deviating from zero thereafter (= results depicted in *Figure 5.6*). In contrast to that, the differences seem to stay positive or negative at any time, or just randomly jumping from positive to negative or vice versa in other countries throughout the observation period. This finding suggests that first round investments of our sample startups in Germany develop significantly

[74] The grey line with the largest deviation displays the development of investments in real versus synthetic Italy. As there are only few observations with investments in Italian startups within our sample, the synthetic control method does not allow a precise replication of investments there, and thus the placebo graph for Italy shows some volatility.

different due to the tax reform compared to a situation without the reform. It confirms the results of Section 5.5.3. All values are reported in *Table A.5.5* of the Appendix.

Figure 5.10: *Placebo Study for First Investment Rounds*



5.7 Possible Limitations and Implications for Future Research

This study describes the effects of a tax reform on startup investments which is of main interest for researchers and public policy makers. It tries to fill the gap in the literature on entrepreneurship and taxes, but we acknowledge that it shows some limitations which call for future research. Some challenges remain related to the dataset as well as the empirical setting.

First, there might be issues regarding the data contained in EIKON. Due to the young nature of startups, it is very likely that our sample is not all-embracing, i.e., that not all investments in all countries within our analyses are comprised within the database. There might, e.g., be deals which have been arranged privately and, thus, are not included in the database. To overcome this concern, we split the sample by several factors, run different robustness tests, and investigate the descriptive statistics in detail. In this process, we do not detect any systematic bias which might distort our results.

We can also not control for the situation when critical thresholds in the shareholder structure with regard to the tax reform are exceeded. Exemplarily, this might be the sale of shares of more than 50% within five years, which changes the treatment of startups' losses (see Section 5.2.1 of this paper or Section 8c(1) KStG). The limitation is based on data availability, i.e., that we do not know how many shares an investor can purchase from a startup with a certain amount of money. It is unlikely that investors can acquire the same equity share with the same amount of money from each startup in our analyses as share prices from different firms usually differ depending on, e.g., supply and demand. In turn, we cannot draw conclusions on the exact equity proportion sold, and if, thereby, a certain threshold addressed in the Sections 8c / 8d KStG is exceeded. However, investigating the effects on the overall investment amount per country per year allows us to evaluate the development of startup investments in German startups before and after the tax reform in the Sections 8c / 8d KStG.

Additionally, first-hand information by EIKON employees confirms that the dataset combines data from different sources. This includes, e.g., government filings, public news releases, and surveys of private equity firms. As there is manual work involved, the information in EIKON might be incomplete or containing mistakes, which one has to keep in mind when interpreting the results. Still, we choose EIKON as it incorporates data from the former venture-capital-specific database "Venture Xpert" which was recognized as one of the main databases in entrepreneurial research. Thus, EIKON is nowadays one of the largest databases containing information on startup investments and widely used in empirical studies. In the regression analysis, missing data on German startups' balance sheets limits the number of investment events included. However, combining data from EIKON and the Bundesanzeiger allows us to analyze effects which have remained under-investigated due to limited data access. We believe that a smaller sample, in this case, is not a major issue for the purpose of this study as EIKON and the Bundesanzeiger contain the most important venture capital deals and related startup information, respectively. Thus, our results display the main effects of the tax reform of the Sections 8c / 8d KStG on startup investments. Furthermore, comparing investments in real versus synthetic Germany allows us to meet this criticism as the bias is equaled out throughout all countries.

Another concern might be that the tax reform is not the only factor driving the investment amount in startups within our sample period. Potential endogeneity must be taken into consideration. External circumstances, e.g., labor frictions, might also affect the amount of venture capital provided by investors (e.g., Bosworth and Burtless 1992; Gompers and Lerner 1999). For the U.S. market, Kopp et al. (2019) confirm that only some part of the increase in investments can be led back to tax reliefs in the Tax Cuts and Jobs Act of 2017. We alleviate this concern by using the synthetic control method, i.e., comparing the development of startup investments between real and synthetic Germany.

Another disadvantage of the dataset relates to the fact that we do not have panel data on startup level. Thus, we cannot investigate the effects of the tax reform splitting the sample, e.g.,

by startup age. We address this concern by analyzing the effects on startups' first investment rounds. In our case, this method seems to be even more appropriate than splitting by age as one cannot assume that all startups enter their first (and any subsequent) investment rounds at the same time after foundation. However, not having panel data leads to, e.g., the impossibility of an analysis on micro level. Missing panel data, a missing control group within Germany, and missing information on the exact proportion which an investor acquires results in the non-usability of the empirical method of difference-in-difference or regression discontinuity design. The synthetic control method mitigates these issues, similarly to the issues of not being able to control for startups' capital contribution at the time of foundation and the time span between two investment rounds.

In future research, temporary timing effects of startups' loss carry forward disclosed and the investment amount received should be considered. On the one hand, capital gains through the deduction of losses in future years, and thus lower tax obligations are realized at a later point in time. Until then, tax rates might have changed. Additionally, Burman and Randolph (1994) show that the immediate reaction to temporary tax changes is higher compared to reactions due to permanent tax reforms. Therefore, future research should concentrate on analyzing the effects of a tax relief which is introduced only for a limited period of time compared to a long-term one.

Furthermore, one could argue to include the development of startup investments in 2020 to 2021 into the analysis to have additional post-intervention periods in order to evaluate the effects of the tax reform in the Sections 8c / 8d KStG. We refrain from using data from these years due to the specificity of the COVID-19 pandemic. Investors might have restrained their investment activities, especially in startups, during these economically unstable times. In turn, the investment sum after the reform might be biased.[75] However, in future studies, it might be of interest to disentangle the effects of the tax reform, the COVID-19 pandemic, and other factors, e.g., on macroeconomic level, on startup investments within these years.

Summing up, these points of criticism call for future research and replications to validate the findings of the analysis above. Specifically, other researchers could conduct similar analyses using data from other databases or other countries. Nonetheless, this study provides first insights on the relationship between tax policy and startup investments in Germany. It complements existing studies and serves as a solid base for future research.

5.8 Discussion and Conclusion

In this study, we investigate whether the corporate tax reform in the Sections 8c / 8d KStG relates to higher investments in German startups. Specifically, we examine the effect of investor anticipations and their investment behavior when the treatment of corporate losses becomes

[75] For the sake of completeness, *Table A.5.4* of the Appendix still displays the development in 2020 and 2021.

more generous from a tax perspective. The literature shows that startups heavily rely on external capital (e.g., Levine 2005; Beck et al. 2006). Tax obligations are a major restriction for startup investments by venture capitalists and startup growth (e.g., Carroll et al. 2000; Da Rin et al. 2006). Our study contributes to the literature by combining data from the Thomson Reuters EIKON database with startups' balance sheet data from the Bundesanzeiger. Using data on 5,200 startups and 8,251 investment rounds, we complement existing studies which mainly focus on IPOs or larger public firms.

First, we take a closer look at the relation of startups' loss carry forward disclosed and the investment amount in Germany. We find that before the tax reform in the Sections 8c / 8d KStG in 2017, loss carry forwards show a negative correlation with the investment amount in startups which reverses to positive thereafter. In 2019, this effect is statistically significant at the 5% level and also relatively large in its absolute size in comparison to the pre-intervention periods. One possible reason for this change could be that after the tax reform, investors perceive losses as an intangible financial asset which can be offset against profits in future years. In contrast, losses were not deductible before 2017 if a substantial amount of shares was sold which made losses financially worthless in terms of taxation. As startups rely on external financial sources, the strict limitation of the usage of losses constituted a financial investment barrier into startups. This study reveals if the tax reform showed the desired effect.

Second, we analyze whether the absolute investment amount in German startups increased after the tax reform. We use the synthetic control method to compare the development in the investment amount in Germany to a synthetic control group which consists of comparable European countries. In contrast to our expectations, we do not find a significantly higher increase in the investment amount in German startups after the tax reform. A possible explanation for this result might be investors' insecurity on the concrete applicability of Section 8d KStG. Additionally, investors have anticipated and awaited the final implementation of Section 8c KStG in 2019 by the German government before undertaking their investments. Existing studies show that investors adjust their activities based on their beliefs in order to take advantage of a possible but uncertain future tax benefit.

When restricting the sample to first round investments, we see an increase in the investment amount in Germany in comparison to the synthetic control group after the implementation of the new Section 8c KStG. The prompt increase in the investment amount after the final implementation of the tax reform in 2019 shows investors' higher risk appetite. Since the reform, they value early-stage startup investments more than before despite the higher risk of losses compared to later-stage investments. It underlines the idea that the restrictive treatment of losses before the tax reform had been a major obstacle for early-stage startups to obtain external financing even though especially those firms usually face high losses and rely on external financial support. In turn, the change in tax policy within Section 8c KStG seems especially beneficial for startups which have not yet taken part in several investment rounds.

The findings of this study underscore the economic importance of creating an adequate public policy environment regarding startups' loss treatment to foster startup performance. We show that tax policy has a significant influence on investor anticipations and decisions, and influences startups' access to external financial resources. Our analyses reveal that not every tax reform shows the expected effect if law makers do not carefully consider the wording of the tax law and its applicability in practice. Legal uncertainty despite court decisions might make investors act more cautiously than expected by public policy makers. By developing technological business models and shaping the economic future, startups can significantly contribute to a renewal of the innovative capability of a country and foster countries' future growth and prosperity. For this reason, further research should investigate which tools in tax policy-making are suitable to create legal frameworks promoting startup investments.

A Appendices

Figures

Figure A.5.1: *Example 1 on the Effects of the Tax Reform in the Sections 8c / 8d KStG*

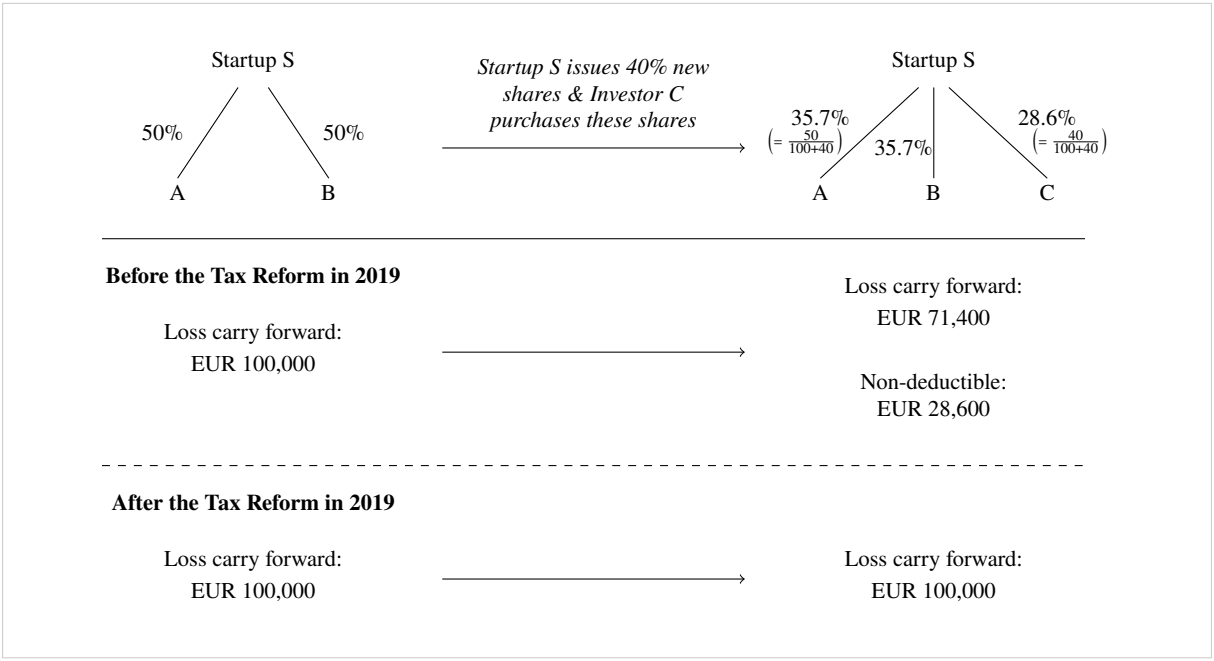
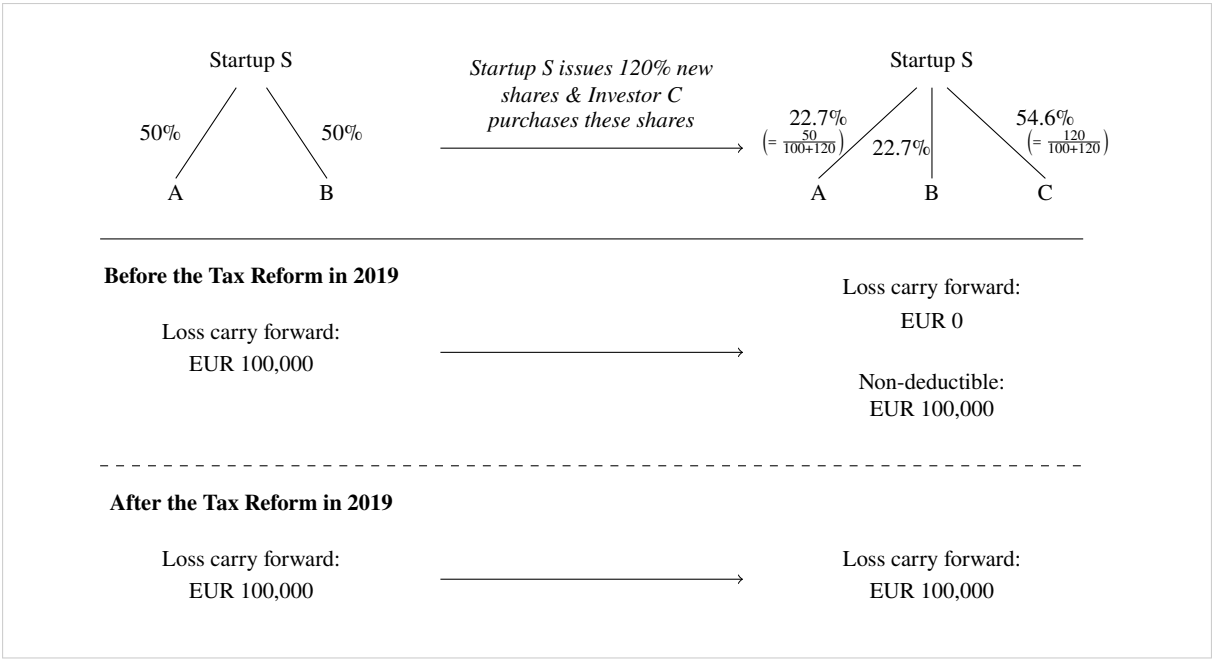


Figure A.5.2: *Example 2 on the Effects of the Tax Reform in the Sections 8c / 8d KStG*



The threshold of 50% is evaluated within a time period of five years and accumulative for all investment rounds within this period (Section 8c(1) KStG). This example holds if Section 8d KStG applies. If Section 8d KStG does not apply at time of the issuance of shares or does not apply at any time within the three years thereafter (Section 8d(1) KStG), the loss carry forward of EUR 100,000 is completely non-deductible.

