Essays on Cross-border Venture Capital and Venture Internationalization

A DISSERTATION SUBMITTED
BY
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TO
THE DEPARTMENT OF TRANSPORT AND REGIONAL ECONOMICS

IN FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF APPLIED ECONOMICS

UNIVERSITY OF ANTWERP
ANTWERP, BELGIUM
FEBRUARY 2018

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Essays on Cross-border Venture Capital and Venture Internationalization

Abstract

The dissertation attends to the evolving international venture capital industry. The topic is analyzed at three distinct but complementary levels of analysis, the macro, meso and micro level. In a first article, the spatial dimension and determinants of aggregated international venture capital [VC] flows are analyzed by means of gravity modeling (macro level). Evidence is found for the continuing importance of physical, but also institutional and cultural proximity, between investor and target firm in the case of cross-border VC investments. Subsequently, the analysis is refined by looking at the impact of investor mobility through air transport accessibility – the opportunity cost of distance – and the likelihood of cross-border investments. In a related study, it is consequently focused on the recipients of these cross-border VC transactions, the portfolio companies (meso level). It is explored how the early growth performance of venture capital backed organizations varies with differences in the structural and physical location of their investors in investment syndication networks. First evidence is provided that spatially more diverse co-investment networks are performance enhancing for new ventures. In a fourth study, the central research focus remains on new ventures, however unit of analysis is instead the level of the entrepreneurial founder or entrepreneurial founding teams (micro level). The aim is to look in more detail at the drivers of the

international expansion of young high technology companies. More specifically, the effects on new ventures' internationalization propensity of three international knowledge sources get addressed: (1) the pre-foundation international experience of the entrepreneur, (2) VC funding, and (3) the founding team's ex post foundation international knowledge acquisition through new manager recruitment. It is forwarded that new ventures benefit more with respect to their international expansion from the early staffing of their founding teams with external experienced managers and VC investors than from bringing in own international experiences. Hence, new ventures that internationalize early on in their development are not "born" global, but rather "grown" global. Summing up, addressing the issue of internationalization from the perspective of multiple actors (VC firms, startups, entrepreneurs), this dissertation provides a holistic view on the internationalization of VC and VC-backed firms. By that it strives to add new insights to the international entrepreneurship field. Besides its academic contribution, the present research is also useful for practitioners and policy-makers.

Essays on Cross-border Venture Capital and Venture Internationalization

Nederlandstalige samenvatting

Voorliggend proefschrift behandelt de zich ontwikkelende internationale durfkapitaalindustrie (venture capital (VC) industry). Het onderwerp wordt geanalyseerd op drie verschillende, maar elkaar aanvullende analyseniveaus, het macro-, meso- en microniveau. In een eerste deel worden de ruimtelijke dimensie en de determinanten van geaggregeerde internationale durfkapitaalstromen geanalyseerd door middel van een serie zwaartekrachtmodellen (macroniveau). Deze modellen tonen het aanhoudende belang aan van fysieke, maar ook institutionele en culturele, nabijheid tussen investeerder en startup in het geval van grensoverschrijdende durfkapitaalinvesteringen. Vervolgens wordt de analyse verfijnd door de waarschijnlijkheid van grensoverschrijdende durfkapitaalinvesteringen te schatten waarbij bijzondere aandacht gaat naar de impact van de bereikbaarheid van regio's voor investeerders via luchttransport – wat een alternatieve manier is om de kost van afstand te meten (macroniveau). Een volgende, gerelateerde studie focust op de ontvangers van deze grensoverschrijdende durfkapitaaltransacties: de portfolio bedrijven (mesoniveau). Hierbij wordt nagegaan hoe de vroege groeiprestaties van door durfkapitaal gesteunde organisaties variëren met verschillen in de structurele en fysieke locatie van hun investeerders die ingebed zijn in zogeheten investeringssyndicatienetwerken. Deze analyse levert een eerste bewijs dat ruimtelijk

meer diverse co-investeringsnetwerken de prestaties van nieuwe ondernemingen verbeteren. In het vierde luik van het onderzoek blijft de centrale onderzoeksfocus op nieuwe ondernemingen gericht, maar het analyseniveau is nu de ondernemer of het team van oprichters (microniveau). Het doel is om meer in detail na te gaan welke factoren de internationale uitbreiding van jonge hightechbedrijven bevorderen. Meer specifiek worden drie verschillende bronnen van internationale kennis onderzocht: (1) de internationale ervaring die de ondernemer opdeed voor het opstarten van het bedrijf, (2) het verwerven van durfkapitaal en (3) het aanwerven van nieuwe managers na de oprichting van het bedrijf. Het blijkt dat nieuwe ondernemingen meer voordeel halen uit hun internationale expansie indien ze vanaf het begin hun oprichtersteam met externe en ervaren managers versterken in vergelijking met bedrijven waarbij de oprichters vooral hun eigen internationale ervaringen inbrengen. Nieuwe ondernemingen die reeds internationaal actief zijn in een vroeg stadium van hun ontwikkeling zijn dus niet, zoals vaak in de literatuur wordt beweerd "born" globals, maar eerder "grown" globals. Samengevat, door het onderwerp van internationalisering vanuit het perspectief van meerdere actoren (durfkapitaalbedrijven, startups, ondernemers) te benaderen, biedt dit proefschrift een holistische kijk op de internationalisering van durfkapitaal en door durfkapitaal gefinancierde jonge bedrijven.

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"To explain all nature is too difficult a task for any one [wo]man or even for any one age. 'Tis much better to do a little with certainty leave the rest for others that come after you." Isaac Newton

Acknowledgments

Doing a PhD is often compared to the tiresome climbing of a gigantic mountain. For me, it has been a quite joyful, inspiring and life-enhancing excursion though. I enjoyed the opportunity to learn many new things, read a tremendous amount of articles and books (and call it "work"), while travelling to new places and discovering the world. The journey has by far also not been a solitary one. I had many wonderful people by my side that accompanied and encouraged me every single day on the way. To some of them, I would like to express my gratitude on these pages.

I was very fortunate to have you, Ann, as my supervisor. You were always open to my ideas and interests, despite their sometimes rather large "distance" to the field of geography. I immensely appreciate your attitude towards your PhD students. You tirelessly encourage us, while giving us the freedom to discover our own research path. You also provided me with many unique opportunities like attending international conferences, going abroad and leading our summer school to Chongqing. Experiences that developed my academic skills, but even more enriched and formed me personally. Besides, you gave me some important life lessons like the mantra: "A 'no' you have, a 'yes' you can get!" Thank you for your continuous commitment to my work and personal life. Your support is unparal-

leled! I enjoy(ed) working for you and I hope that also in the future our paths will cross.

My appreciation also goes to my second supervisor. Thomas, you have been a great mentor for me: patient, uplifting, helpful in clarifying research ideas and keeping the focus on the essentials. I enjoyed our many talks about research and life, which gave me the feeling that there is still so much more to learn and absorb out there (e.g. writing a first dialogue on venture capital). Your encouragement has been crucial to the completion of this dissertation.

I am also thankful for the proofreading, reflections and helpful suggestions from my other doctoral jury members. It is a great honour to me to have a group of such reputable scholars evaluating and commenting on my research.

Prof. Dr. Olav Sorenson, the semester I spent under your supervision at the Yale School of Management has been an incredibly inspiring and motivating experience. Your extensive knowledge on venture capital and your thoughtful and valuable advice on quantitative modeling have considerably improved my research skills. I was delighted when you also accepted the invitation to become a member of my doctoral jury. Thank you for your time and energy providing advice on the papers in this dissertation and travelling to Antwerp.

Prof. Dr. Sophie Manigart, I could not wish for a more distinguished reader of this thesis. With your ideas and critique you have stimulated me to still think deeper on the topic. Prof. Dr. Colin Mason, your handbook has been a loyal companion on my desk throughout the years. I feel delighted you were willing to put my dissertation on your desk now. Your insightful remarks have helped to further develop this work. Prof. Dr. Marc Deloof, I would like to thank you for your constructive and very detailed feedback, which surely improved the quality of this book.

I wish to express my sincere gratitude to Prof. Dr. Hilde Meersman for functioning as Chair of my doctoral jury. Since following a TransportNet course in Lisbon in

my first year as a PhD student, I have been impressed by your intellectual rigour and mindfulness. I will try to follow your example in my future career.

I would also like to thank all my (former) colleagues at the department, who have contributed to completing this dissertation by ensuring a healthy work-life balance. Especially I want to thank Anne Arekens, Yasmine Rashed, Claudia Pani, Sisangile Nduna, Valentin Carlan, Ties Vanthillo, Danica Bauer, Eleni Moschouli, and Joris Beckers for a fantastic time and making TPR a fun place to work. There are three exceptional persons who have comforted and inspired me in uncountable ways during the past years: Katrien De Langhe, Florent Laroche, and Ivan Cardenas, I am grateful for our friendship.

Ein besonderer Dank gilt meinen Eltern. Kerstin und Dieter, ich danke euch von Herzen für eure unermüdliche Unterstützung, aufmunterenden Worte, Motivation und eurem Interesse an meiner Arbeit. Danke, dass ihr immer an mich glaubt und wir immer füreinander da sind.

Bram, many years ago you encouraged me to attend a PhD fair, which ended up in me actually applying for a PhD program. I am not sure if that day, you were fully aware of what you got yourself into for the following years: Spending your life with a (workaholic) PhD student. In either way, your support and care has never faded, you still make me laugh and enjoy the world every day. Thank you for your part in my journey!

Katja Bringmann

Antwerp, February 2018

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Introduction

Since I started my dissertation research on cross-border venture capital in 2012, I have observed an accelerating public interest in the topic. The number of news articles and media coverage is burgeoning, while the fostering of globally competitive innovative startup ecosystems ranks high on the agenda of policy makers. Hardly a week goes by without the announcement or launch of a new auspicious startup initiative. This Chapter provides a brief overview of this intriguing industry.

1.1 Setting the Stage

The venture capital [VC] industry is in motion. The share of foreign direct investment and equity flows in cross-border capital flows has never been as high as today (36 per cent (2007); 69 per cent (2016)) (Lund et al., 2017). In Europe alone, one third of the amount of VC or a total of 1.24 bn Euro has been invested across borders in 2016 (compared to an aggregated amount of 2.65 bn Euro invested domestically) (InvestEurope, 2016). In the US, the share of outgoing cross-border VC transactions is less pronounced in relative numbers. However, industry insiders forward that the participation of US investors in foreign markets on the rise. In 2010 about 180 VC firms invested outside of the US, which had been rising to 257 VC firms in 2013 (CBInsights, 2014). Concerning inwards investments, US-based companies received nearly 70 per cent of the capital invested by VC funds globally in 2014 (Nepelski, Piroli, & De Prato, 2016). It is expected that cross-border VC flows still increase in relevance in the future, given the recent emergence of new promising VC markets such as China.

Why do transnational VC deals constitute a fundamental change in the VC landscape? Although creating some of the most globally successful high tech firms, and despite being a financial asset and therefore naturally "weightless" and "frictionless", VC activity has for long been characterized by an uneven spatial pattern and a strong local bias. Geographic proximity is regarded as crucial prerequisite for successful investments (Cumming & Dai, 2010). Against this background, the advent of VC firms that operate increasingly internationally, at long distances, is noteworthy. The occurrence of cross-border VC transactions suggests that an important paradigm change is happening in the VC industry. The altering circumstances call for a full immersion in and conceptual debate on the matter (Aizenman & Kendall, 2012; Alhorr, Moore, & Payne, 2008).

Though cross-border VC deals are an increasingly prominent real world phenomenon, only a limited body of academic studies has dealt with this subject. Tykvová (2017)

solely identifies 27 studies in leading finance, management and entrepreneurship journals published between 2011 and 2016 that consider VC and private equity internationalization. However that does not dissuade the author to promote the topic as prospectively 'hot research area'. So even a decade after the seminal call of Wright, Pruthi, and Lockett (2005) for more research on cross-border VC transactions, studies have remained scarce. A key reason might be the prevailing US centric character of the VC literature. For the US domestic market, the ratio of cross-border investment to total investments has been less striking than in other VC markets, e.g. in Europe, and therefore may have attracted only limited academic notice. However, given the relevancy of the asset class for entrepreneurs and the economy in general, it is imperative to address recent dynamics in the VC industry. In the following paragraphs, I elaborate in more detail on the important role of VC and why the industry and its progress should be considered as a topic of both academic and societal interest.

Despite the fact that only a very small percentage of companies in the economy is VC funded, solely about 0.005 per cent of existing companies in Europe, VC-backed businesses carry a large economic and societal significance. Many of today's highest valued technology companies have relied on VC financing early on in their development. Popular examples include Skype and WhatsApp, communication applications that are used by millions of customers around the globe. Related, Facebook, Pinterest and Instagram, leading social networking services, relied on VC to scale-up their business activities. Also innovative firms in other fields than IT, especially in the biotech and health care industry, are regularly financed by venture capitalists [VCs] at an early growth stage. Well-known names include Galapagos (Belgium), Argen-x (Belgium), Amgen (USA), and Genentech (USA). Recently, with the spread of platforms like iOS and Android, the "App Economy" has been providing a large number of new investment opportunities, ranging from businesses dedicated to developing mobile commerce services, to social media and gaming tools as well as mobile payment programs. Many of these young high-tech startups are revolutionizing and transforming traditional sectors like banking

(Blockchain), education (AltSchool), and transportation (Uber, Lyft). It is unquestioned that these services will have a large impact on reshaping the economy and our daily lives in the future.

By financing innovative fast-growing companies, VC is an important accelerator of innovative entrepreneurship and plays a vital role for the economy. Innovation is considered as backbone for economic growth, at the latest, since the publication of Joseph Schumpeter's seminal work "Capitalism, Socialism and Democracy" in 1942, circulating the concept of "creative destruction". In his work, Schumpeter recognized that 'inventors of innovation' lack sufficient capital to fully exploit their ideas by establishing striving new firms. Consequently, the Schumpeterian entrepreneur blends in, who owns the financial resources and management skills to transform innovative ideas into potentially successful businesses. Half a century later, VCs have taken on a role similar to that of the Schumpeterian entrepreneur in identifying marketable innovations and growing successful high-tech startups.

Another rational for studying in particular the determinants of cross-border VC flows is the observation that not all innovative entrepreneurs have the same access to VC financing. While total cross-border interactions are on the rise compared to the decades before, VC markets still remain highly fragmented along national boundaries. By 2014, about two thirds of total VC was invested in startups located in the US. VC investments in Europe only accounted for 15 per cent of the total global share (Nepelski, Piroli, & De Prato, 2016). In comparison to their US counterparts, European startups receive still five times less funding from capital markets (EU Commission, 2015). Within Europe, domestic VC markets largely vary in their resource endowment and there prevails an unbalanced distribution of VC ecosystems. Entrepreneurs in less dynamic regions therefore regularly face business formation hampering 'equity gaps'. To close these 'funding gaps', the European Commission has set as one of its priorities the removal of obstacles to cross-border VC investments and a more integrated European VC market (European Commission, 2009; EU Commission, 2013). The 'Capital Markets Union' initia-

tive launched in 2015 is supposed to activate a freer movement of capital flows (European Commission, 2015a). A deepening of VC markets in Europe is expected to increase VC funds available to companies. In the light of these recent and prospective policy initiatives, such as the revision of the European risk capital legislation, detailed knowledge on cross-border VC investments is not only desirable from an academic point of view, but also of utmost importance for policy-makers in order to take informed decisions.