Tables

Table A.5.1: *Detailed Descriptive Statistics*

	N	Mean	StdDev	Min	p25	p50	p75	Max
ln(InvestmentAmount)	8,251	14.90	1.51	7.58	13.92	14.91	15.89	20.87
ln(AgeAtFinancing)	439	3.72	0.62	0.00	3.40	3.85	4.16	4.95
ln(EquityCapital)	439	8.90	6.82	0.00	0.00	12.66	14.42	19.74
InvestmentRoundNumber	439	2.75	1.84	1.00	1.00	2.00	3.00	12.00
ln(LossCarryForward)	439	12.71	4.00	0.00	11.81	13.82	15.01	18.71
ln(TotalAssets)	439	14.37	2.13	0.00	13.51	14.44	15.60	20.05
Variables Included in the Analyses but without the Natural Logarithm								
InvestmentAmount	8,251	9,490,317	31,700,000	1967.80	1,112,590	2,999,961	8,000,000	1,150,000,000
AgeAtFinancing	439	47.77	22.55	1.00	30.00	47.00	64.00	141.00
EquityCapital	439	5,197,913	28,300,000	1.00	1.00	314,977	1,823,507	37,400,000
LossCarryForward	439	4,433,636	12,800,000	1.00	134,709	1,008,212	3,301,349	134,000,000
TotalAssets	439	10,200,000	39,700,000	1.00	734,135	1,871,784	5,950,685	509,000,000
GDPPerCapita	63	50,442	13,734	30,230	42,038	47,726	52,830	88,416

This table displays detailed descriptive statistics including all variables of the empirical analysis. N describes the number of observations (for sample selection criteria, see Section 5.4.1). Table A.5.8 of the Appendix displays the definitions of all variables.

Table A.5.2: *Detailed Descriptive Statistics of Macroeconomic Variables*

	N	Mean	StdDev	Min	p25	p50	p75	Max
All Countries								
(a1) General Macroeconomic Situation								
DomesticCreditToThe PrivateSector	63	112.60	31.18	48.13	90.84	104.26	130.84	185.36
EconomicFreedom	63	72.32	6.16	58.80	71.10	73.50	75.80	81.90
EffectiveAverageTaxRate	63	0.21	0.05	0.10	0.18	0.21	0.25	0.30
ln(GDPPerCapita)	63	10.80	0.25	10.32	10.65	10.77	10.87	11.39
Inflation	63	1.06	1.14	-1.14	0.18	0.98	2.01	3.86
(a2) Startup Environment								
PerceivedCapacity ForInnovation	63	5.21	0.60	3.74	4.88	5.38	5.66	6.12
PerceivedOpportunities	61	40.65	13.88	17.34	31.30	37.59	47.40	78.50
PerceivedFearOfFailure	61	37.06	6.35	23.76	33.22	36.53	40.43	57.68
PerceivedVCAvailability	63	3.39	0.71	1.84	3.02	3.49	3.92	4.63
Germany								
(b1) General Macroeconomic Situation								
DomesticCreditToThe PrivateSector	7	82.01	4.03	77.47	78.02	82.10	84.90	88.49
EconomicFreedom	7	72.61	1.34	71	71.10	72.80	73.80	74.40
EffectiveAverageTaxRate	7	0.26	0.00	0.26	0.26	0.26	0.26	0.26
ln(GDPPerCapita)	7	10.69	0.06	10.62	10.63	10.69	10.75	10.78
Inflation	7	1.23	0.65	0.49	0.51	1.10	2.01	2.10
(b2) Startup Environment								
PerceivedCapacity ForInnovation	7	5.69	0.10	5.60	5.62	5.66	5.74	5.88
PerceivedOpportunities	7	34.94	3.69	28.48	31.30	36.16	37.59	38.27
PerceivedFearOfFailure	7	39.92	3.05	33.69	38.58	41.04	41.99	42.29
PerceivedVCAvailability	7	3.27	0.33	2.78	3.02	3.23	3.52	3.78
Synthetic Germany (Netherlands & United Kingdom)								
(c1) General Macroeconomic Situation								
DomesticCreditToThe PrivateSector	14	133.32	24.23	111.60	114.50	123.89	149.49	185.36
EconomicFreedom	14	74.71	0.98	73.30	74.10	74.65	75.00	76.50
EffectiveAverageTaxRate	14	0.22	0.02	0.19	0.22	0.22	0.22	0.26
ln(GDPPerCapita)	14	10.74	0.10	10.58	10.66	10.73	10.83	10.90
Inflation	14	1.75	1.04	0.32	0.98	1.87	2.49	3.86
(c2) Startup Environment								
PerceivedCapacity ForInnovation	14	5.11	0.25	4.65	4.96	5.13	5.27	5.44
PerceivedOpportunities	14	40.25	7.40	29.24	33.30	41.27	45.55	54.25
PerceivedFearOfFailure	14	34.13	3.73	23.76	33.17	35.16	36.40	37.93
PerceivedVCAvailability	14	3.64	0.28	3.02	3.49	3.63	3.78	4.18

This table displays detailed descriptive statistics on the macroeconomic variables employed for creating the synthetic control group. N describes the number of observations. Table A.5.8 of the Appendix displays the definitions of all variables.

Table A.5.3: *Development in Germany and the Synthetic Control Group*

	(1) Germany	(2) Synthetic Control Group	(3) Germany	(4) Synthetic Control Group	(5) Germany	(6) Synthetic Control Group	(7) Germany	(8) Synthetic Control Group
2010	19.85	20.17	18.51	18.76	33.20	41.94	42.86	51.97
2011	19.97	20.00	19.07	18.91	27.24	41.73	39.43	54.96
2012	20.34	20.31	18.56	18.67	39.04	38.28	40.35	52.16
2013	20.06	20.07	18.52	18.49	35.19	35.54	45.92	53.00
2014	20.97	20.88	19.11	19.09	42.27	50.55	50.44	53.54
2015	21.45	21.07	19.32	19.10	48.64	55.64	39.25	53.59
2016	21.04	21.10	19.33	19.40	43.11	46.74	48.37	51.89
2017	21.27	21.43	19.50	19.72	46.01	52.11	45.45	51.47
2018	21.29	21.22	19.02	19.97	53.45	43.43	54.89	55.05
2019	21.69	21.86	20.20	20.01	57.55	55.64	50.52	51.67

This table displays in Columns (1) to (4) the values of the natural logarithm of the total absolute investment amount in German startups and the synthetic control group. Years are sorted in ascending order. Columns (1) and (2) relate to all startup investments in Germany, and correspond to Figure 5.5. Columns (3) and (4) relate to startup investments within the first investment rounds in Germany, and correspond to Figure 5.6. Columns (5) and (6) display the share of foreign investors divided by all investors, and correspond to Figure 5.7. Columns (7) and (8) display the share of IVC investors divided by all investors, and correspond to Figure 5.8.

Table A.5.4: *Investment Amount in Germany and the Synthetic Control Group*

	(1) Germany	(2) Synthetic Control Group
2010	19.85	20.17
2011	19.97	20.00
2012	20.34	20.31
2013	20.06	20.07
2014	20.97	20.88
2015	21.45	21.07
2016	21.04	21.10
2017	21.27	21.43
2018	21.29	21.22
2019	21.69	21.86
2020	22.08	22.07
2021	22.86	22.93

This table displays the values of the natural logarithm of the total absolute investment amount in German startups and the synthetic control group. Years are sorted in ascending order.

Table A.5.5: *Placebo Studies*

Panel A: All Investments									
	(1) Finland	(2) France	(3) Germany	(4) Ireland	(5) Italy	(6) Netherlands	(7) Sweden	(8) Switzerland	(9) United Kingdom
2010	-0.42	0.29	-0.46	0.29	-2.72	-0.49	1.01	-0.27	0.83
2011	0.41	0.08	-0.14	-0.11	-1.28	-0.29	0.07	-0.21	0.75
2012	-0.03	-0.06	0.03	-0.44	-1.51	0.29	-0.19	-0.06	0.98
2013	0.83	0.25	-0.10	0.02	-3.16	-0.21	-0.43	0.34	0.72
2014	-0.76	-0.37	0.28	0.02	-2.66	0.44	0.23	-0.03	1.22
2015	0.21	-0.01	0.37	0.14	-2.81	0.03	-0.34	0.06	0.99
2016	-0.53	-0.35	-0.10	-0.01	-0.21	-0.41	-0.35	0.16	0.98
2017	-0.16	-0.62	-0.03	-0.92	-0.81	-0.47	-0.63	1.14	1.23
2018	-0.18	-0.28	0.02	-0.44	-0.99	-0.97	0.15	0.70	0.97
2019	0.23	-0.27	-0.16	-1.23	-0.75	-0.54	-0.27	1.01	0.97
Panel B: First Investment Rounds									
	(1) Finland	(2) France	(3) Germany	(4) Ireland	(5) Italy	(6) Netherlands	(7) Sweden	(8) Switzerland	(9) United Kingdom
2010	0.80	0.36	0.18	0.38	1.34	-0.24	0.02	-0.38	0.50
2011	0.99	0.12	0.17	0.74	-0.74	-1.22	-0.16	0.13	0.51
2012	0.12	0.32	-0.11	-0.89	0.26	-0.25	-0.18	-0.24	0.75
2013	-0.26	-0.09	0.00	0.06	-1.40	0.02	0.06	0.22	0.81
2014	-0.70	-0.46	-0.17	-1.34	-1.00	0.20	0.62	0.37	1.31
2015	-0.01	-0.19	0.35	0.12	-1.13	0.26	-0.35	-0.24	1.14
2016	-0.29	0.44	-0.09	0.63	-1.42	0.19	-0.41	0.23	0.19
2017	-0.76	0.41	-0.73	-2.21	1.37	-0.01	-1.03	1.67	0.19
2018	-0.07	-0.16	-0.96	-0.54	0.48	-0.45	-0.40	0.14	0.87
2019	0.76	-0.39	-0.01	0.27	0.04	-1.92	-0.78	1.34	1.01

This table displays the differences between the development of the natural logarithm of the investment amount in the respective country and its synthetic control group. Thus, it shows for each country the results of the following spread: $ln(InvestmentAmount)_{real} - ln(InvestmentAmount)_{synthetic}$. *Panel A corresponds to Figure 5.9 and Panel B corresponds to Figure 5.10. Countries are sorted alphabetically, years are sorted in ascending order.*

Table A.5.6: *Tax Law Changes in the Countries of the Synthetic Control Group*

Country	**Change in Tax Law**	**Year**	**Reference**
Finland	Reform of corporate tax system: Increased taxation of dividends	2005	Kari, Seppo, Hanna Karikallio, and Jukka Pirtillä. 2008. Anticipating Tax Changes: Evidence from the Finnish Corporate Income Tax Reform of 2005. CESifo Working Paper No. 2201.
France	Reduction in corporate tax rate (no change for small companies)	2019	Ebner Stolz. 2018. Frankreich: Senkung des Körperschaftsteuersatzes. https://www.ebnerstolz.de/de/frankreich-senkt-koerperschaftsteuersatz-161400.html. Accessed on March 25, 2021.
	Simplified firm foundation starting 2021; Reform of inheritance tax; New regulations on the appointment of auditors / (certified public) accountants	2019	Rejano, Laura, Christophe Kühl, and Laure-Amandine Tresarrieu. 2019. Newsletter 3.19 Französisches Wirtschaftsrecht: I. Gesellschaftsrecht. https://www.qivive.com/sites/default/files/NL%2003.19%20franzoesisches%20Wirtschaftsrecht.pdf. Accessed on March 25, 2021.
	Increase of the tax rate for high income levels	2012	AFP, dpa Reuters. 2012. Frankreichs Sozialisten kassieren bei Millionären. https://www.zeit.de/politik/ausland/2012-07/frankreich-vermoegensteuer-mehrwertsteuer. Accessed on March 25, 2021.
(Republic of) Ireland	Fundamental reform of Irish corporate law	2015	Friedrich Graf von Westphalen & Partner mbB. 2015. Neues Gesellschaftsrecht in Irland. https://www.fgvw.de/neues/archiv-2015/neues-gesellschaftsrecht-in-irland#:~:text=Mit%20dem%20Inkrafttreten%20des%20irischen,den%20irischen%20gesellschaftsrechtlichen%20Rahmen%20bilden. Accessed on March 25, 2021.
Italy	Increase in tax deductions for startup investments (based on the startup law of 2012)	2017	DIKE Schindhelm. 2017. Steuerliche Erleichterungen für innovative Startup-Unternehmen. https://it.schindhelm.com/news-jusful/news/steuerliche-erleichterungen-fuer-innovative-startup-unternehmen. Accessed on March 25, 2021.
	Elimination of the annual payment to the Chamber of Commerce and other administrative fees for startups	2014	EBAN. 2017. Compendium of Fiscal Incentives: Tax Outlook in Europe 2017 - Business Angels Perspective. https://www.eban.org/2017-eban-compendium-of-fiscal-incentives/. Accessed on March 25, 2021.
	Fundamental reform of Italian corporate law, in particular concerning corporations (including substantial redesign of the s.r.l., amendment of applicable company agreements as well as effects under commercial and accounting law)	2004	Buenger, Florian. 2004. Die Reform des italienischen Gesellschaftsrechts. Recht der Internationalen Wirtschaft, 2004(4): 249-255.
Netherlands	Amendment of the Dutch law on limited liability companies (B.V.)	2012	Germany Trade & Invest. 2021. Gesellschaftsformen. https://www.gtai.de/gtai-de/trade/recht/portal-21/niederlande/gesellschaftsformen-92494. Accessed on March 25, 2021.
Sweden	-	-	-

Country	**Change in Tax Law**	**Year**	**Reference**
Switzerland	Reform of corporate tax law; No preferential treatment for MNCs and reduced tax rates starting 2020	2019	De Hoon, Iven. 2019. Switzerland will adopt new corporate tax rules. https://nomoretax.eu/switzerland-new-corporate-tax/. Accessed on March 25, 2021.
	Fundamental reform of Swiss corporate law	2008	Senn, Silvan, and Michael Betschart. 2008. Schweizerisches Gesellschaftsrecht: Reform zum 1.1.08 in Kraft getreten. https://www.iww.de/pistb/archiv/schweiz-schweizerisches-gesellschaftsrecht-reform-zum-1108-in-kraft-getreten-f43492. Accessed on March 25, 2021.
United Kingdom	-	-	-

This table displays the tax law changes in the countries of the synthetic control group which might have affected startup investments in these countries. It appears that all tax reforms are of minor importance, i.e., they do not bias our results. However, for the sake of completeness, this table is attached to this study.

Table A.5.7: *Corporate Legal Forms in the Countries of the Synthetic Control Group*

Country	**Corporate Legal Form**	**Most Similar to the German Legal Form**	**Theoretical Applicability of the Sections 1, 8c, 8d KStG**
Finland	Yksityinen Osakeyhtiö/Privat Aktiebolag (oy)	AG / GmbH	Yes
	Julkinen Osakeyhtiö/Publikt Aktiebolag (oyj)	AG	Yes
	Kommandittiyhiö	KG	No
	Avoin Ightiö	OHG	No
France	Société à responsabilité limitée (S.A.R.L.)	GmbH	Yes
	Société anonyme (S.A.)	AG	Yes
	Société par actions simplifiée (S.A.S.)	AG	Yes
	Société en commandite simple (SCS)	KG	No
	Société en commandite par actions (SCA)	KGaA	Yes
	Société en nom collectif (SNC)	OHG	No
	Société civile (SC)	GbR	No
	Entreprise unipersonnelleà responsabilité limitée (E.U.R.L.)	GmbH	Yes
	Entrepreneur individuel à responsabilité limitée (E.I.R.L.)	e.K. (with limited liability)	Yes
(Republic of) Ireland	Private company limited by shares (LTD) / Teoranta (TEO)	GmbH	Yes
	Company limited by guarantee (CLG) / Cuideachta faoi theorainn ráthaíochta (CTR)	GmbH	Yes
	Designated activity company (DAC) / Cuideachta ghníomhaíochta ainmnithe (CGA)	GmbH	Yes
	Public limited company (PLC) / Cuideachta phoiblí theoranta (CPT)	AG	Yes
	Unlimited Company (UC) / Cuideachta neamhtheoranta (CN)	GmbH (with unlimited liability)	Yes
Italy	Società semplice (S.s.)	OHG / KG	No
	Società in nome collettivo (S.n.c.)	OHG	No
	Società in accomandita semplice (S.a.s.)	KG	No
	Società a responsabilità limitata (S.r.l.)	GmbH	Yes
	Società per azioni (S.p.A.)	AG	Yes
	Società a responsabilità limitata semplificata (S.r.l.s.)	GmbH	Yes
	Società a responsabilità limitata a capitale minimo o ridotto (S.r.l.c.r.)	GmbH	Yes
	Società in accomandita per azioni (S.a.p.A.)	AG	Yes
Netherlands	Besloten vennootshap met beperkte aansprakelijkheid (BV)	GmbH	Yes
	Naamloze vennootschap (NV)	AG	Yes
	Commanditaire vennootschap op andelen (CVoA)	KGaA	Yes
	Commanditaire vennootschap (CV)	KG	No
	Vennotschap onder firma (VoF)	OHG	No
	Maatschap	GbR	No
Sweden	Publikt Aktiebolag (AB)	AG	Yes
	Privat Aktiebolag (AB)	GmbH	Yes
	Handelsbolag (HB)	OHG	No
	Kommanditbolag (KB)	KG	No
	Enkelt bolag	GbR	No

Country	**Corporate Legal Form**	**Most Similar to the German Legal Form**	**Theoretical Applicability of the Sections 1, 8c, 8d KStG**
Switzerland	Gesellschaft mit beschränkter Haftung (GmbH)	GmbH	Yes
	Aktiengesellschaft (AG/SA)	AG	Yes
	Kommanditaktiengesellschaft	KGaA	Yes
	Kommanditgesellschaft (KG)	KG	No
	Einfache Gesellschaft	GbR	No
	Kollektivgesellschaft	OHG	No
United Kingdom	Private company limited by shares (Ltd.)	GmbH	Yes
	Public company limited by shares (p.l.c.)	AG	Yes
	Limited partnership	KG	No
	Partnership	OHG	No
	(Privat) Unlimited company	GbR	No
	Limited liability partnership (LLP)	KG (without general partner)	No

This table displays the list of legal forms which exist in the countries of the synthetic control group. In the last column, the table shows if the respective legal form would fall under Section 1 KStG and, in turn, the Sections 8c / 8d KStG. This evaluation is made with regard to the question if the legal form is (rather) equivalent to a German "Personengesellschaft" or "Kapitalgesellschaft" as the German corporate tax law only applies to firms in the legal form of a "Kapitalgesellschaft" (Section 1 KStG).

Derivations

Derivation A.5.1: *Creation of the Synthetic Control Group*

This part displays the mathematical approach for creating the synthetic control group. It is adapted from Abadie and Gardeazabal (2003), Abadie et al. (2010) and Abadie (2021). For a definition of the variables, see Table A.5.8 of the Appendix.

A synthetic control group is defined as the weighted average of the units in the donor pool which matches the development of the dependent variable the best before the intervention event. Thereby, any difference thereafter can be led back to the intervention event itself. In this study, the synthetic control group describes a weighted average of eight European countries which matches the development of the investment amount in Germany before the tax reform in the Sections 8c / 8d KStG the best. In turn, we can lead back the difference between the development of the investment amount in real Germany (with the tax reform) versus synthetic Germany (simulated Germany without the tax reform) after the intervention event to the tax reform.

In order to compare the development of the investment amount in German startups after the reform, countries are matched to Germany based on certain control variables.

Let $\mathbf{X_1}$ be a (14×1) vector containing the values for Germany for each of the nine macroeconomic variables (GDP per capita, inflation, the effective average tax rate, domestic credit to the private sector, countries' economic freedom, the perceived capacity for innovation, fear of failure, opportunities, and venture capital availability). Each macroeconomic variable is averaged over the entire pre-observation period (2010-2016) and thus included once within the vector $\mathbf{X_1}$. Additionally, the vector $\mathbf{X_1}$ contains the values of the dependent variable $ln(InvestmentAmount)$ for each of the years 2010, 2013, 2014, 2015, and 2016. Including former periods (of the intervention event) of the dependent variable in the vector $\mathbf{X_1}$ controls for the fact that no structural or country-level differences exist prior to the intervention event.

$\mathbf{X_0}$ describes a (14×8) matrix containing the values for the same variables as in $\mathbf{X_1}$ for the eight control countries (Finland, France, Ireland, Italy, Netherlands, Sweden, Switzerland, and the United Kingdom).

$\mathbf{W}$ describes a (8×1) vector of weights for the countries within the synthetic control group. Then, $(\mathbf{X_1} - \mathbf{X_0} * \mathbf{W})$ describes a vector containing the differences between Germany and its synthetic counterpart for the given matching variables before the intervention event. This difference is aimed to be minimized with respect to the countries' weights $\mathbf{W}$. Thus, the optimization problem to solve is

$$\min_{\mathbf{w}} \quad (\mathbf{X_1} - \mathbf{X_0} * \mathbf{W})' \mathbf{V} (\mathbf{X_1} - \mathbf{X_0} * \mathbf{W})$$

subject to $\mathbf{w_j} \geq \mathbf{0}$ and $\sum_{\mathbf{j=1}}^{\mathbf{8}} \mathbf{w_j} = \mathbf{1}$ to avoid extrapolation (with $\mathbf{j}$ being a running number for the eight potential control countries).

The optimal vector of weights $\mathbf{W}^*$ depends on the matrix $\mathbf{V}$. It gives higher weights to variables with a larger predictive power for the dependent variable $ln(InvestmentAmount)$. $\mathbf{V}$ is a diagonal positive semidefinite matrix such that the mean squared prediction error of the dependent variable $ln(InvestmentAmount)$ is minimized within the pre-treatment periods.

Let $\mathbf{Z_1}$ be a (7×1) vector containing the $ln(InvestmentAmount)$ for Germany during the pre-intervention period 2010-2016. Let $\mathbf{Z_0}$ be a similar (7×8) matrix containing the values for the same variable for the eight potential control countries before the intervention event. Thus, the optimization problem to solve is

$$\min_{\mathbf{v}} \quad (\mathbf{Z_1} - \mathbf{Z_0} * \mathbf{W}(\mathbf{V}))' (\mathbf{Z_1} - \mathbf{Z_0} * \mathbf{W}(\mathbf{V}))$$

subject to $\mathbf{v_i} \geq \mathbf{0}$ and $\sum_{\mathbf{i=1}}^{\mathbf{14}} \mathbf{v_i} = \mathbf{1}$ (with i being a running number for the macroeconomic and other control variables). $\mathbf{V} \in \mathbf{v}$ is a set of all non-negative diagonal (14×14) matrices containing the weights on the diagonal which fulfill the minimization problem.

The weights for the countries in the synthetic control group for Germany (depending on $\mathbf{V}$) are then given by

$$\mathbf{W}^*(\mathbf{V}) = \arg\min_{\mathbf{w}} \quad (\mathbf{X_1} - \mathbf{X_0} * \mathbf{W})' \mathbf{V} (\mathbf{X_1} - \mathbf{X_0} * \mathbf{W})$$

Restricting the synthetic control weights to being non-negative and summing up to one, generates synthetic controls that are weighted averages of the outcomes of units in the donor pool with weights that are typically sparse. This implies that only a small number of units in the donor pool contributes to the estimate of the counterfactual (in our case, synthetic Germany). However, these estimates are particularly transparent. It is in line with the findings by Sharpe (1999) on the optimal portfolio composition.

The weights for the macroeconomic variables and other control variables are given by

$$\mathbf{V}^* = \arg\min_{\mathbf{v}} \quad (\mathbf{Z_1} - \mathbf{Z_0} * \mathbf{W}^*(\mathbf{V}))' (\mathbf{Z_1} - \mathbf{Z_0} * \mathbf{W}^*(\mathbf{V}))$$

which describes the weights of (macroeconomic and other) variables in $\mathbf{X_0}$ and $\mathbf{X_1}$. The weights for the countries are then given by $\mathbf{W}^*(\mathbf{V}^*)$ and the difference between the real development of the investment amount in Germany (with the tax reform) and the development in synthetic Germany (without the tax reform) can be calculated by

$$\hat{\tau}_\mathbf{t} = \mathbf{Z_1} - \mathbf{W} * \mathbf{Z_0}$$

For this study, the matrices look as follows

$$X_0 = \begin{bmatrix} Domestic\ Credit_{FI} & Domestic\ Credit_{FR} & Domestic\ Credit_{IE} & Domestic\ Credit_{IT} & Domestic\ Credit_{NL} & Domestic\ Credit_{SE} & Domestic\ Credit_{CH} & Domestic\ Credit_{UK} \\ EATR_{FI} & EATR_{FR} & EATR_{IE} & EATR_{IT} & EATR_{NL} & EATR_{SE} & EATR_{CH} & EATR_{UK} \\ Economic\ Freedom_{FI} & Economic\ Freedom_{FR} & Economic\ Freedom_{IE} & Economic\ Freedom_{IT} & Economic\ Freedom_{NL} & Economic\ Freedom_{SE} & Economic\ Freedom_{CH} & Economic\ Freedom_{UK} \\ GDP_{FI} & GDP_{FR} & GDP_{IE} & GDP_{IT} & GDP_{NL} & GDP_{SE} & GDP_{CH} & GDP_{UK} \\ Inflation_{FI} & Inflation_{FR} & Inflation_{IE} & Inflation_{IT} & Inflation_{NL} & Inflation_{SE} & Inflation_{CH} & Inflation_{UK} \\ Perc.Capacity\ ForInnov._{FI} & Perc.Capacity\ ForInnov._{FR} & Perc.Capacity\ ForInnov._{IE} & Perc.Capacity\ ForInnov._{IT} & Perc.Capacity\ ForInnov._{NL} & Perc.Capacity\ ForInnov._{SE} & Perc.Capacity\ ForInnov._{CH} & Perc.Capacity\ ForInnov._{UK} \\ Perc.FearOf\ Failure_{FI} & Perc.FearOf\ Failure_{FR} & Perc.FearOf\ Failure_{IE} & Perc.FearOf\ Failure_{IT} & Perc.FearOf\ Failure_{NL} & Perc.FearOf\ Failure_{SE} & Perc.FearOf\ Failure_{CH} & Perc.FearOf\ Failure_{UK} \\ Perc.Opport._{FI} & Perc.Opport._{FR} & Perc.Opport._{IE} & Perc.Opport._{IT} & Perc.Opport._{NL} & Perc.Opport._{SE} & Perc.Opport._{CH} & Perc.Opport._{UK} \\ Perc.VC\ Availability_{FI} & Perc.VC\ Availability_{FR} & Perc.VC\ Availability_{IE} & Perc.VC\ Availability_{IT} & Perc.VC\ Availability_{NL} & Perc.VC\ Availability_{SE} & Perc.VC\ Availability_{CH} & Perc.VC\ Availability_{UK} \\ ln(InvAm)_{FI,2010} & ln(InvAm)_{FR,2010} & ln(InvAm)_{IE,2010} & ln(InvAm)_{IT,2010} & ln(InvAm)_{NL,2010} & ln(InvAm)_{SE,2010} & ln(InvAm)_{CH,2010} & ln(InvAm)_{UK,2010} \\ ln(InvAm)_{FI,2013} & ln(InvAm)_{FR,2013} & ln(InvAm)_{IE,2013} & ln(InvAm)_{IT,2013} & ln(InvAm)_{NL,2013} & ln(InvAm)_{SE,2013} & ln(InvAm)_{CH,2013} & ln(InvAm)_{UK,2013} \\ ln(InvAm)_{FI,2014} & ln(InvAm)_{FR,2014} & ln(InvAm)_{IE,2014} & ln(InvAm)_{IT,2014} & ln(InvAm)_{NL,2014} & ln(InvAm)_{SE,2014} & ln(InvAm)_{CH,2014} & ln(InvAm)_{UK,2014} \\ ln(InvAm)_{FI,2015} & ln(InvAm)_{FR,2015} & ln(InvAm)_{IE,2015} & ln(InvAm)_{IT,2015} & ln(InvAm)_{NL,2015} & ln(InvAm)_{SE,2015} & ln(InvAm)_{CH,2015} & ln(InvAm)_{UK,2015} \\ ln(InvAm)_{FI,2016} & ln(InvAm)_{FR,2016} & ln(InvAm)_{IE,2016} & ln(InvAm)_{IT,2016} & ln(InvAm)_{NL,2016} & ln(InvAm)_{SE,2016} & ln(InvAm)_{CH,2016} & ln(InvAm)_{UK,2016} \end{bmatrix}$$