While there is a wide range of relevant topics associated with cross-border VC, only three distinct themes linked to the internationalization of VC activity are addressed in this dissertation: The first issue is related to the identification of the scope and drivers of cross-border VC flows. The second matter that is considered is about the performance implications of cross-border VC investments for portfolio companies, while the third subject I raise regards, in turn, the interplay of VC involvement and other knowledge resources and startup internationalization. With this selection of topics, the dissertation strives to provide a holistic view on international venture (capital) activity. Holistic implies here that I look at the topic from different angles at the macro, meso and micro level. The wide lens that is applied to examine international VC activity is also reflected in the selection of a broad title for this work: "Essays on Cross-border Venture Capital and Venture Internationalization".

The remainder of this chapter is organized as follows. Before coming to the empirical findings of my dissertation research in Chapters 2-5, some conceptual explanations are provided in this first chapter. I start with defining and describing VC as a specific class of investment, detail the stages of a typical VC deal as well as lay out the evolution and status quo of the VC industry. After offering a concise definition of VC, a synopsis covering methodological matters underlying this research project such as the research gap, scope, design, as well as relevant empirical and methodological frameworks follows. Consequently, I also use this part to inform about the rationales that motivate research on venture (capital) inter-

nationalization and that I believe can stimulate much needed further research in this area. Following, given the difficulties to obtain comprehensive industry data, different data sources that are regularly exploited for scientific research on VC and, more specifically, those that I have employed to conduct my empirical studies are reviewed. Finally, a reader's guide and schematic structure of the thesis are provided.

1.2 Defining Venture Capital

The aim of this section is to delimit venture capital from other financial instruments available to innovative high growth firms, most importantly private equity and angel investment. After defining VC, describing the VC investment cycle as well as elaborating on the evolution of the industry, the economic and societal relevance of VC is highlighted. This brief introduction into the fundamentals of VC will subsequently help the reader to grasp the significance of the recent changes in the industry and embed the empirical work of this dissertation into a broader industry context.

Innovative startups are desirable instruments to stimulate economic progress. However, they often require large investments before delivering a marketable product or service creating positive cash flows. The financial needs of young high-potential firms are generally too high to be carried by founder(s) alone. Though the majority of newly founded small and medium sized firms relies on bank capital, entrepreneurs that implement new innovative business models, entailing a high level of uncertainty and information asymmetries, often face difficulties getting capitalized by conventional sources of money i.e. public securities markets, bank lending, insurance companies and debt offerings (Zider, 1998). Track records as well as publicly available information on firm performance such as financial audits are often absent in the case of these starting businesses. Given their early development phase and a yet unforeseeable rate of return, coupled with a limited availability of

tangible assets to be used as collaterals, innovative startups are regularly rejected funding by banks. For the most promising of these young and highly innovative firms, 'venture capital' therefore constitutes an important financial option to advance and accelerate business activities.

VC is a special form or subset of private equity. Gompers and Lerner (2001) define VC as "independent, professionally managed, dedicated pools of capital that focus on equity or equity-linked investments in privately held, high growth companies" (p. 146). This definition entails three important specifications: First, VC is employed to back embryonic, high potential growth firms that are still privately-owned i.e. unquoted at the stock market and independent of a larger corporation. Second, VC is provided by accredited investors, which create investment vehicles, so-called funds, raising money from institutional investors such as insurance companies and pension funds, wealthy individuals, and universities. Third, in return for their investment, VCs obtain preferred equity stakes in the target companies. In other words, they become shareholders of the ventures. Holding an equity stake in the startup entitles them subsequently to actively participate in the management and decision-making processes of the young firm.

The latter, the hands-on involvement of VCs in the startup's day-to-day business, constitutes the key distinguishing characteristic of VC (and private equity in general) to other forms of financial intermediaries such as bank lending. It is undisputed in large parts of the VC literature, that VCs in this way provide important value additions to their target companies apart from mere monetary assets and in form of relevant business knowledge and skills (Chemmanur, Krishnan, & Nandy, 2010; Fried & Hisrich, 1994; Sapienza, Manigart, & Vermeir, 1996). Via their hands-on involvement, VCs try to steer the building up and growth of the portfolio company into successful businesses. Private venture capitalists are often themselves ex-entrepreneurs or have gathered extensive business experience in the industry beforehand. The knowledge, skills and professional contacts they have developed during their prior careers are regarded as useful resources for the business

development of their portfolio companies (Baum & Silverman, 2004; Gorman & Sahlman, 1989; Sapienza, 1992). An incentive for investors to be actively involved in the development of their targets arises from the fact that investment returns are generally not contractually fixed apart from a management fee and predefined percentage of carried interests (around 20 to 25 per cent of the fund's profit). Thus, the ultimate size of the investment return is dependent on the success and commitment of the entrepreneur pursuing a profitable trade sale or IPO.

1.3 Types of Venture Capital Funds

On basis of their capital source, we can distinguish between four types of VC funds:

Independent VC funds are pooled investment vehicles that invest the money they have received from limited partner (pension funds, insurance companies, banks, asset managers, and to an increasing extent also family offices) into promising innovative young firms with a strong growth potential. The aim is to achieve a profitable exit in form of an IPO or trade sale. For a further discussion on the detailed working and fund sourcing of independent VC funds, I refer to the following section (Section 1.4).

Bank-owned VC is primarily a European phenomenon and less common in the US context. In this case, the VC fund is owned and managed by a bank. Due to the implementation of stricter risk legislations in Europe during the past years, banks however primarily invest in later stage deals.

Corporate VC is equity capital released by large (non-financial) corporations, mostly multinational enterprises, to be invested in promising innovative startups. The key motivations for corporate VC investments are consequently also more strategic in nature than financial. Examples of firms having launched their own VC funds include Intel and Oracle.

These first three categories are often summarized and referred to as 'private VC funds'.

Public VC funds, in contrast, include those funds that are owned by public authorities, mostly at the state or regional level. Often, they are set up and managed by state-owned development banks, like e.g. the KfW (Kreditanstalt für Wiederaufbau) banking group in the case of Germany. Their main aim is to close any remaining equity gaps hampering the foundation and early growth of innovative new ventures.

Overall, the different types of VC funds vary not only according to their source of money, but also concerning the value contributions the VCs provide to their target firms. In this dissertation, all types of VC are considered besides corporate/ in-house VC funds. We exclude corporate VC funds as their main focus is not on the investment itself, but rather based on strategic rationales. To reach a competitive advantage, the incumbent firm is sourcing innovative ideas and processes from the new firm it invests in. For other private VC funds, in contrast, financial returns are the primary investment motive.

1.4 The Venture Capital Investment Process

Figure 1.4.1 exemplifies the VC investment cycle from the initial raising of funds till the exit of the portfolio firm and, in case of profits, the redistribution of capital gains to the fund's investors. At the fundraising stage, the money VC firms raise from university endowments, financial intermediaries or wealthy individuals is pooled in specific funds. After a fund has been closed, venture capitalists acting as general partners carefully select the most promising investment opportunities from the bulk of investment proposals they have received. After detailed due diligence and thorough evaluation, VC is subsequently granted to a small number of firms (portfolio companies) with the best return on investment prospects. After

deal closure, the incubation period, where the venture capitalist monitors and nurtures the target firm begins.