$$X_1 = \begin{bmatrix} DomesticCredit_{DE} \\ EATR_{DE} \\ EconomicFreedom_{DE} \\ GDP_{DE} \\ Inflation_{DE} \\ Perc.CapacityForInnov._{DE} \\ Perc.FearOfFailure_{DE} \\ Perc.Opport._{DE} \\ Perc.VCAvailability_{DE} \\ ln(InvAm)_{DE,2010} \\ ln(InvAm)_{DE,2013} \\ ln(InvAm)_{DE,2014} \\ ln(InvAm)_{DE,2015} \\ ln(InvAm)_{DE,2016} \end{bmatrix}$$

$$W = \begin{bmatrix} w_{FI} \\ w_{FR} \\ w_{IE} \\ w_{IT} \\ w_{NL} \\ w_{SE} \\ w_{CH} \\ w_{UK} \end{bmatrix}$$

$$V = \begin{bmatrix} v_{Dom.Cred.} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & v_{EATR} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & v_{Econ.Freed.} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & v_{GDP} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & v_{Inflation} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & v_{Perc.Innov.} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & v_{Perc.Fail.} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & v_{Perc.Opp.} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & v_{Perc.VCAvail.} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & v_{InvAm.2010} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & v_{InvAm.2013} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & v_{InvAm.2014} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & v_{InvAm.2015} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & v_{InvAm.2016} \end{bmatrix}$$

$$Z_1 = \begin{bmatrix} ln(InvestmentAmount)_{DE,2010} \\ ln(InvestmentAmount)_{DE,2011} \\ ln(InvestmentAmount)_{DE,2012} \\ ln(InvestmentAmount)_{DE,2013} \\ ln(InvestmentAmount)_{DE,2014} \\ ln(InvestmentAmount)_{DE,2015} \\ ln(InvestmentAmount)_{DE,2016} \end{bmatrix}$$

$$Z_0 = \begin{bmatrix} ln(InvAm)_{FI,2010} & ln(InvAm)_{FR,2010} & ln(InvAm)_{IE,2010} & ln(InvAm)_{IT,2010} & ln(InvAm)_{NL,2010} & ln(InvAm)_{SE,2010} & ln(InvAm)_{CH,2010} & ln(InvAm)_{UK,2010} \\ ln(InvAm)_{FI,2011} & ln(InvAm)_{FR,2011} & ln(InvAm)_{IE,2011} & ln(InvAm)_{IT,2011} & ln(InvAm)_{NL,2011} & ln(InvAm)_{SE,2011} & ln(InvAm)_{CH,2011} & ln(InvAm)_{UK,2011} \\ ln(InvAm)_{FI,2012} & ln(InvAm)_{FR,2012} & ln(InvAm)_{IE,2012} & ln(InvAm)_{IT,2012} & ln(InvAm)_{NL,2012} & ln(InvAm)_{SE,2012} & ln(InvAm)_{CH,2012} & ln(InvAm)_{UK,2012} \\ ln(InvAm)_{FI,2013} & ln(InvAm)_{FR,2013} & ln(InvAm)_{IE,2013} & ln(InvAm)_{IT,2013} & ln(InvAm)_{NL,2013} & ln(InvAm)_{SE,2013} & ln(InvAm)_{CH,2013} & ln(InvAm)_{UK,2013} \\ ln(InvAm)_{FI,2014} & ln(InvAm)_{FR,2014} & ln(InvAm)_{IE,2014} & ln(InvAm)_{IT,2014} & ln(InvAm)_{NL,2014} & ln(InvAm)_{SE,2014} & ln(InvAm)_{CH,2014} & ln(InvAm)_{UK,2014} \\ ln(InvAm)_{FI,2015} & ln(InvAm)_{FR,2015} & ln(InvAm)_{IE,2015} & ln(InvAm)_{IT,2015} & ln(InvAm)_{NL,2015} & ln(InvAm)_{SE,2015} & ln(InvAm)_{CH,2015} & ln(InvAm)_{UK,2015} \\ ln(InvAm)_{FI,2016} & ln(InvAm)_{FR,2016} & ln(InvAm)_{IE,2016} & ln(InvAm)_{IT,2016} & ln(InvAm)_{NL,2016} & ln(InvAm)_{SE,2016} & ln(InvAm)_{CH,2016} & ln(InvAm)_{UK,2016} \end{bmatrix}$$

Abbreviations used within this *Derivation A.5.1*:

Countries (acc. ISO 3166-1 Alpha-2)		**Variables (for definitions, see *Table A.5.8* of the Appendix)**	
DE	Germany	DomesticCredit / Dom.cred.	DomesticCreditToThePrivateSector
FI	Finland	EATR	EffectiveAverageTaxRate
FR	France	GDP	GDPPerCapita
IE	(Republic of) Ireland	Perc.CapacityForInnov. / Perc.Innov.	PerceivedCapacityForInnovation
IT	Italy	Perc.FearOfFailure / Perc.Fail.	PerceivedFearOfFailure
NL	Netherlands	Perc.Opport. / Perc.Opp.	PerceivedOpportunities
SE	Sweden	Perc.VCAvailability / Perc.VCAvail.	PerceivedVCAvailability
CH	Switzerland	InvAm.	InvestmentAmount
UK	United Kingdom		

Variable Definitions

Table A.5.8: *Variable Definitions*

All variables are retrieved from either the Thomson Reuters EIKON database or the Bundesanzeiger (see details below).

Explanatory and Dependent Variables

Variable	*Definition*
ln(AgeAtFinancing)	Variable for measuring startups' maturity. It is measured in the natural logarithm of the months between a startup's foundation and the investment. Higher values refer to higher maturity. It is retrieved from the Thomson Reuters EIKON database (variable $Age\,at\,Financing\,(Months)$).
ln(EquityCapital)	Variable for measuring startups' internal financial endowment. The proxy is measured in the natural logarithm of startups' equity capital in EUR. Higher values refer to higher internal funds. It is retrieved from the startups' balance sheets published at the Bundesanzeiger.
ln(InvestmentAmount)	Variable for measuring the amount of financial resources which investors provide to startups. It is measured in the natural logarithm of the investment amount in EUR. Higher values refer to higher financial support. It is retrieved from the Thomson Reuters EIKON database (variable $Equity\,Amount$).
InvestmentRoundNumber	Variable for measuring the investment risk. It is measured in integers starting with 1. Higher values refer to lower investment risk. This variable is retrieved from the Thomson Reuters EIKON database (variable $Round\,Number$).
ln(LossCarryForward)	Variable for measuring startups' loss carry forwards disclosed. The proxy is measured in the natural logarithm of startups' loss carry forward in EUR. Higher values refer to higher loss carry forwards. It is retrieved from the startups' balance sheets published at the Bundesanzeiger.
ln(TotalAssets)	Variable for measuring startup size. The proxy is measured in the natural logarithm of startups' total assets in EUR. Higher values refer to higher internal funds. It is retrieved from the startups' balance sheets published at the Bundesanzeiger.
CompareYear	Variable for measuring the year of investment. It takes the value of one if an investment has taken place in the given year. It is retrieved from the Thomson Reuters EIKON database (variable $Investment\,Year$).

Control Variables: Macroeconomic Environment

Variable	*Definition*
DomesticCreditToThe PrivateSector	Variable for measuring the financial resources which financial corporations (monetary authorities, deposit money banks, and other financial corporations) provide to the private sector through loans, purchases of non-equity securities, trade credits and other accounts receivable. It is measured as the proportion of credits divided by the GDP. Higher values refer to better financial endowment. It is retrieved from the World Bank Database (variable code $FS.AST.PRVT.GD.ZS$).

Control Variables: Macroeconomic Environment (continued)

Variable	*Definition*
EconomicFreedom	Variable for measuring countries' economic freedom. It is measured on a scale from 0 to 100 as an equally weighted score of rule of law, government size, regulatory efficiency, and market openness. Higher values refer to higher economic freedom [100 = highest economic freedom possible; 0 = virtually no economic freedom]. It is retrieved from the "Index of Economic Freedom" from the Heritage Foundation (variable $Economic\,Freedom\,(Overall\,Score)$).
EffectiveAverageTaxRate	Variable for measuring the average tax burden of a startup initiating an investment project. It is measured on a scale from 0 to 1, corresponding to the tax rates in percentage terms. Higher values refer to a higher tax burden. It is retrieved from Steinmüller et al. (2019).
GDPPerCapita	Variable for measuring the GDP per capita. It is measured in (current) USD. Higher values refer to a higher GDP per capita. It is retrieved from the World Bank Database (variable code $NY.GDP.PCAP.CD$).
Inflation	Variable for measuring the price change in the economy. It is measured in percentage terms as the annual growth rate of the GDP implicit deflator. Higher values refer to higher inflation. It is retrieved from the World Bank Database (variable code $NY.GDP.DEFL.KD.ZG$).
PerceivedCapacity ForInnovation	Variable for measuring countries' capability to innovate. It is measured on a scale from 1 to 7 based on the categories "diversity and collaboration", "research and development" and "commercialization" within the Executive Opinion Survey by the World Economic Forum. Higher values refer to higher innovative capacity [7 = very high approval regarding the statement; 1 = very low approval]. It is retrieved from the World Competitiveness Index by the World Economic Forum (variable $EOSQ119$).
PerceivedFearOfFailure	Variable for measuring the chances of business failure. It is measured as the proportion of the population between 18 and 64 years who agrees that they see good opportunities but would not start a business for fear it might fail. It is retrieved from the Global Entrepreneurship Monitor (variable $Fear\,Of\,Failure$, column 6).
PerceivedOpportunities	Variable for measuring the chances for firm foundation. It is measured as the proportion of the population between 18 and 64 years who agrees to see good opportunities to start a business in the area where they live. It is retrieved from the Global Entrepreneurship Monitor (variable $Perceived\,Opportunities$, column 4).
PerceivedVCAvailability	Variable for measuring the difficulty of obtaining equity funding for start-up entrepreneurs with innovative but risky projects. It is measured on a scale from 1 to 7 within the Executive Opinion Survey by the World Economic Forum. Higher values refer to better chances for getting external funding via venture capital [7 = extremely easy; 1 = extremely difficult]. It is retrieved from the World Competitiveness Index by the World Economic Forum (variable $EOSQ089$).

Chapter 6
Conclusion and Outlook

This thesis focuses on the impact of financial constraints, non-financial resources, information asymmetries, and the tax environment on investment decisions and startup performance. The goal of the presented work is to provide insights into the effects of internal and external factors influencing startup development. Thereby, the thesis provides information to, e.g., researchers and policy makers, when they reflect upon the factors to consider when trying to foster startup growth or future research topics.

The first part of the analysis (Chapter 2, "Startups' Demand for Non-Financial Resources: Descriptive Evidence from an International Corporate Venture Capitalist") displays the importance of different areas of non-financial support for startups. Besides external financial help (e.g., Levine 2005; Bottazzi et al. 2014), non-financial resources are crucial for startup success (e.g., Baum et al. 2000; Alvarez-Garrido and Dushnitsky 2016; Anderson et al. 2018). Using proprietary data by one large corporate venture capitalist, this study provides descriptive evidence that getting access to the CVC's network and getting in touch with other investors or the CVC's clients are of startups' main interest when they engage in a relationship with a CVC. The results underscore that the demand for particular non-financial resources varies depending on startup-specific characteristics, e.g., the startups' slack financial resources, startups' business model, and firm size. This chapter of the thesis extends existing studies by revealing the importance of particular non-financial support from investors using proprietary data. It serves as the base for future research when striving to reveal causal effects of non-financial assets on startup performance. After the first approach by Quas et al. (2021), further research is necessary to measure the magnitude of the effects of specific non-financial resources which help to relieve startups' constraints. Additionally, researchers in this field should distinguish between CVCs with varying degrees of experience, countries in which supporting CVCs have operated in, or CVCs' ability with regard to the business area which they can add value to. Similarly, heterogeneity on the startups' side regarding, e.g., the industry, country, or legal system which startups operate in, could be of interest to look at in future research.

Especially in the early development stage, startups face many challenges. Studies show that one of the most pressing challenges for startups are their financial shortcomings (e.g., Levine 2005). However, also non-financial aspects are of high importance to work on (e.g., Alvarez-Garrido and Dushnitsky 2016). Chapter 3 ("Financial Constraints, Entrepreneurial Challenges, and the Effects on Performance") demonstrates that high-technology startups initially focus on the development of their products or operations as well as the relationship to their clients or users. The unique dataset from one large corporate venture capitalist provides evidence that increasing their revenues appears significantly more important for startups with low financial

endowment. This part of the thesis also shows that working on the development of internal human resources and products or operations helps startups to overcome financial constraints and induce positive firm performance. The effect appears stronger for startups in less developed countries. This paper fills the gap in the literature linking startups' financial situation to other challenges which startups face, and the effects on performance. The findings can serve as the base for future research to further investigate the concrete reasons for the lower performance effect in more developed countries. Future research could also look at, e.g., other industries besides the high-technology sector, or the non-financial support from other investor types, e.g., business angels, private equity investors, or other forms of venture capitalists. Following the approach by Giraudo et al. (2019) who study past entrepreneurship policy approaches, the question of how to efficiently tackle startups' financial constraints might be of research interest in the near future.

Chapter 4 ("How Close is Your Crowd? The Role of Information Asymmetries for Investment Decisions in Crowdinvesting") examines the role of distance in investment decisions in crowdinvesting where distance serves as a proxy for information asymmetries. Studies show that informational differences play a major role in decision-making (Kleinert and Volkmann 2019). Based on a proprietary dataset by the largest crowdinvesting platform in Mexico, informational disadvantages of investors seem to decrease the investment probability and investment amount. A given investor-startup-relationship does not appear to fully equal out this detrimental effect. In contrast, observable signals represented through startup likes on the crowdinvesting platform seem to positively influence investment decisions. I extend the literature by using detailed private data by a large crowdinvesting platform to connect all three areas. Future research could additionally take the effects of different degrees of investor rights in crowdinvesting as well as different types of investors into account. Researchers could also replicate this study using data from other countries, or more advanced research methodologies to identify causal effects.

The last part of the analysis (Chapter 5, "The Effects of a Reform in Corporate Tax Law on Startup Investments") shows that a tax reform may lead to higher startup investments. It confirms the findings by Carroll et al. (2000) and Mirrlees and Adam (2011) who show that taxation rules may have an effect on startup growth and success, even though tax systems should originally be decision and investment neutral (Boadway and Bruce 1984; Devereux and Freeman 1991). This part of the thesis focuses on a recent tax change in the German corporate tax law which has increased startups' possibilities to disclose loss carry forwards and, thus, allows to deduct additional losses from profits in future years, leading to reduced tax payments. Investigating investors' behavior before and after the tax reform in Germany, higher loss carry forwards negatively correlate with the investment amount before and positively correlate with the investment amount after the tax reform. Still, the investment behavior in Germany after the tax reform does not automatically differ from the behavior of investors in a synthetic control group made up of comparable European countries. Changing investment behavior after the tax reform can only be observed for very early investments. Findings suggest that public perception

of a tax reform is important to consider for policy makers in order to reach the desired goal of a reform (e.g., Mertens and Ravn 2011; De Simone et al. 2019). It appears important to consider anticipation effects of investors as investors might decide to postpone their investments depending on public announcements. At the same time, this finding reveals a way for policy makers to foster startup investments by decreasing investor doubts in the legal environment. As the tax reform in Germany has just recently taken place, it complements existing studies on the effects of earlier tax changes on startup investments. Future studies could investigate the effects of other changes in tax law on the venture capital market. Besides the results of this thesis, the findings by Bradley et al. (2021) on the taxation of intellectual property could be used as the literature base. Additionally, future research could distinguish between different forms of startup investments, e.g., by business angels or via crowdinvesting. As a starting point, Denes et al. (2020) find increased investments in angel investments after a reform in tax law in the U.S.

In conclusion, the importance of startups has strongly increased in recent years. In an era with low interest rates on traditional investment alternatives, startups may continue to become a more and more noteworthy investment alternative for professional as well as private investors. It is well-known that the innovative nature of startups may foster the development of all industry sectors. However, this relationship only holds true if startups are equipped with sufficient financial and non-financial resources, and if the macroeconomic environment fits startups' needs. Predicting the development of startup investments appears difficult due to their comparatively short time of existence. Four empirical studies within this thesis reveal some aspects which determine startup performance and growth. The results of this thesis should be considered in future endeavors to foster startup growth, as startup development might influence the development of the whole economy (Aldrich and Ruef 2011). In turn, startups' access to financial as well as non-financial resources describes an important factor to consider in public policy making, for future research, and for all participants of the financial sector.

References

Abadie, Alberto. 2021. Using synthetic controls: Feasibility, data requirements, and methodological aspects. *Journal of Economic Literature*, 59(2): 391–425. doi:10.1257/jel.20191450.

Abadie, Alberto, Alexis Diamond, and Jens Hainmueller. 2010. Synthetic control methods for comparative case studies: Estimating the effect of California's Tobacco Control Program. *Journal of the American Statistical Association*, 105(490): 493–505. doi:10.1198/jasa.2009.ap08746.

Abadie, Alberto, Alexis Diamond, and Jens Hainmueller. 2015. Comparative politics and the synthetic control method. *American Journal of Political Science*, 59(2): 495–510. doi:10.1111/ajps.12116.

Abadie, Alberto, and Javier Gardeazabal. 2003. The economic costs of conflict: A case study of the Basque Country. *American Economic Review*, 93(1): 113–132. doi:10.1257/000282803321455188.

Achleitner, Ann-Kristin, and Reiner Braun. 2018. Entrepreneurial finance. In *Handbuch Entrepreneurship*, ed. by Günther Faltin, 1–20. Wiesbaden: Springer Gabler. doi:10.1007/978-3-658-05263-8_8-1.

Agrawal, Ajay, Christian Catalini, and Avi Goldfarb. 2015. Crowdfunding: Geography, social networks, and the timing of investment decisions. *Journal of Economics & Management Strategy*, 24(2): 253–274. doi:10.1111/jems.12093.

Agrawal, Ajay, Devesh Kapur, and John McHale. 2008. How do spatial and social proximity influence knowledge flows? Evidence from patent data. *Journal of Urban Economics*, 64(2): 258–269. doi:10.1016/j.jue.2008.01.003.

Ahlers, Gerrit K.C., Douglas Cumming, Christina Günther, and Denis Schweizer. 2015. Signaling in equity crowdfunding. *Entrepreneurship Theory and Practice*, 39(4): 955–980. doi:10.1111/etap.12157.

Akcigit, Ufuk, and William R. Kerr. 2018. Growth through heterogeneous innovations. *Journal of Political Economy*, 126(4): 1374–1443. doi:10.1086/697901.

Akerlof, George A. 1970. The market for "lemons": Quality uncertainty and the market mechanism. *Quarterly Journal of Economics*, 84(3): 488–500. doi:10.2307/1879431.

Aldrich, Howard E., and Martin Ruef. 2011. *Organizations Evolving.* 2. ed., London: SAGE Publications Ltd.

Allen, Franklin, Elena Carletti, Jun Qianc, and Patricio Valenzuela. 2013. Financial Intermediation, Markets, and Alternative Financial Sectors. In *Handbook Of The Economics Of Finance*, ed. by George M. Constantinides, Milton Harris and René M. Stulz, 759–798. Amsterdam: Elsevier. doi:10.1016/B978-0-44-453594-8.00011-2.

Alvarez-Garrido, Elisa, and Gary Dushnitsky. 2016. Are entrepreneurial venture's innovation rates sensitive to investor complementary assets? Comparing biotech ventures backed by corporate and independent VCs. *Strategic Management Journal*, 37(5): 819–834. doi:10.1002/smj.2359.

Anderson, Stephen J., Rajesh Chandy, and Bilal Zia. 2018. Pathways to profits: The impact of marketing vs. finance skills on business performance. *Management Science*, 64(12): 5461–5959. doi:10.1287/mnsc.2017.2920.

Angerer, Martin, Alexander Brem, Sascha Kraus, and Andreas Peter. 2017. Start-up funding via equity crowdfunding in Germany: A qualitative analysis of success factors. *Journal of Entrepreneurial Finance*, 19(1): 1–34. https://www.econstor.eu/handle/10419/197535, accessed on January 24, 2023.

Angerer, Martin, Thomas Niemand, Sascha Kraus, and Thies Ferdinand. 2018. Risk-reducing options in crowdinvesting: An experimental study. *Journal of Small Business Strategy*, 28(3): 1–17. https://hdl.handle.net/10863/17242, accessed on February 25, 2023.

Bae, Kee-Hong, René M. Stulz, and Hongping Tan. 2008. Do local analysts know more? A cross-country study of the performance of local analysts and foreign analysts. *Journal of Financial Economics*, 88(3): 581–606. doi:10.1016/j.jfineco.2007.02.004.

Bailetti, Tony. 2012. What technology startups must get right to globalize early and rapidly. *Technology Innovation Management Review*, 2(10): 5–16. doi:10.22215/timreview/614.

Banerji, Devika, and Torsten Reimer. 2019. Startup founders and their LinkedIn connections: Are well-connected entrepreneurs more successful? *Computers in Human Behavior*, 90: 46–52. doi:10.1016/j.chb.2018.08.033.

Bascha, Andreas, and Uwe Walz. 2007. Financing practices in the German venture capital industry. In *Venture Capital In Europe*, ed. by Greg N. Gregoriou, Maher Kooli and Roman Kräussl, 217–231. Amsterdam: Elsevier. doi:10.1016/B978-075068259-6.50019-1.

Bauernschmitt, Isabel, and Sabrina Kraus. 2017. Die neue Verlustverrechnung nach §8d KStG: Nutzen für Start-up-Unternehmen. https://www.roedl.de/themen/start-up-finanzierung/8c-kstg-verlustverrechnung-neuregelung-8d-verlustnutzung, accessed on December 21, 2020.

Baum, Joel A.C. 1996. Organizational ecology. In *Handbook Of Organization Studies*, ed. by Stewart R. Clegg, Cynthia Hardy and Walter R. Nord, 77–114. London: SAGE Publications Ltd.

Baum, Joel A. C., Tony Calabrese, and Brian S. Silverman. 2000. Don't go it alone: Alliance network composition and startups' performance in Canadian biotechnology. *Strategic Management Journal*, 21(3): 267–294. doi:10.1002/(SICI)1097-0266(200003)21:3<267::AID-SMJ89>3.0.CO;2-8.

Becchetti, Leonardo, and Giovanni Trovato. 2002. The determinants of growth for small and medium sized firms. The role of the availability of external finance. *Small Business Economics*, 19(4): 291–306. doi:10.1023/A:1019678429111.

Beck, Thorsten, and Asli Demirgüç-Kunt. 2006. Small and medium-size enterprises: Access to finance as a growth constraint. *Journal of Banking & Finance*, 30(11): 2931–2943. doi:10.1016/j.jbankfin.2006.05.009.

Beck, Thorsten, Asli Demirgüç-Kunt, and Vojislav Maksimovic. 2005. Financial and legal constraints to growth: Does firm size matter? *Journal of Finance*, 60(1): 137–177. doi:10.1111/j.1540-6261.2005.00727.x.

Beck, Thorsten, Asli Demirgüç-Kunt, and Vojislav Maksimovic. 2006. The influence of financial and legal institutions on firm size. *Journal of Banking & Finance*, 30(11): 2995–3015. doi:10.1016/j.jbankfin.2006.05.006.

Beck, Thorsten, Erik Feyen, Alain Ize, and Florencia Moizeszowicz. 2008. Benchmarking financial development. *Policy Research Working Paper Series*, 4638. http://hdl.handle.net/10986/6643, accessed on January 24, 2023.

Berger, Allen N., and Gregory F. Udell. 2006. A more complete conceptual framework for SME finance. *Journal of Banking & Finance*, 30(11): 2945–2966. doi:10.1016/j.jbankfin.2006.05.008.

Bernanke, Ben S. 1983. Irreversibility, uncertainty, and cyclical investment. *The Quarterly Journal of Economics*, 98(1): 85. doi:10.2307/1885568.

Bernoth, Kerstin, and Roberta Colavecchio. 2014. The macroeconomic determinants of private equity investment: A European comparison. *Journal of Accounting Economics*, 46(11): 1170–1183. doi:10.1080/00036846.2013.866306.

Berre, Max, and Benjamin Le Pendeven. 2021. Startups, growth, and the macroeconomic environment: Valuation and business cycles. *Working Paper*. http://entfin.org/wp-content/uploads/2021/06/Startups-growth-and-the-Macroeconomic-Environment-Valuation-and-Business-Cycles.pdf, accessed on January 25, 2023.

Bhayani, Mital, Priyanka Bobade, Vinod Malkar, and Pooja Kawale. 2019. Disparity in investment behavior of urban and rural individual investors. *International Journal of Social Science and Economic Research*, 4(5): 3764–3776. https://ijsser.org/more2019.php?id=286.

Bienz, Carsten, and Julia Hirsch. 2012. The dynamics of venture capital contracts. *Review of Finance*, 16(1): 157–195. doi:10.2139/ssrn.929491.

Block, Joern, Christian Fisch, Silvio Vismara, and René Andres. 2019. Private equity investment criteria: An experimental conjoint analysis of venture capital, business angels, and family offices. *Journal of Corporate Finance*, 58: 329–352. doi:10.1016/j.jcorpfin.2019.05.009.

Block, Jörn, Lars Hornuf, and Alexandra Moritz. 2018. Which updates during an equity crowdfunding campaign increase crowd participation? *Small Business Economics*, 50(1): 3–27. doi:10.1007/s11187-017-9876-4.

Bloom, Nick, Stephen Bond, and John van Reenen. 2007. Uncertainty and investment dynamics. *Review of Economic Studies*, 74(2): 391–415. doi:10.1111/j.1467-937X.2007.00426.x.

Blum, Bernardo S., and Avi Goldfarb. 2006. Does the internet defy the law of gravity? *Journal of International Economics*, 70(2): 384–405. doi:10.1016/j.jinteco.2005.10.002.

Boadway, Robin, and Neil Bruce. 1984. A general proposition on the design of a neutral business tax. *Journal of Public Economics*, 24(2): 231–239. doi:10.1016/0047-2727(84)90026-4.

Bock, Carolin, and Martin Watzinger. 2019. The capital gains tax: A curse but also a blessing for venture capital investment. *Journal of Small Business Management*, 57(4): 1200–1231. doi:10.1111/jsbm.12373.

Bosworth, Barry, and Gary Burtless. 1992. Effects of tax reform on labor supply, investment, and saving. *Journal of Economic Perspectives*, 6(1): 3–25. doi:10.1257/jep.6.1.3.

Bottazzi, Giulio, Angelo Secchi, and Federico Tamagni. 2014. Financial constraints and firm dynamics. *Small Business Economics*, 42(1): 99–116. doi:10.1007/s11187-012-9465-5.

Bottazzi, Laura, Marco Da Rin, and Thomas Hellmann. 2008. Who are the active investors? Evidence from venture capital. *Journal of Financial Economics*, 89(3): 488–512. doi:10.1016/j.jfineco.2007.09.003.

Bradley, Sebastien, Leslie Robinson, and Martin Ruf. 2021. The impact of IP box regimes on the M&A market. *Journal of Accounting and Economics*, 72(2-3): 101448. doi:10.1016/j.jacceco.2021.101448.

Brinckmann, Jan, Dietmar Grichnik, and Diana Kapsa. 2010. Should entrepreneurs plan or just storm the castle? A meta-analysis on contextual factors impacting the business planning–performance relationship in small firms. *Journal of Business Venturing*, 25(1): 24–40. doi:10.1016/j.jbusvent.2008.10.007.

Bundesministerium der Finanzen. 2020. Entwurf eines BMF-Schreibens zur Anwendung des § 8d Körperschaftssteuergesetz (KStG) - DOK 2020/0816027, 14.08.2020.

Bundesverfassungsgericht. 2017. Beschluss des Zweiten Senats vom 29.03.2017 - Zur Ungleichbehandlung von Kapitalgesellschaften beim Verlustabzug infolge eines schädlichen Beteiligungserwerbs nach § 8c Satz 1 KStG (jetzt § 8c Absatz 1 Satz 1 KStG) - 2 BvL 6/11.

Bureau of Labor Statistics. 2018. Survival of private sector establishments by opening year: Quarterly census of employment and wages program, business employment dynamics. https://www.bls.gov/bdm/us_age_naics_00_table7.txt, accessed on November 7, 2019.

Burman, Leonard E., and William C. Randolph. 1994. Measuring permanent respones to capital-gains tax changes in panel data. *American Economic Review*, 84(4): 794–809. https://www.jstor.org/stable/2118031, accessed on January 25, 2023.

BVK. 2020. BVK-Statistiken Deutschland. https://www.bvkap.de/statistiken/bvk-statistiken-deutschland, accessed on February 3, 2021.

Carpenter, Robert, and Bruce Petersen. 2002. Capital market imperfections, high-tech investment, and new equity financing. *The Economic Journal*, 112(477): 54–72. doi:10.1111/1468-0297.00683.

Carr, Caleb T., Rebecca A. Hayes, and Erin M. Sumner. 2018. Predicting the threshold of perceived Facebook post success via likes and reactions: A test of explanatory mechanisms. *Communication Research Reports*, 35(2): 141–151. doi:10.1080/08824096.2017.1409618.

Carroll, Robert, Douglas Holtz-Eakin, Mark Rider, and Harvey S. Rosen. 2000. Personal income taxes and the growth of small firms. *NBER Working Paper*, 7980. doi:10.3386/w7980.