A typical VC deal is undertaken by an investor syndicate, instead of a stand-alone investor. Syndication implies the co-investment of more than one investment firm in a deal. In addition, most VC deals are executed in rounds, a practice that is also referred to as staging. In staged deals, the payment of VC funding is dispersed over multiple points in time (Series A round, Series B round etc.). Tying the disbursement of funds to the achievement of a priori specified milestones provides investors with an important monitoring tool and reduces the risk and potential impact of information asymmetries including opportunistic behavior on side of the entrepreneur. If a startup does not perform according to the predefined goals, VCs have the option to retract their involvement (Chemmanur et al., 2010).

VC is a long-term investment vehicle. Only after 5 to 10 years, depending on the industry and market, portfolio companies, if successful, launch an "exit". Occasionally they get acquired by another corporation or go public via an initial public offering [IPO]. When the entrepreneurial firm is going public or is acquired by another entity, VC investors regularly exit (sell their shares). The profits raised during a successful exit of a portfolio company are then distributed between the VC firm and the fund's investors, whereby the latter commonly receive the largest share (initial invested capital plus a previously defined rate of return).

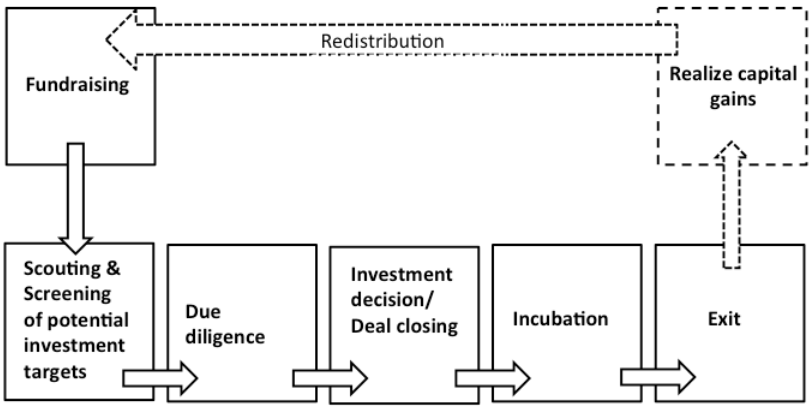


Figure 1.4.1: VC investment process

1.5 Alternative Financing Sources

Figure 1.5.1 depicts the financing cycle of an innovative startup in a simplified way. A breakdown of available financing options is given per development stage. There still exists much fuzziness in both practice and the academic field concerning the exact demarcation of VC, in particular to investment intermediaries such as private equity, angel investments and, more recently, equity crowdfunding. In essence, *venture capital* is a part of the broader asset class of 'private equity'. The major distinction between private equity investments and its subcategory 'venture capital' relates to their investment stage focus. *Private equity* is generally used to conduct leveraged buyouts (acquire an equity majority share) of later stage, mature companies, whereby for VCs young businesses are in the spotlight. Because their investment preference concentrates on larger companies, private equity funds generally also have a higher capitalization than VC funds and invest larger tranches of

money.

A second closely related investment vehicle is angel investment. *Business angels* are high net worth individuals, who provide their own capital to innovative entrepreneurs. Often business angels have been entrepreneurs themselves, consequently, in a similar way to VC investors, they provide strategic advice and industry contacts to their funding targets. They are often the first "professional" investors after 'friends and family'. Differentiating aspects between VCs and business angels again refer to the preferential investment stage focus, size of the investment, as well as the source of capital. Traditionally, business angels have focused on investments in startups that are in their seed stage. Investment amounts starts at some thousand Euro up to several millions of Euro.

Equity crowdfunding is a relatively novel financing vehicle for young and innovative enterprises, which is however quickly gaining in momentum. Applying equity crowdfunding strategies, entrepreneurs seek financing on online equity platforms. First equity based crowdfunding platforms have been launched in 2010 in the US, including sites such as CrowdCube, WeFunder and Seedrs. Individual (non-accredited) investors, "the crowd", can make an investment choice among the firms presented on the platform and invest in young companies alongside professional (accredited) investors like VCs. Equity crowdfunding is distinct from reward-based crowdfunding offered by platforms like Kickstarter and IndieGoGo. In the case of equity crowdfunding "backers" receive a share in the business in return to their involvement instead of merely some kind of tangible or intangible non-monetary rewards. A related instrument is debt crowdfunding, functioning mainly along the same principles as equity crowdfunding, only with the main distinction that investors appear as lenders providing businesses or individuals with a loan. As of 2017, legal restrictions still largely prohibit startups in many (European) countries to trade equity shares with non-accredited investors via online platforms. In the US, the equity crowdfunding business has been fuelled by the JOBS Acts which is in effect since 2016 and allows non-professional investors to

fund ventures via online equity crowdfunding platforms.

Very recently, *initial coin offerings* [ICOs] have gained popularity among high-growth startups as a quick means to obtain funding. Instead of providing investors with an equity share in return to their high-risk investments, launching an ICO, firms offer a virtual currency ('coin') in return for investors' commitment. In contrast to traditional VC, also individual, non-accredited investors are able to buy coins and in that fund young firms. As financing instrument, ICOs are thus much more similar to crowdfunding platforms like Kickstarter than to professional VC. Some young firms even rather use this form of fund-raising to bypass the lengthy and challenging screening and due diligence process most VCs implement. Nevertheless, compared to VC, the issuing and selling of 'coins' is hitherto a largely unregulated process. Given the ease of fraudulent business practices, ICOs have been banned by regulators in China and South Korea in 2017 and put under restrictions in the US. However, solely in 2017, the ICO market accounted for $6.8 billion in funding (Lee, 2018).

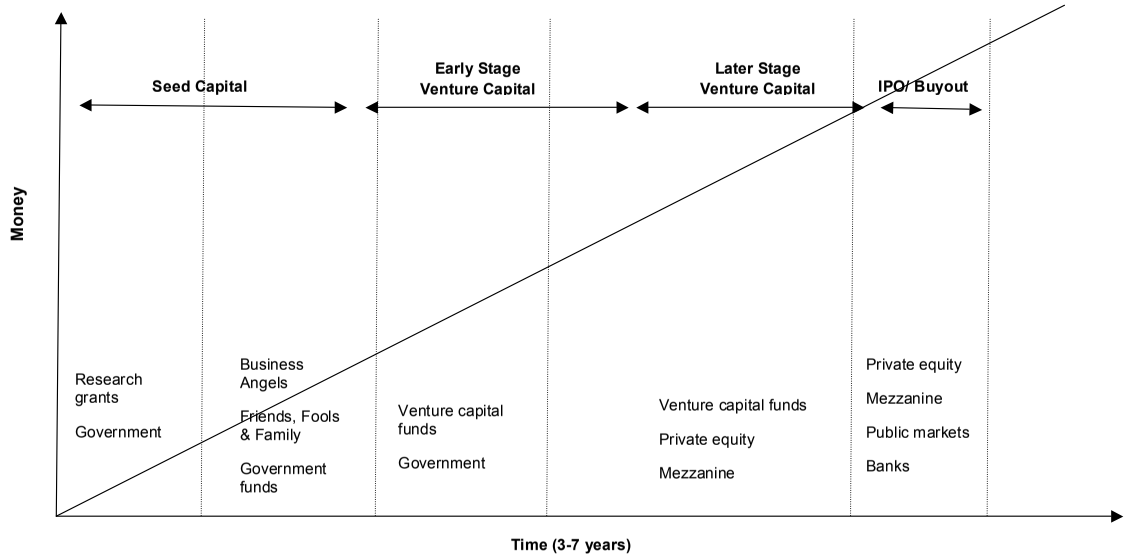


Figure 1.5.1: Firm life-cycle and funding opportunities

Summing up, over the years, the boundaries between the different investment vehicles have become increasingly diluted and disputed. Investment syndicates in some cases include both professional VC firms and affluent individuals acting as angel investors as well as, at a later stage, private equity firms. In other cases, startups that have received angel investments go on to search for VC funding when their money requirements become larger. Likewise, private equity funds will follow up VC funding in promising firms with escalating financial needs. Despite the existence of various alternative, though related, instruments of firm financing, I focus in this dissertation on the most prominent asset class for young innovative startups: "Venture Capital". Throughout the dissertation, data has been carefully selected and screened (see Section 1.12) to avoid as much as possible the inclusion of financing tools apart from VC. The perils related to collecting reliable VC data are further discussed in the following section and Section 1.12.