Carter, Nancy M., William B. Gartner, and Paul D. Reynolds. 1996. Exploring start-up event sequences. *Journal of Business Venturing*, 11(3): 151–166. doi:10.1016/0883-9026(95)00129-8.

Chen, Henry, Paul Gompers, Anna Kovner, and Josh Lerner. 2010. Buy local? The geography of venture capital. *Journal of Urban Economics*, 67(1): 90–102. doi:10.1016/j.jue.2009.09.013.

Chorev, Schaul, and Alistair R. Anderson. 2006. Marketing in high-tech start-ups: Overcoming the liability of newness in Israel. *International Entrepreneurship and Management Journal*, 2(2): 281–297. doi:10.1007/s11365-006-8689-8.

Christofzik, Désirée I., Angela Fuest, and Robin Jessen. 2022. Macroeconomic effects of the anticipation and implementation of tax changes in Germany: Evidence from a narrative account. *Economica*, 89: 62–81. doi:10.1111/ecca.12389.

Čihák, Martin, Asli Demirgüç-Kunt, Erik Feyen, and Ross Levine. 2013. Financial development in 205 economies: 1960 to 2010. *Journal of Financial Perspectives*, 1(2): 17–36. doi:10.3386/w18946.

Cooper, Michael, and Matthew Knittel. 2006. Partial loss refundability: How are corporate tax losses used? *National Tax Journal*, 59(3): 651–663. doi:10.17310/ntj.2006.3.16.

Copeland, Craig. 2022. Understanding the finances of rural vs. urban Americans. *EBRI Issue Brief*, 553: 1–16. https://www.ebri.org/content/understanding-the-finances-of-rural-vs.-urban-americans, accessed on January 31, 2023.

Cordova, Arturo, Arturo García-Santillán, Dulce E. Espinosa Capistrán, and Manuel D. N. Beauregard. 2017. Financial inclusion in Mexico: Where we are? A theoretical reflection. *Ecoforum*, 6(3): 1–10. http://www.ecoforumjournal.ro/index.php/eco/article/view/702/440, accessed on January 25, 2023.

Coursaris, Constantinos K., Wietske van Osch, and Brigitte A. Balogh. 2016. Do facebook likes lead to shares or sales? Exploring the empirical links between social media content, brand equity, purchase intention, and engagement (49th HICSS 2016). https://ieeexplore.ieee.org/abstract/document/7427628, accessed on February 26, 2023.

Courtney, Christopher, Supradeep Dutta, and Yong Li. 2017. Resolving information asymmetry: Signaling, endorsement, and crowdfunding success. *Entrepreneurship Theory and Practice*, 41(2): 265–290. doi:10.1111/etap.12267.

Coval, Joshua D., and Tobias J. Moskowitz. 1999. Home bias at home: Local equity preference in domestic portfolios. *Journal of Finance*, 54(6): 2045–2073. doi:10.1111/0022-1082.00181.

Cumming, Douglas, and Na Dai. 2010. Local bias in venture capital investments. *Journal of Empirical Finance*, 17(3): 362–380. doi:10.1016/j.jempfin.2009.11.001.

Cumming, Douglas, Michele Meoli, and Silvio Vismara. 2021. Does equity crowdfunding democratize entrepreneurial finance? *Small Business Economics*, 56(2): 533–552. doi:10.1007/s11187-019-00188-z.

Da Rin, Marco, Giovanna Nicodano, and Alessandro Sembenelli. 2006. Public policy and the creation of active venture capital markets. *Journal of Public Economics*, 90(8-9): 1699–1723. doi:10.1016/j.jpubeco.2005.09.013.

Da Rin, Marco, Thomas Hellmann, and Manju Puri. 2013. A survey of venture capital research. In *Handbook Of The Economics Of Finance*, Vol. 2, ed. by George M. Constantinides, Milton Harris and René M. Stulz, 573–648. Amsterdam: Elsevier. doi:10.1016/B978-0-44-453594-8.00008-2.

Davila, Antonio, George Foster, and Mahendra Gupta. 2003. Venture capital financing and the growth of startup firms. *Journal of Business Venturing*, 18(6): 689–708. doi:10.1016/S0883-9026(02)00127-1.

Dean, Benjamin. 2016. Natural and quasi-natural experiments to evaluate cybersecurity policies. *Journal of International Affairs*, 70(1): 139–190. https://www.jstor.org/stable/90012599, accessed on January 25, 2023.

Degryse, Hans, and Steven Ongena. 2005. Distance, lending relationships, and competition. *Journal of Finance*, 60(1): 231–266. doi:10.1111/j.1540-6261.2005.00729.x.

Dejean, Sylvain. 2020. The role of distance and social networks in the geography of crowdfunding: Evidence from France. *Regional Studies*, 54(3): 329–339. doi:10.1080/00343404.2019.1619924.

Delmar, Frdric, and Scott Shane. 2003. Does business planning facilitate the development of new ventures? *Strategic Management Journal*, 24(12): 1165–1185. doi:10.1002/smj.349.

Deloof, Marc, Maurizio La Rocca, and Tom Vanacker. 2019. Local banking development and the use of debt financing by new firms. *Entrepreneurship Theory and Practice*, 43(6): 1250–1276. doi:10.1177/1042258718783486.

Demir, Firat. 2009. Macroeconomic uncertainty and private investment in Argentina, Mexico and Turkey. *Applied Economics Letters*, 16(6): 567–571. doi:10.1080/13504850701206528.

Denes, Matthew, Sabrina Howell, Filippo Mezzanotti, Xinxin Wang, and Ting Xu. 2020. Investor Tax Credits and Entrepreneurship: Evidence from U.S. States. *National Bureau of Economic Research*. doi:10.3386/w27751.

De Simone, Lisa, Joseph D. Piotroski, and Rimmy E. Tomy. 2019. Repatriation taxes and foreign cash holdings: The impact of anticipated tax reform. *Review of Financial Studies*, 32(8): 3105–3143. doi:10.1093/rfs/hhy124.

Deutscher Bundestag. 2007a. Entwurf eines Unternehmensteuerreformgesetzes 2008 - Gesetzentwurf der Fraktionen der CDU/CSU und SPD: Drucksache 16/4841, 14.03.2007.

Deutscher Bundestag. 2007b. Entwurf eines Gesetzes zur Modernisierung der Rahmenbedingungen für Kapitalbeteiligungen - MoRaKG: Drucksache 16/6311, 07.09.2007.

Deutscher Bundestag. 2016. Entwurf eines Gesetzes zur Weiterentwicklung der steuerlichen Verlustverrechnung bei Körperschaften: Drucksache 18/9986, 17.10.2016.

Devereux, Michael, and Harold Freeman. 1991. A general neutral profits tax. *Fiscal Studies*, 12(3): 1–15. doi:10.1111/j.1475-5890.1991.tb00158.x.

Di Pietro, Francesca, Luca Grilli, and Francesca Masciarelli. 2020. Talking about a revolution? Costly and costless signals and the role of innovativeness in equity crowdfunding. *Journal of Small Business Management*, 1–32. doi:10.1080/00472778.2020.1816435.

Dörr, Luisa, Florian Dorn, Stefanie Gäbler, and Niklas Potrafke. 2019. How new airport infrastructure promotes tourism: Evidence from a synthetic control approach in German regions. *ifo Working Paper*, 318: 1–36. doi:10.1080/00343404.2020.1714022.

Dreßler, Daniel. 2017. Körperschaftsteuer: Anteiliger Entfall von Verlustvorträgen mit Grundgesetz unvereinbar. https://www.fgs-blog.de/kstg-anteiliger-entfall-von-verlustvortraegen-mit-grundgesetz-unvereinbar/, accessed on April 1, 2021.

Dushnitsky, Gary, and Michael J. Lenox. 2005. When do incumbents learn from entrepreneurial ventures? *Research Policy*, 34(5): 615–639. doi:10.1016/j.respol.2005.01.017.

Eckblad, Joshua, Tobias Gutmann, and Christian Lindener. 2019. Report on global corporate venture research data. https://www.corporateventuringresearch.org/, accessed on December 18, 2020.

Edwards, Alexander, and Maximilian Todtenhaupt. 2020. Capital gains taxation and funding for start-ups. *Journal of Financial Economics*, 138(2): 549–571. doi:10.1016/j.jfineco.2020.06.009.

EFI. 2020. Gutachten der Expertenkommission Forschung und Innovation zu Forschung, Innovation und technologischer Leistungsfähigkeit Deutschlands. https://www.e-fi.de/publikationen/gutachten, accessed on January 25, 2023.

El Ghoul, Sadok, Omrane Guedhami, Yang Ni, Jeffrey Pittman, and Samir Saadi. 2013. Does information asymmetry matter to equity pricing? Evidence from firms' geographic location. *Contemporary Accounting Research*, 30(1): 140–181. doi:10.1111/j.1911-3846.2011.01147.x.

Engelen, Christian, and Christian Heider. 2020. Fortführungsgebunder Verlustvortrag nach § 8d KStG. https://www.fgs.de/news-and-insights/blog/detail/fortfuehrungsgebundener-verlustvortrag-nach-8d-kstg, accessed on December 21, 2020.

Eranti, Veikko, and Markku Lonkila. 2015. The social significance of the Facebook like button. *First Monday*, 20(6): 1–14. doi:10.5210/fm.v20i6.5505.

Ernst, Markus. 2011. Neuordnung der Verlustnutzung nach Anteilseignerwechsel - Reformbedarf und haushaltspolitische Bedeutung des § 8c KStG. Berlin: Institut Finanzen und Steuern.

European Commission. 2009. Commission decision of 30 September 2009 on aid scheme No C2/09 (ex N 221/08 and N413/08) which Germany intends to grant to modernise the general conditions for capital investments. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32010D0013&from=DE, accessed on January 25, 2023.

European Commission. 2020. EU tax database: Table 85: Effective average tax rates. https://ec.europa.eu/taxation_customs/business/economic-analysis-taxation/data-taxation_en, accessed on October 23, 2020.

Evans, David S. 1987. The relationship between firm growth, size, and age: Estimates for 100 manufacturing industries. *Journal of Industrial Economics*, 35(4): 567–581. doi:10.2307/2098588.

Evers, Natasha. 2003. The process and problems of business start-ups. *ITB Journal*, 4(3): 17–41. doi:10.21427/D7WT8K.

EY. 2019. Standort Deutschland 2019: Neuer Schwung? EY Attractiveness Survey. https://www.ey.com/en_gl/attractiveness, accessed on December 11, 2020.

EY. 2020. Start-Up Barometer Deutschland. https://www.ey.com/de_de/news/2020/01/ey-start-up-barometer-januar-2020, accessed on October 23, 2020.

EY. 2022a. Startup Barometer Germany January 2022. https://startup.ey.com/wp-content/uploads/2022/01/ENG_EY-Startup-Barometer-Januar-2022.pdf, accessed on October 6, 2022.

EY. 2022b. Deutsche Startups bei der Finanzierung die Nummer 2 in Europa. https://www.ey.com/de_de/news/2022-pressemitteilungen/04/ey-startup-barometer-europa-april-2022, accessed on February 14, 2023.

Farinha, Luísa, and Sónia Félix. 2015. Credit rationing for Portuguese SMEs. *Finance Research Letters*, 14: 167–177. doi:10.1016/j.frl.2015.05.001.

Finanzgericht Hamburg. 2011. Rechtsprechung - Urteil vom 04.04.2011 - 2 K 33/10. https://dejure.org/dienste/vernetzung/rechtsprechung?Gericht=FG%20Hamburg&Datum=04.04.2011&Aktenzeichen=2%20K%2033/10, accessed on January 25, 2023.

Fried, Vance H., and Robert D. Hisrich. 1994. Toward a model of venture capital investment decision making. *Financial Management*, 23(3): 28–37. doi:10.2307/3665619.

Garmaise, Mark J. 2008. Production in entrepreneurial firms: The effects of financial constraints on labor and capital. *Review of Financial Studies*, 21(2): 543–577. doi:10.1093/rfs/hhm081.

Giardino, Carmine, Michael Unterkalmsteiner, Nicolo Paternoster, Tony Gorschek, and Pekka Abrahamsson. 2014. What do we know about software development in startups? *IEEE Software*, 31(5): 28–32. doi:10.1109/MS.2014.129.

Giardino, Carmine, Sohaib S. Bajwa, Xiaofeng Wang, and Pekka Abrahamsson. 2015. Key challenges in early-stage software startups. In *Agile Processes in Software Engineering and Extreme Programming*, ed. by Casper Lassenius, Torgeir Dingsoyr and Maria Paasivaara, 52–63. Wiesbaden: Springer Gabler. doi:10.1007/978-3-319-18612-2_5.

Giraudo, Emanuele, Giancarlo Giudici, and Luca Grilli. 2019. Entrepreneurship policy and the financing of young innovative companies: Evidence from the Italian Startup Act. *Research Policy*, 48(9): 103801. doi:10.1016/j.respol.2019.05.010.

Goethner, Maximilian, Sebastian Luettig, and Tobias Regner. 2021. Crowdinvesting in entrepreneurial projects: Disentangling patterns of investor behavior. *Small Business Economics*, 57(2): 905–926. doi:10.1007/s11187-020-00332-0.

Goetzmann, William N., and Alok Kumar. 2008. Equity portfolio diversification. *Review of Finance*, 12(3): 433–463. doi:10.1093/rof/rfn005.

Gompers, Paul A., and Josh Lerner. 1999. What drives venture capital fundraising? *NBER Working Paper*, 6906. doi:10.2139/ssrn.57935.

Gompers, Paul A., Will Gornall, Steven N. Kaplan, and Ilya A. Strebulaev. 2020. How do venture capitalists make decisions? *Journal of Financial Economics*, 135(1): 169–190. doi:10.1016/j.jfineco.2019.06.011.

Gottschalk, Sandra, Jürgen Egeln, Frank Herrmann, Silke Hupperts, Karsten Reuss, Mila Köhler, Johannes Bersch, and Simona Wagner. 2016. *Evaluation Des Förderprogramms "INVEST - Zuschuss Für Wagniskapital"*. Mannheim: ZEW - Leibniz-Zentrum für Europäische Wirtschaftsforschung. https://ftp.zew.de/pub/zew-docs/gutachten/Evaluation_INVEST_20160616.pdf, accessed on January 25, 2023.

Granier, Caroline, Valérie Revest, and Alessandro Sapio. 2019. SMEs and junior stock markets: A comparison between European and Japanese markets. *Journal of Innovation Economics*, 29(1): 43. doi:10.3917/jie.029.0043.