1.6 Industry Size

Representative and coherent VC industry statistics are difficult to obtain as aggregated data quality and availability largely vary across countries. VC firms are not legally required to publicly disclose their investments, thus, statistics widely vary along the methodology and underlying primary data sources they apply. An additional issue that severely impedes a coherent data collection is the lack of a standard definition of VC. As detailed in Section 1.4, the transition from the seed and VC stage to private equity related stages such as mezzanine capital, expansion, turnaround and buyout capital is often challenging to decipher. One striking example is the definition of "venture capital" by the New Zealand Private Equity and Venture Capital Association, which includes late stage financing vehicles linked to "turnaround stage financing" (OECD, 2015). In the US, VC usually comprises seed, startup and expansion stage capital and excludes buyout capital, whereas in Europe also the financing of management and leveraged buyouts is often accounted for as VC.

In Figure 1.6.1, the large variations in data sources that give rise to extremely diverting interpretation of the status quo of the VC industry in Europe are exemplified. According to PitchBook (2017), the absolute number of VC deals in Europe has been rising annually since the financial crisis of 2007-08 until 2014. From 2015 on, a downward trend in deal numbers is detected in both PitchBook (2017) and InvestEurope (2016) data. In contrast, a report published by the European Commission (Nepelski et al., 2016) reveals already a consolidation in deal volume a year earlier, in 2014 and a considerable lower aggregate deal volume overall.

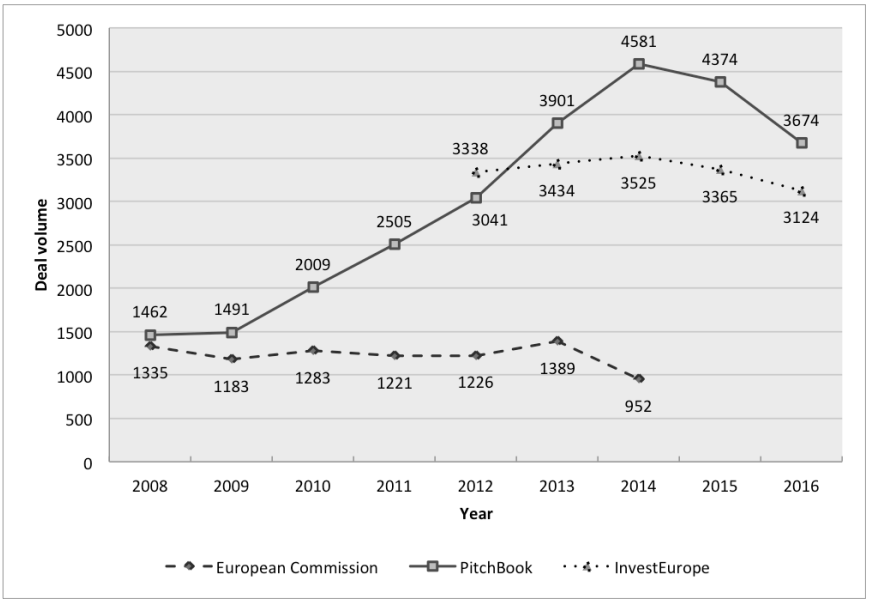


Figure 1.6.1: VC deal volumes (Europe)

Also with respect to VC investment size large dissimilarities between industry statistics are found. Figure 1.6.2 represents the annual size of VC investments in Europe. VC activity measured in terms of capital invested has been steadily increasing since the financial crisis, reaching a peak in 2015 with 15.4 billion EUR of invested capital. In view of the lower deal number in 2015 apparent from Figure 1.6.1, this trend suggests that VC deals in Europe are monetary wise becoming larger. Data from InvestEurope in contrast suggests that the amount of capital invested has main-

tained less volatile. The industry association forwards a continuous increase in VC spending between 2012 and 2016.

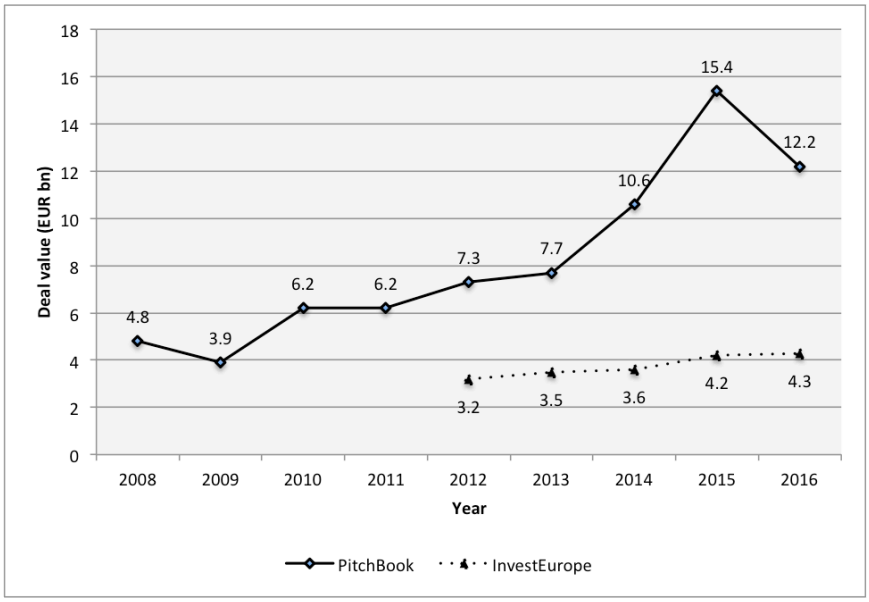
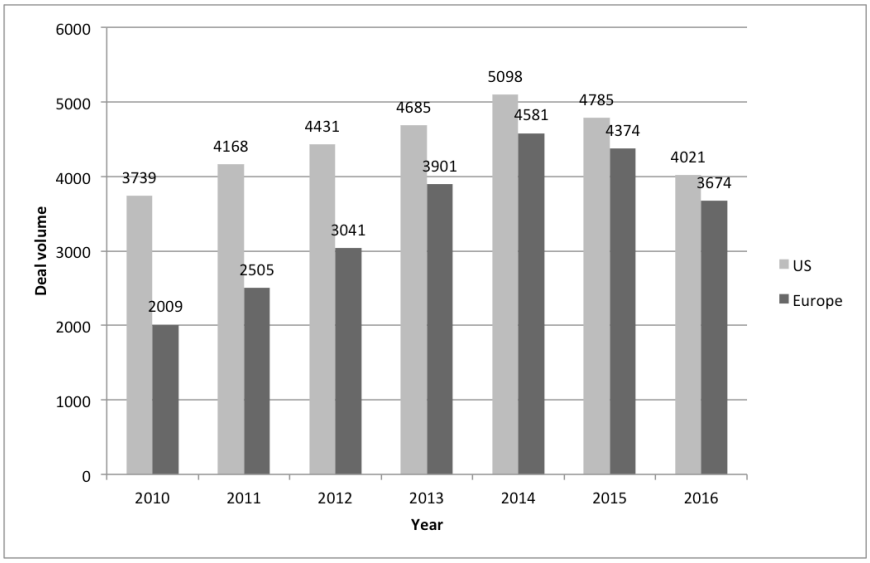