Greening, Daniel W., Bruce R. Barringer, and Granger Macy. 1996. A qualitative study of managerial challenges facing small business geographic expansion. *Journal of Business Venturing*, 11(4): 233–256. doi:10.1016/0883-9026(95)00108-5.

Grilli, Luca. 2019. There must be an angel? Local financial markets, business angels and the financing of innovative start-ups. *Regional Studies*, 53(5): 620–629. doi:10.1080/00343404.2018.1479524.

Grilli, Luca, and Samuele Murtinu. 2014. Government, venture capital and the growth of European high-tech entrepreneurial firms. *Research Policy*, 43(9): 1523–1543. doi:10.1016/j.respol.2014.04.002.

Guenther, Christina, Sofia Johan, and Denis Schweizer. 2018. Is the crowd sensitive to distance? How investment decisions differ by investor type. *Small Business Economics*, 50(2): 289–305. doi:10.1007/s11187-016-9834-6.

Guenther, David A., and Michael Willenborg. 1999. Capital gains tax rates and the cost of capital for small business: Evidence from the IPO market. *Journal of Financial Economics*, 53(3): 385–408. doi:10.1016/S0304-405X(99)00026-4.

Hanlon, Michelle, and Shane Heitzman. 2010. A review of tax research. *Journal of Accounting and Economics*, 50(2-3): 127–178. doi:10.1016/j.jacceco.2010.09.002.

Hansson, Åsa. 2012. Tax policy and entrepreneurship: Empirical evidence from Sweden. *Small Business Economics*, 38(4): 495–513. doi:10.1007/s11187-010-9282-7.

Haufler, Andreas, Pehr-Johan Norbäck, and Lars Persson. 2014. Entrepreneurial innovations and taxation. *Journal of Public Economics*, 113: 13–31. doi:10.1016/j.jpubeco.2014.03.002.

Hellmann, Thomas, and Manju Puri. 2002. Venture capital and the professionalization of start-up firms: Empirical evidence. *Journal of Finance*, 57(1): 169–197. doi:10.1111/1540-6261.00419.

Helms, Marilyn M. 2003. The challenge of entrepreneurship in a developed economy: The problematic case of Japan. *Journal of Developmental Entrepreneurship*, 8(3): 247–264.

Henrekson, Magnus, and Tino Sanandaji. 2011. Entrepreneurship and the theory of taxation. *Small Business Economics*, 37(2): 167–185. doi:10.1007/s11187-009-9242-2.

Hernández-Trillo, Fausto, José A. Pagán, and Julia Paxton. 2005. Start-up Capital, Microenterprises and Technical Efficiency in Mexico. *Review of Development Economics*, 9(3): 434–447. doi:10.1111/j.1467-9361.2005.00286.x.

Hervé, Fabrice, Elodie Manthé, Aurélie Sannajust, and Armin Schwienbacher. 2019. Determinants of individual investment decisions in investment-based crowdfunding. *Journal of Business, Finance & Accounting*, 46(5-6): 762–783. doi:10.1111/jbfa.12372.

Hey, Johanna. 2007. Verletzung fundamentaler Besteuerungsprinzipien durch die Gegenfinanzierungsmaßnahmen des Unternehmensteuerreformgesetzes 2008. *Betriebsberater*, 22: 1259–1263.

Hill, Katherine, Donald Hirsch, and Abigail Davis. 2021. The role of social support networks in helping low income families through uncertain times. *Social Policy and Society*, 20(1): 17–32. doi:10.1017/S1474746420000184.

Homburg, Christian, Alexander Hahn, Torsten Bornemann, and Philipp Sandner. 2014. The role of chief marketing officers for venture capital funding: Endowing new ventures with marketing legitimacy. *Journal of Marketing Research*, 51(5): 625–644. doi:10.1509/jmr.11.0350.

Homburg, Stefan. 2007. Germany's Company Tax Reform of 2008. *FinanzArchiv Public Finance Analysis*, 63(4): 591–612. https://www.jstor.org/stable/40913171, accessed on January 25, 2023.

Honold, Dirk, Patrick Hümmer, Enrico Reiche, and Gerhard Wacker. 2020. Venture Capital Marktstudie 2020 - Finanzierung von Startups mit Venture Capital und deren Bewertung in der gelebten Praxis. https://www.pwc.de/de/deals/wie-gestalten-investoren-finanzierung-und-bewertung-von-startups-waehrend-covid-19.html, accessed on December 12, 2020.

Hornuf, Lars, and Matthias Neuenkirch. 2017. Pricing shares in equity crowdfunding. *Small Business Economics*, 48(4): 795–811. doi:10.1007/s11187-016-9807-9.

Hornuf, Lars, Matthias Schmitt, and Eliza Stenzhorn. 2018. Equity crowdfunding in Germany and the United Kingdom: Follow-up funding and firm failure. *Corporate Governance: An International Review*, 26(5): 331–354. doi:10.1111/corg.12260.

Hornuf, Lars, Matthias Schmitt, and Eliza Stenzhorn. 2022. The local bias in equity crowdfunding: Behavioral anomaly or rational preference? *Journal of Economics & Management Strategy*, 31(3): 693–733. doi:10.1111/jems.12475.

House, J. S., D. Umberson, and K. R. Landis. 1988. Structures and processes of social support. *Annual Review of Sociology*, 14(1): 293–318. doi:10.1146/annurev.so.14.080188.001453.

Hsu, Yao-Wen. 2010. Staging of venture capital investment: A real options analysis. *Small Business Economics*, 35: 265–281. doi:10.1007/s11187-008-9158-2.

Hvide, Hans K., and Jarle Møen. 2010. Lean and hungry or fat and content? Entrepreneurs' wealth and start-up performance. *Management Science*, 56(8): 1242–1258. doi:10.1287/mnsc.1100.1177.

Jiang, Li, and Jeong-Bon Kim. 2004. Foreign equity ownership and information asymmetry: Evidence from Japan. *Journal of International Financial Management and Accounting*, 15(3): 185–211. doi:10.1111/j.1467-646X.2004.00107.x.

Kerr, William R., Josh Lerner, and Antoinette Schoar. 2014. The Consequences of Entrepreneurial Finance: Evidence from Angel Financings. *Review of Financial Studies*, 27(1): 20–55. doi:10.1093/rfs/hhr098.

Keuschnigg, Christian, and Søren Bo Nielsen. 2004. Taxation and venture capital backed entrepreneurship. *International Tax and Public Finance*, 11(4): 369–390. doi:10.1023/B:ITAX.0000033984.29301.9e.

Kleinert, Simon, and Christine Volkmann. 2019. Equity crowdfunding and the role of investor discussion boards. *Venture Capital*, 21(4): 327–352. doi:10.1080/13691066.2019.1569853.

Kleinert, Simon, Christine Volkmann, and Marc Grünhagen. 2020. Third-party signals in equity crowdfunding: The role of prior financing. *Small Business Economics*, 54(1): 341–365. doi:10.1007/s11187-018-0125-2.

Knott, Anne Marie, and Carl Vieregger. 2020. Reconciling the firm size and innovation puzzle. *Organization Science*, 31(2): 477–488. doi:10.1287/orsc.2019.1310.

Kollmann, Tobias, Simon Hensellek, Philipp Benedikt Jung, and Lucas Kleine-Stegemann. 2019. Deutscher Startup Monitor 2019 - Mehr Mut, neue Wege. https://deutscherstartupmonitor.de/, accessed on November 9, 2020.

Konovalova, Maria E., Olga Y. Kuzmina, and Sergey A. Zhironkin. 2020. Digital technologies as a factor of expanding the investment opportunities of business entities. In *Digital Age: Chances, Challenges And Future*, Vol. 84 of *Lecture Notes in Networks and Systems*, ed. by Svetlana Igorevna Ashmarina, Marek Vochozka and Valentina Vyacheslavovna Mantulenko, 180–188. Cham: Springer International Publishing. doi:10.1007/978-3-030-27015-5_23.

Kopp, Emanuel, Daniel Leigh, Susanna Mursula, and Suchanan Tambunlertchai. 2019. U.S. investment since the Tax Cuts and Jobs Act of 2017. *IMF Working Paper*, 19(120). doi:10.5089/9781498317047.001.

Kortum, Samuel, and Josh Lerner. 2001. Does venture capital spur innovation? In *Entrepreneurial Inputs And Outcomes: New Studies Of Entrepreneurship In The United States*, Vol. 13 of *Advances in the Study of Entrepreneurship, Innovation & Economic Growth*, ed. by Gary Libecap, 1–44. Bingley: Emerald (MCB UP). doi:10.1016/S1048-4736(01)13003-1.

KPMG. 2022. Venture Pulse Q2 2022. https://assets.kpmg/content/dam/kpmg/xx/pdf/2022/07/venture-pulse-q2-2022.pdf, accessed on October 6, 2022.

Langenmayr, Dominika. 2017. Voluntary disclosure of evaded taxes — Increasing revenue, or increasing incentives to evade? *Journal of Public Economics*, 151: 110–125. doi:10.1016/j.jpubeco.2015.08.007.

Law, Siong Hook, and Nirvikar Singh. 2014. Does too much finance harm economic growth? *Journal of Banking & Finance*, 41: 36–44. doi:10.1016/j.jbankfin.2013.12.020.

Leboeuf, Gael, and Armin Schwienbacher. 2018. Crowdfunding as a new financing tool. In *The Economics of Crowdfunding: Startups, Portals and Investor Behavior*, ed. by Douglas Cumming and Lars Hornuf, 11–28. Cham: Springer Nature.

Lee, Samuel, and Petra Persson. 2016. Financing from family and friends. *Review of Financial Studies*, 29(9): 2341–2386. doi:10.1093/rfs/hhw031.

Leibner, Lars, and Ewald Dötsch. 2020. Vor- und Nachteile des Antrags (§ 8d KStG). In *Die Körperschaftsteuer*, ed. by Ewald Dötsch, Alexandra Pung and Rolf Möhlenbrock, Tz. 90–91. Stuttgart: Schäffer-Poeschel.

Levine, Ross. 2005. Finance and growth: Theory and evidence. In *Handbook Of Economic Growth*, Vol. 1 of *Handbooks in Economics*, ed. by Philippe Aghion and Steven N. Durlauf, 865–934. Amsterdam: Elsevier. doi:10.1016/S1574-0684(05)01012-9.

Levine, Ross, Norman Loayza, and Thorsten Beck. 2000. Financial intermediation and growth: Causality and causes. *Journal of Monetary Economics*, 46(1): 31–77. doi:10.1016/S0304-3932(00)00017-9.

Leyden, Dennis P., Albert N. Link, and Donald S. Siegel. 2014. A theoretical analysis of the role of social networks in entrepreneurship. *Research Policy*, 43(7): 1157–1163. doi:10.1016/j.respol.2014.04.010.

Li, Haidan, Morton Pincus, and Sonja Olhoft Rego. 2008. Market reaction to events surrounding the Sarbanes–Oxley Act of 2002 and earnings Management. *Journal of Law and Economics*, 51(1): 111–134. doi:10.1086/588597.

Long, Trinh Quang. 2019. Becoming a high-growth firm in a developing country: The role of co-funding. *Finance Research Letters*, 29: 330–335. doi:10.1016/j.frl.2018.08.018.

Lumpkin, Tom, and Keith Brigham. 2011. Long-term orientation and intertemporal choice in family firms. *Entrepreneurship: Theory and Practice*, 35(6): 1149–1169. doi:10.1111/j.1540-6520.2011.00495.x.

Lunenburg, Fred C. 2011. Goal-setting theory of motivation. *International Journal of Management, Business, and Administration*, 15(1): 1–6. https://static1.squarespace.com/static/5b0b8f55365f02045e1ecaa5/t/5b14d215758d46f9851858d1/1528091160453/Lunenburg%2C+Fred+C.+Goal-Setting+Theoryof+Motivation+IJMBA+V15+N1+2011.pdf, accessed on January 1, 2023.

Lutz, Eva, Marko Bender, Ann-Kristin Achleitner, and Christoph Kaserer. 2013. Importance of spatial proximity between venture capital investors and investees in Germany. *Journal of Business Research*, 66(11): 2346–2354. doi:10.1016/j.jbusres.2012.04.016.

Malloy, Christopher J. 2005. The geography of equity analysis. *Journal of Finance*, 60(2): 719–755. doi:10.1111/j.1540-6261.2005.00744.x.

Manigart, Sophie, and Harry Sapienza. 2017. Venture capital and growth. In *The Blackwell Handbook Of Entrepreneurship*, Vol. 1 of *Handbooks in management*, ed. by Donald L. Sexton and Hans Landström, 240–258. Malden: Blackwell Publishers Ltd.

Markman, Gideon D., David B. Balkin, and Robert A. Baron. 2002. Inventors and new venture formation: The effects of general self–efficacy and regretful thinking. *Entrepreneurship Theory and Practice*, 27(2): 149–165. doi:10.1111/1540-8520.00004.

McFadden, Daniel. 1974. Conditional logit analysis of qualitative choice behavior. *Frontiers in Econometrics*, 2(2): 105–142. doi:10.1016/S1574-0684(05)01012-9.

McMullen, Jeffery S., and Dean A. Shepherd. 2006. Entrepreneurial action and the role of uncertainty in the theory of the entrepreneur. *Academy of Management Review*, 31(1): 132–152. doi:10.5465/AMR.2006.19379628.

Mertens, Karel, and Morten O. Ravn. 2011. Understanding the aggregate effects of anticipated and unanticipated tax policy shocks. *Review of Economic Dynamics*, 14(1): 27–54. doi:10.1016/j.red.2010.07.004.

Meyer, Bruce D. 1995. Natural and quasi-experiments in economics. *Journal of Business and Economic Statistics*, 13(2): 151. doi:10.2307/1392369.

Mintzberg, Henry. 2013. *Rise And Fall Of Strategic Planning.* New York: Free Press.

Mirrlees, James A., and Stuart Adam. 2011. *The Mirrlees Review: Tax By Design.* Oxford and New York: Oxford University Press.

Mishra, Anil V., and Ronald A. Ratti. 2013. Home bias and cross border taxation. *Journal of International Money and Finance*, 32: 169–193. doi:10.1016/j.jimonfin.2012.04.004.

Mochon, Daniel, Karen Johnson, and Dan Ariely. 2017. What are likes worth? A Facebook page field experiment. *Journal of Marketing Research*, 54(2): 306–317. doi:10.1509/jmr.15.0409.

Mollick, Ethan. 2014. The dynamics of crowdfunding: An exploratory study. *Journal of Business Venturing*, 29(1): 1–16. doi:10.1016/j.jbusvent.2013.06.005.

Monti, Marco, Vittorio Pelligra, Laura Martignon, and Nathan Berg. 2014. Retail investors and financial advisors: New evidence on trust and advice taking heuristics. *Journal of Business Research*, 67(8): 1749–1757. doi:10.1016/j.jbusres.2014.02.022.