Figure 1.6.2: VC deal value (Europe)

Though the US and EU economies are similar in size, the European VC market only amounts to a fifth of its US counterpart, whereby VC markets across Europe greatly vary concerning their development and market capitalization. In 2014, the VC to GDP ratio was only 0.05 per cent in Europe, compared to 0.29 per cent in the US (BCG, 2015). Figure 3 provides an overview of US deal numbers and compares them to the European market. Whereas there used to be a large gap between deal volumes in the US and Europe, the latter has been catching up during recent years. Though deal numbers are comparable, capital invested still remains much higher in the US. Compared to Europe, the US has a much more mature VC market. According to the National Venture Capital Association [NVCA] (2017) investments peaked in 2015 when 79 bn USD VC were provided to startups and young firms. In 2016, effective VC investments decreased to about 70 billion USD (compared to only between 4.3 – 12.2 bn EUR in Europe). About 48 per cent of the

money has been directed towards young companies in the software sector, making it the most popular sector for VC investments. With respect to fundraising rates, 2016 marks the year with the highest activity in the US since the dotcom bubble in 2000-01. US VC funds obtained 42 bn USD in new capital (compared to 35 bn USD in 2015) (NVCA, 2017).



Data Source:NVCA & PitchBook (2017), PitchBook (2017), & Nepelski et al. (2016)

Figure 1.6.3: Deal volumes in US and Europe (2010-2016)

Both VC ecosystems also differ largely with respect to the average deal size a company can expect to receive. In the US the mean deal size between 2007-2015 amounted to 6.3 million EUR. Deals in Europe are on average five times smaller (1.3 million EUR) (Fernández Acevedo et al., 2016). The largest industry difference however persists regarding VC-backed exits. The technology news publisher Tech Crunch estimated that between 2012 and 2016 a total of 1,017 US startups entered the exit phase compared to only 346 firms in Europe. This large gap also gets reflected in the value of these exits. Whereby VC backed exits in the US amounted to 201,128 million USD, companies in Europe only realized 23,535 million USD (Basta, 2017).

Thus, there continues to be a large difference between the US and EU VC industries concerning invested capital and exit markets (venture-backed initial public offerings [IPOs] and trade sales). To absorb perceived lacks of private VC, government agencies in EU countries provide to a much larger extent public funding than their US counterparts. In Belgium, for example, the government is the largest provider of venture capital. In Germany, the High-Tech Starter Fund and the ERP- Starterfonds are considered important programs providing public VC. Though also in the US, public institutions have been significant drivers of VC activity and have introduced a number of initiatives to promote young firm financing, most prominently, the Small Business Investment Company Program and Small Business Innovation Research Program.

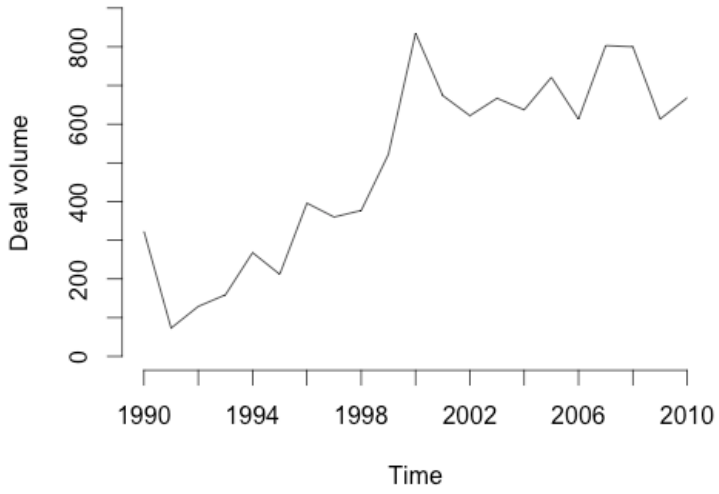
Apart from the US and European playing fields, recent years have seen the emergence of new VC markets. Especially Asian countries denote a quick rise in VC fundraising activities, with China establishing as a major player. VC activity has been consistently strong in Asia[1], even during the global recession. In 2015, the region has seen 3651 VC deals with a total amount of invested capital of 52 bn USD, which compares closely to the US (4785) and Europe (4374). In the same year, 98 new funds were raised with an aggregate capital of 11.9 bn USD (Preqin, 2016).

Besides obvious differences in deal number and size as well as industry cycles, there also exist large dissimilarities in investment patterns between bank- and market-based financial systems as well as preferred age, size, and stage of investments between VC industries in the US, Europe and Asia. Institutional and cultural differences between VC markets around the globe have been treated extensively in a discrete strand of studies (see Bertoni, Colombo, & Quas, 2011; Bruton and Ahlstrom, 2003; Mayer, Schoors, & Yafeh, 2005). I will not commit to this topic in further detail here as for the empirical analyses of this study either a highly aggregated unit of analysis has been chosen, rendering cultural investment particu-

[1] Countries include: China, Japan, South Korea, Hong Kong, India, Singapore, Taiwan, and Malaysia.

larities apart from obvious statistical differences less important. In other cases, the unit of analysis focuses on a particular market (Belgium).

Despite country and continent (Europe, North American and Asia) related VC numbers, there exists a lack of statistics depicting the status quo of cross-border VC transactions. None of the industry sources (PitchBook, NVCA and InvestEurope) distinguishes between national and international VC flows. Based on data retrieved from ThomsonOne (previously VentureXpert), the evolution of global cross-border transaction has been calculated for this dissertation and is illustrated in Figure 1.6.4.



Data Source:VentureXpert.

Figure 1.6.4: Global evolution of cross-border deals 1990-2010

1.7 Geography of Venture Capital Activity

The previous sections have illustrated the accelerating role VC plays for innovation and economic growth by funding high-tech, high-potential startups. Nevertheless, not all regions benefit to the same degree from the innovation spurring powers of VC. VC activity has been highly concentrated in a few metropolitan areas and an important characteristic of VC investments is their spatial sensitivity (Kolympiris, Kalaitzandonakes, & Miller, 2011; Powell, Koput, Bowie, & Smith-Doerr, 2002). Following, I elaborate on the spiky geographical pattern of VC investments and show how the advent of cross-border transactions contests prevailing assumptions on the spatial organization of VC and constitutes an important new area of study.

1.7.1 Concentration of VC firms

Though financial services have a general tendency to spatially agglomerate in a few metropolitan areas, the VC industry appears to be even more geographically skewed (Chen, Gompers, Kovner, & Lerner, 2010). With respect to the US, most VC funds are located in either California, New York or New England. On a more detailed geographical scale, we see that more than half of all US VC firms are situated in three metropolitan areas, San Francisco, Boston and New York (Cumming & Dai, 2010; Mason, 2007; Powell et al., 2002).

Also when looking to Europe, a high geographical concentration of VC firms persists (Griffith, Yam, & Subramaniam, 2007). In the UK, traditionally, more than half of all VC investors have their office in London. Also in France, VC firms are highly geographically skewed, with the majority of them being located in Paris. The least concentration of VC firms is observed in Germany where headquarters are spread across major economic hubs including Frankfurt, Hamburg, Hanover, Düsseldorf, Munich and Berlin (Lutz, Bender, Achleitner, & Kaserer, 2013; Martin, Sunley, & Turner, 2002). Contrary to France or the UK, where Paris and, re-

spectively, London are the main hubs of financial activity, financial institutions in Germany have traditionally been more dispersed which may also explain the wider spread of VC firms.