Morin, Roger-A., and A. Fernandez Suarez. 1983. Risk aversion revisited. *Journal of Finance*, 38(4): 1201. doi:10.2307/2328020.

Moritz, Alexandra, and Joern Hendrich Block. 2014. Crowdfunding und Crowdinvesting: State-of-the-Art der wissenschaftlichen Literatur (Crowdfunding and Crowdinvesting: A Review of the Literature). *Zeitschrift für KMU und Entrepreneurship*, 62(1): 57–89. doi:10.2139/ssrn.2274141.

Musso, Patrick, and Stefano Schiavo. 2008. The impact of financial constraints on firm survival and growth. *Journal of Evolutionary Economics*, 18(2): 135–149. doi:10.1007/s00191-007-0087-z.

N26. 2019. Jahresabschluss zum Geschäftsjahr vom 01.01.2018 bis zum 31.12.2018. https://www.unternehmensregister.de/, accessed on November 23, 2020.

Nichter, Simeon, and Lara Goldmark. 2009. Small firm growth in developing countries. *World Development*, 37(9): 1453–1464. doi:10.1016/j.worlddev.2009.01.013.

Niemand, Thomas, Martin Angerer, Ferdinand Thies, Sascha Kraus, and René Hebenstreit. 2018. Equity crowdfunding across borders: A conjoint experiment. *International Journal of Entrepreneurial Behavior & Research*, 24(4): 911–932. doi:10.1108/IJEBR-07-2017-0256.

Ning, Yixi, Wei Wang, and Bo Yu. 2015. The driving forces of venture capital investments. *Small Business Economics*, 44(2): 315–344. doi:10.1007/s11187-014-9591-3.

Nitani, Miwako, Allan Riding, and Beichuan He. 2019. On equity crowdfunding: Investor rationality and success factors. *Venture Capital*, 21(2-3): 243–272. doi:10.1080/13691066.2018.1468542.

OECD. 2019. An introduction to online platforms and their role in the digital transformation. doi:10.1787/53e5f593-en.

OECD. 2022. OECD Economic surveys (Mexico, May 2019). https://www.oecd-ilibrary.org/economics/oecd-economic-surveys-mexico-2019_a536d00e-enhttp://www.oecd.org/economy/mexico-economic-snapshot/, accessed on April 22, 2022.

Oliveira, Blandina, and Adelino Fortunato. 2006. Firm growth and liquidity constraints: A dynamic analysis. *Small Business Economics*, 27(2-3): 139–156. doi:10.1007/s11187-006-0006-y.

Parker, Simon C., and C. Mirjam van Praag. 2006. Schooling, capital constraints, and entrepreneurial performance. *Journal of Business & Economic Statistics*, 24(4): 416–431. doi:10.1198/073500106000000215.

Paternoster, Nicolò, Carmine Giardino, Michael Unterkalmsteiner, Tony Gorschek, and Pekka Abrahamsson. 2014. Software development in startup companies: A systematic mapping study. *Information and Software Technology*, 56(10): 1200–1218. doi:10.1016/j.infsof.2014.04.014.

Patzelt, Holger, Dean A. Shepherd, David Deeds, and Steven W. Bradley. 2008. Financial slack and venture managers' decisions to seek a new alliance. *Journal of Business Venturing*, 23(4): 465–481. doi:10.1016/j.jbusvent.2007.06.001.

Peña, Iñaki. 2002. Intellectual capital and business start–up success. *Journal of Intellectual Capital*, 3(2): 180–198. doi:10.1108/14691930210424761.

Picken, Joseph C. 2017. From startup to scalable enterprise: Laying the foundation. *Business Horizons*, 60(5): 587–595. doi:10.1016/j.bushor.2017.05.002.

Pisoni, Alessia, and Alberto Onetti. 2018. When startups exit: Comparing strategies in Europe and the USA. *Journal of Business Strategy*, 39(3): 26–33. doi:10.1108/JBS-02-2017-0022.

Piva, Evila, and Cristina Rossi-Lamastra. 2018. Human capital signals and entrepreneurs' success in equity crowdfunding. *Small Business Economics*, 51(3): 667–686. doi:10.1007/s11187-017-9950-y.

Polzin, Friedemann, Helen Toxopeus, and Erik Stam. 2018. The wisdom of the crowd in funding: Information heterogeneity and social networks of crowdfunders. *Small Business Economics*, 50(2): 251–273. doi:10.1007/s11187-016-9829-3.

Quas, Anita, Jose Martí, and Carmelo Reverte. 2021. What money cannot buy: A new approach to measure venture capital ability to add non-financial resources. *Small Business Economics*, 57(3): 1361–1382. doi:10.1007/s11187-020-00352-w.

Reisdorfer-Leite, Bernardo, Michele Marcos de Oliveira, Marcelo Rudek, Anderson Luis Szejka, and Osiris Canciglieri Junior. 2020. Startup definition proposal using product lifecycle management. In *Product Lifecycle Management Enabling Smart X*, ed. by Felix Nyffenegger, Jose Rios, Louis Rivest and Abdelaziz Bouras, 426–435. Springer, Cham. doi:10.1007/978-3-030-62807-9_34.

Rieger, Marc Oliver, Mei Wang, and Thorsten Hens. 2015. Risk preferences around the world. *Management Science*, 61(3): 637–648. doi:10.1287/mnsc.2013.1869.

Riyanto, Yohanes E., and Armin Schwienbacher. 2006. The strategic use of corporate venture financing for securing demand. *Journal of Banking & Finance*, 30(10): 2809–2833. doi:10.1016/j.jbankfin.2005.11.005.

Roberts, Steve, and Elena Naydenova. 2019. Private equity trend report 2019: Powering through uncertainty. https://store.pwc.de/de/pdf/2019/january/private-equity-trend-report-2019-powering-through-uncertainty, accessed on November 9, 2020.

Rosser, J. Barkley. 2003. A Nobel Prize for asymmetric information: The economic contributions of George Akerlof, Michael Spence and Joseph Stiglitz. *Review of Political Economy*, 15(1): 3–21. doi:10.1080/09538250308445.

Sachan, Abhishek, and Pawan K. Chugan. 2020. Availability bias of urban and rural investors: Relationship study of the Gujarat State of India. *Journal of Behavioural Economics*, 8(1): 1–6. doi:10.12691/jbe-8-1-1.

Sachverständigenrat. 2016. Jahresgutachten 2015/16: Kapitel 08: Öffentliche Finanzen: Fehlende Neutralität im Steuersystem hemmt Investitionen und Wachstum. https://www.sachverstaendigenrat-wirtschaft.de/publikationen/jahresgutachten/fruehere-jahresgutachten/jahresgutachten-201516.html, accessed on February 18, 2021.

Sah, Raaj K., and Joseph E. Stiglitz. 1986. The architecture of economic systems: Hierarchies and polyarchies. *American Economic Review*, 76(4): 716–727. https://www.jstor.org/stable/1806069, accessed on February 24, 2023.

Sapienza, Harry J. 1992. When do venture capitalists add value? *Journal of Business Venturing*, 7(1): 9–27. doi:10.1016/0883-9026(92)90032-M.

Saxton, Gregory D., and Richard D. Waters. 2014. What do stakeholders like on Facebook? Examining public reactions to non-profit organizations' informational, promotional, and community-building messages. *Public Relations Research*, 26(3): 280–299. doi:10.1080/1062726X.2014.908721.

Schertler, Andrea, and Tereza Tykvová. 2012. What lures cross-border venture capital inflows? *Journal of International Money and Finance*, 31(6): 1777–1799. doi:10.1016/j.jimonfin.2012.03.012.

Shackelford, Douglas A. 2000. Stock market reaction to capital gains tax changes: Empirical evidence from the 1997 and 1998 Tax Acts. *Tax Policy and the Economy*, 14: 67–92. doi:10.1086/654703.

Sørensen, Jens F. L. 2016. Rural–urban differences in bonding and bridging social capital. *Regional Studies*, 50(3): 391–410. doi:10.1080/00343404.2014.918945.

Sorenson, Olav, and Toby E. Stuart. 2001. Syndication networks and the spatial distribution of venture capital investments. *American Journal of Sociology*, 106(6): 1546–1588. doi:10.1086/321301.

Spence, Michael. 1973. Job market signaling. *Quarterly Journal of Economics*, 87(3): 355–374. doi:10.2307/1882010.

Spence, Michael. 2002. Signaling in retrospect and the informational structure of markets. *American Economic Review*, 92(3): 434–459. doi:10.1257/00028280260136200.

Statista. 2022a. Crowdinvesting in Mexico. https://www.statista.com/outlook/dmo/fintech/digital-capital-raising/crowdinvesting/mexico, accessed on April 26, 2022.

Statista. 2022b. Crowdinvesting in Germany. https://es.statista.com/outlook/dmo/fintech/digital-capital-raising/crowdinvesting/germanyst, accessed on April 26, 2022.

Statista. 2022c. Crowdinvesting in the United States. https://www.statista.com/outlook/dmo/fintech/digital-capital-raising/crowdinvesting/united-states, accessed on April 26, 2022.

Statistisches Bundesamt. 2021. Finanzen und Steuern – Körperschaftsteuerstatistik 2016: Fachserie 14, Reihe 7.2. https://www.destatis.de/DE/Service/Bibliothek/_publikationen-fachserienliste-14.html, accessed on May 18, 2021.

Stayton, John, and Vincent Mangematin. 2016. Startup time, innovation and organizational emergence: A study of USA-based international technology ventures. *Journal of International Entrepreneurship*, 14(3): 373–409. doi:10.1007/s10843-016-0183-y.

Steinmüller, Elias, Georg U. Thunecke, and Georg Wamser. 2019. Corporate income taxes around the world: A survey on forward-looking tax measures and two applications. *International Tax and Public Finance*, 26(2): 418–456. doi:10.1007/s10797-018-9511-6.

Stichcombe, A. 1965. Social structure and organizations. In *Handbook Of Organization*, ed. by James March, 142–193. Chicago: Rand McNally.

Stucki, Tobias. 2014. Success of start-up firms: The role of financial constraints. *American Economic Review*, 23(1): 25–64. doi:10.1093/icc/dtt008.

Sumner, Erin M., Rebecca A. Hayes, Caleb T. Carr, and Donghee Y. Wohn. 2020. Assessing the cognitive and communicative properties of Facebook reactions and likes as lightweight feedback cues. *First Monday*, 25(2): 1–19. doi:10.5210/fm.v25i2.9621 .

Swenson, Deborah L. 1994. The impact of U.S. tax reform on foreign direct investment in the United States. *Journal of Public Economics*, 54(2): 243–266. doi:10.1016/0047-2727(94)90062-0.

Teare, Gené, and Sophia Kunthara. 2020. European venture report: VC dollars rise in 2019. https://news.crunchbase.com/news/european-venture-report-vc-dollars-rise-in-2019/, accessed on November 9, 2020.

Thees, Alexander, and Sebastian Zajons. 2017. Unternehmensbewertungen im Kontext der Neuregelung des § 8d KStG. *Betriebsberater*, 24: 1303–1309.

Timmons, Jeffry A., and William D. Bygrave. 1986. Venture capital's role in financing innovation for economic growth. *Journal of Business Venturing*, 1(2): 161–176. doi:10.1016/0883-9026(86)90012-1.

Treibenreif, Simone. 2022. Darum ist Italien kein Land für Gründer:innen. https://swz.it/darum-ist-italien-kein-land-fuer-gruenderinnen/, accessed on February 14, 2023.

Tykvová, Tereza. 2018. Venture capital and private equity financing: An overview of recent literature and an agenda for future research. *Journal of Business Economics*, 88(3-4): 325–362. doi:10.1007/s11573-017-0874-4.

Uber. 2020. Financial report 2019. https://investor.uber.com/news-events/news/press-release-details/2020/Uber-Announces-Results-for-Fourth-Quarter-and-Full-Year-2019/, accessed on November 9, 2020.

Ughetto, Elisa, Marc Cowling, and Neil Lee. 2019. Regional and spatial issues in the financing of small and medium-sized enterprises and new ventures. *Regional Studies*, 53(5): 617–619. doi:10.1080/00343404.2019.1601174.

Vesper, Karl H. 1990. *New Ventures Strategies.* Revised ed. ed., Englewood Cliffs: Prentice-Hall.

Virlics, Agnes. 2013. Investment decision making and risk. *Procedia Economics and Finance*, 6: 169–177. doi:10.1016/S2212-5671(13)00129-9.

Vismara, Silvio. 2016. Equity retention and social network theory in equity crowdfunding. *Small Business Economics*, 46(4): 579–590. doi:10.1007/s11187-016-9710-4.

Vismara, Silvio. 2018. Information cascades among investors in equity crowdfunding. *Entrepreneurship Theory and Practice*, 42(3): 467–497. doi:10.1111/etap.12261.

Vulkan, Nir, Thomas Åstebro, and Manuel Fernandez Sierra. 2016. Equity crowdfunding: A new phenomena. *Journal of Business Venturing Insights*, 5: 37–49. doi:10.1016/j.jbvi.2016.02.001.

Watson, Warren, Wayne H. Stewart, and Anat BarNir. 2003. The effects of human capital, organizational demography, and interpersonal processes on venture partner perceptions of firm profit and growth. *Journal of Business Venturing*, 18(2): 145–164. doi:10.1016/S0883-9026(01)00082-9.

Welch, Ivo. 1992. Sequential sales, learning, and cascades. *Journal of Finance*, 47(2): 695–732. doi:10.1111/j.1540-6261.1992.tb04406.x.

Whadwa, Anu, and Suresh Kotha. 2006. Knowledge creation through external venturing: Evidence from the telecommunications equipment manufacturing industry. *Academy of Management Journal*, 49(4): 819–835. doi:10.5465/amj.2006.22083132.

Wooldridge, Jeffrey M. 2016. *Introductory Econometrics: A Modern Approach.* 6th edition ed., Boston (USA): Cengage Learning.

World Bank. 2023. Inflation, consumer pricces (annual %) - Mexico. https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?end=2019&locations=MX&start=2015, accessed on March 01, 2023.

Wu, Sibin, Linda Matthews, and Grace K. Dagher. 2007. Need for achievement, business goals, and entrepreneurial persistence. *Management Research News*, 30(12): 928–941. doi:10.1108/01409170710833358.

Zbinden, Fabian, and Galia Kondova. 2019. Economic development in Mexico and the role of blockchain. *Advances in Economics and Business*, 7(1): 55–64. doi:10.13189/aeb.2019.070106.

Zook, Matthew A. 2002. Grounded capital: venture financing and the geography of the Internet industry, 1994-2000. *Journal of Economic Geography*, 2(2): 151–177. doi:10.1093/jeg/2.2.151.