It is suggested that agglomeration effects as defined by Marshall (1890) play a role with regard to location decisions of VC providers. Chen et al. (2010) observe that VC firms are attracted to places where other VC firms are already active. Three broad reasons are commonly forwarded to explain the clustering of VC firms. First, it is assumed that the co-location of VC firms increases knowledge spillover between actors and allows them to benefit from an already established infrastructure. This e.g. facilitates the search for capable personnel. Second, the proximate location of different VC firms eases the search for partners in the case of syndicated investment deals (the joint investment of two or more venture capitalists in the same financing round of a specific target firm). Third, the larger availability of capital attracts entrepreneurs to the place, thereby increasing deal flow, which in turn enlarges the survival chances of VC firms (Chen et al., 2010).

1.7.2 Concentration of VC Investments

Similar to the agglomeration tendency of VC firms, also their investments, the portfolio firms, are geographically highly concentrated (Martin et al., 2002). In the US, about 39 per cent of total VC invested is directed to only two metropolitan areas, San Francisco and Boston. Also in the UK, venture capitalists situated in London or the South East are observed to predominantly invest in these regions (Mason & Harrison, 2002). German venture capitalists commonly invest in ventures located in three regions: Bavaria, Baden-Wurttemberg and North Rhine-Westphalia (Mason, 2007).

Different reasons for the concentration of VC investments in proximity to major VC hubs have been forwarded in the literature (Kolympiris et al., 2011). Generally, the agglomeration of VC firms and their target companies is attributed to the

geographically restricted investment radius of VC investors. Given information asymmetries and other principal-agent problems that amplify with geographical distance and that exacerbate deal selection and monitoring, venture capitalists are more likely to invest in companies that are located in proximity to their offices. To curtail information asymmetries, venture capitalists often refer to their broad social network to informally learn about promising new investment opportunities (Fried & Hisrich, 1994; Hochberg, Ljungqvist, & Lu, 2007). Among others, investment bankers, entrepreneurs, VC firms, and consultants with whom the investor has worked in the past belong to this network. The relationship between referee and investor is marked by a high level of mutual trust resulting from repeated interactions, which allow for informal and tacit knowledge exchange. Given that this sort of information sharing usually requires face-to-face contacts, venture capitalists' networks are predominantly local in scope. Consequently, venture capitalists are better informed about deals involving local firms than investment opportunities that are located further away. This leads to a considerable local bias already in the opportunity identification stage (Mason, 2007).

Potentially, there is also a discrepancy between the goals of the entrepreneur and those of the venture capitalists. Thus, agency theory is often applied in the literature to describe the venture capitalist – entrepreneur relationship (Arthurs & Busenitz, 2003; Van Osnabrugge, 2000). Typical performance impeding principal-agent problems resulting from information asymmetries after deal closure include decreasing efforts on behalf of the agent, the entrepreneur, as well as wasteful spending of investor's money in personal, status-enhancing items such as luxurious company cars and lavish office buildings (De Clercq & Manigart, 2007; Gompers & Lerner, 2001). To curtail opportunistic behavior and manage risks, VC investors frequently monitor the operation of their portfolio firms. Not being located in proximity, it takes investors much more time and costs to oversee portfolio firms' business affairs.

Besides supplying incumbent innovative firms with funds, venture capitalists also

provide value-adding advisory services to target firms in the aftermath of the initial investment (Gorman & Sahlman, 1989; Sapienza, 1992; Sapienza et al., 1996). For example, venture capitalists, reverting to their vast sectoral knowledge and personal contacts, are frequently facilitating the entry of startups into existing industry networks. Especially in the early growth phase of a startup, close personal contact to the venture capitalist is of particular importance. During this phase, the young firm makes its first experiences in the market environment and subsequently strategy adaptations are often made. With respect to the reassessment of the business strategy and the provision of valuable business contacts, the abundant expertise of the venture capitalist is crucial (Devigne, Vanacker, Manigart, & Paeleman, 2013). With respect to the generation of these beneficial synergies, it is argued that the distance between the VC fund and the portfolio firm plays a key role (Florida & Kenney, 1988). More precisely, it is assumed that tapping non-monetary resources is eased by the co-location of investors and investees (Martin, Berndt, Klagge, & Sunley, 2005; Mason & Harrison, 1995; Powell et al., 2002). Zook asserts that: "Getting the most from a venture capitalist or 'smart money' [...] is constrained by geography [...] Firms located near sources of venture capital have better access to the funding, networks, and advice of venture capitalists" (Zook, 2002, p. 163).

The 'spatial stickiness' of VC potentially implicates 'equity gaps' for entrepreneurs located in regions, which do not domicile any VC centers. To abate disparities in regional economic development, policy makers envisage a more even geographical spread of VC. To ensure sufficient finance for young innovative high growth companies across regions, the European Commission aims, for example, at the strengthening of VC markets by removing obstacles to cross-border VC financing (European Commission, 2009). This is an attempt to decrease the fragmentation of VC markets in the EU, establish an integrated single market for VC and by that increase the overall supply of VC for young high-growth firms.

Some circumstances have been identified that moderate the impact of distance on deal selection. Geographical proximity seems to matters less in syndicated invest-

ment deals (Fritsch & Schilder, 2008). In syndicated deals often one of the investors, mostly the lead investor is nevertheless still located close to the portfolio firm. Thus, also in syndicated deals the impact of geography does not completely disappear. Rather, it is limited to the lead investor. Also VC firms' experience is found to limit the impact of geographical considerations on their investment decisions. Older, more experienced VC firms that usually possess a large network of contacts are observed to be more likely to select more distant target firms (Griffith et al., 2007; Powell et al., 2002).

Summing up, a clear tendency has been observed for venture capital firms and their target companies to cluster. To limit transaction costs with respect to the oversight of their target firms and the active post-deal closure involvement, investors seek geographically proximate investments. Being located next door to their investment projects makes it easier for the venture capitalist to intervene. In turn, being co-located also enables the entrepreneur to better access the knowledge and other resources of the venture capitalist. Though co-location has been the 'leitmotiv' of VC investing, the augmented existence of long-distance VC deals can nevertheless not be neglected and will be further examined in this dissertation.

1.8 Knowledge Gaps

Scholarly interest in VC has been increasing along the evolution of the industry. First academic studies were published in the 1970s coinciding with the expansion of the VC market in the US (Landström, 2007). Most of VC research has consequently been concentrated on the US market given its earlier maturity compared to other parts of the world. Meanwhile, VC investments have been diffusing to countries outside of the US like Canada, the UK, France and Germany, as well as more recently China and South Africa. Likewise, over the past decades, the VC literature has expanded. Several dedicated journals such as *Journal of Business Venturing* and *Venture Capital* attend to the topic at present. Others like *Entrepreneur-*

ship, Practice and Theory touch on the subject occasionally. Despite the dedication of these outlets to the field of venture capital, scientific research addressing specifically the cross-border dimension of VC investing remains relatively scarce. Existing research has primarily focused on transactions in the context of the nation state or even on the sub-national level (e.g. Silicon Valley). Following, three overarching gaps concerning our knowledge of international VC are identified.

First, **a general understanding of the spatial distribution and drivers of cross-border VC deals is missing**. As elaborated in the previous section (Section 1.7), domestic VC patterns appear to be spiky and highly spatially concentrated, whereby VC activity is clustered in few metropolitan areas. Given the pronounced local bias and unequal distribution of domestic VC, it seems likely that also long distance, cross-border VC deals are not frictionless. Systematic research that traces the direction of international VC transactions is nevertheless scarce. Whereas economic geographers pay attention to and stress the spatiality of economic interactions, the geography of specific financial products such as venture capital has been marginalized in the broader geography literature. Instead, finance has frequently been considered as domain exclusively reserved for financial economists (Christophers, 2017). As Martin and Pollard (2017) summarize, in economic geography, "the dynamics of money and finance have, for too long, appeared 'offstage' relative to long(er) standing concerns of production, work, technological change, competition, agglomeration and urban and regional economic development." (p.1). In the field of economics, in turn, spatial concerns have for long maintained merely circumstantial. In contrast, in neoclassical economics, geographic aspects have solely gained in significance since Paul Krugman's introduction of the "new economic geography" approach (i.e. 'geographical economics'), where he calls for the integration of more spatially informed concepts in international trade theory. Krugman's 'New Economic Geography' theory has consequently led to a newly emerging interest in geographic constructs and transportation costs to explain the location of economic activity in economics. A flaw of the framework is nevertheless that most attention is paid to the spatial organization of production, whereas

the spatiality of capital flows is at best treated as side issue.

A second knowledge gap relates to the **effects of long distance VC investments for entrepreneurs**. Apart from a lack of understanding of the distribution of international capital flows at the macro level, increasingly geographically distributed investor syndicates may carry implications for the startups they support. In Section 1.7, I convey that it has been widely accepted in the relevant academic literature that the co-location of investor and investee constitutes an important precondition for investment success. However, similar to the fuzzy knowledge we currently have about international VC activity at the macro level, we posses very little information so far concerning the effects of cross-border deals at the level of the target firm, the meso level.

Thirdly, a recent report of the European Commission has revealed that few innovative companies, and especially ICT businesses, succeed in establishing a presence outside of their native market (Mulligan & Card, 2014). The few European digital companies that have successfully entered into foreign markets originated mostly from larger home markets like France, Germany and the UK. To look at international VC activity in its entirety, attention therefore needs to be paid towards the **international expansion of new ventures** and especially those that are headquartered in smaller European market economies.

1.9 Aims of this Thesis

The dissertation aspires to reduce the above mentioned knowledge gaps by contributing to the scientific knowledge on cross border VC transactions, their patterns and drivers (Chapter 2 and 3) and the effect of cross-border VC deals on portfolio companies (Chapter 4). To provide a holistic as possible understanding of the internationalization of the sector, Chapter 5 aims in turn at expanding the existing knowledge on venture capitalist involvement and venture international-

ization.

The *first* issue this thesis regards is the degree of globalization of VC markets. Despite the existence of cross-border VC investments and its *prima facie* stark contradiction with the long observed local investment patterns, there have been very few empirical analyses of this phenomenon. Given the changing investment environment, a re-assessment of the geographic fundamental of VC activities with a focus on international transaction patterns seems relevant. Consequently, the research question addressed in this part is: *"How global is the VC industry?"* A deeper understanding of the geographic pattern of VC deals will fuel a more fruitful policy discussion and assist policy makers in formulating more effective initiatives to foster knowledge-based and high-tech industries. A less fragmented VC market along national borders offers more opportunities to entrepreneurs (especially those located in less mature VC markets) to find financing solutions for their business ideas. The topic is dealt with in Chapter 2.

Related to the evolving landscape of VC investments, I approach to answer the question: *"What are the determinants of cross-border capital transactions?"* in Chapters 2 and 3. To attract cross-border VC, it is important to identify the determinants of incoming VC transactions i.e. factors that mitigate the negative effects of geographical distance.

When it comes to the long prevailing importance of vicinity for VC activity, investor mobility is a key rationale, however it is mostly treated implicitly. An exception is the work by Bernstein, Giroud, and Townsend (2016) where the effects of the launch of a direct flight connection for the interaction between investor and target firm are measured. Both reductions in transit time as well as a more convenient travel experience are found to increase contact hours. A higher level of mentoring and monitoring is eventually found to accelerate innovation and to lead to a higher likelihood of a successful exit. The second aim of this dissertation is therefore to start filling this notable gap – the lack of physical accessibility considerations - in the finance literature. Chapter 3 deals with this issue.

The *third* aspect of this dissertation relates to the performance implications of cross-border VC funding. It is captured by the research question *"How do cross-border VC investments affect the performance of startups?"* With the occurrence of investor syndicates including a mix of proximate and more distant investors, it becomes important to be aware of any performance effects of these distinct geographical constellations for portfolio companies. Prior studies have investigated the social topography and geographic spread of domestic VC co-investment networks and have stressed that embedded relationships are crucial during the entrepreneurial process (Sorenson & Stuart, 2001). I intend to contribute to this earlier research by adding a broader (global) geographical lens, while also studying performance implications related to spatially more diverse co-investor networks on the portfolio firm level. Specifically, the third aim of my research is to examine and discuss whether domestic and international investor linkages are qualitatively different in scope with respect to their information and knowledge content and if they vary in their impact on portfolio firm growth. The third aim is addressed in Chapter 4.

The *fourth* goal of this dissertation is to unveil strategies for entrepreneurs that stimulate the international expansion of their businesses early on. In a globalizing world, not only VC investors, but also new ventures need to think increasingly international from the start. Both young firms' innovative capacity and the consequent exploitation of their technical developments increases with internationalization (Kafouros, Buckley, Sharp, & Wang, 2008). For this study the research question is: *"What drives the early internationalization of young firms?"* Chapter 5 is dedicated to venture internationalization.

A more detailed elaboration on the theoretical aims and contributions each of the four empirical studies focuses on is provided in the respective chapters.

1.10 Practical and Societal Relevance

Despite the fact that only a very tiny percentage of young innovative firms eventually finance their growth by means of VC (less than 1 per cent of all registered companies), the economic and societal effects of the industry are non-negligible. Following, I delineate six areas where VC has a lasting impact on, in addition to the direct effect investors exert on the development of their portfolio companies. The relevance of this asset class on a wide range of economic and societal issues illustrates once more the need for an in-depth understanding of the changing landscape of VC investment and entrepreneurial activity. Nevertheless, the total benefits and positive spillovers created by VC-backed businesses remain difficult to estimate and the overview given here is likely to underestimate the true value of VC (Strebulaev & Gornall, 2014).

- *Entrepreneurs*: Many entrepreneurs encounter financing difficulties early on, which often forces them to give up on their business ideas. For innovative and high potential growth companies, VC can bridge this funding gap and help entrepreneurs to process with and develop their product. Thus, VC constitutes an important catalyst for the creation of young and innovative entrepreneurial firms and contributes to the development of a knowledge-based economy (Mason & Harrison, 2002).

- *Research & Development*: VC backed businesses are a major source of R&D spending. In the US, those firms that have previously benefited from VC undertake 44 per cent of R&D spending of public companies (Strebulaev & Gornall, 2014).

- *Employment*: VC has an enormous leveraging effect on employment and productivity. As of 2013, US VC backed companies were employing 4 million people. Many (43 per cent) of the largest and most important public US companies were VC-backed in their early days e.g. Apple, Google,

and Microsoft. Given that overall VC funds only invested in about 0.19 per cent of newly founded US businesses, their impact on job creation, R&D, and innovation has been tremendous (Strebulaev & Gornall, 2014). The employment effect of VC backed firms also appeared to be more resilient to economic downturns. In contrast to non-VC backed firms, VC-backed companies continued to create new jobs during the economic crisis in 2008, though on a lower level (Tykvová, Borell & Kroencke, 2012).

- *Economic growth*: Innovation and technological progress, the products of innovative entrepreneurship, are key elements of economic growth. There exists a broad consensus among policy makers and academics alike that innovative entrepreneurship facilitates long-term economic growth. The claim is informed by the popular paradigm of "creative destruction" promulgated by Joseph Schumpeter (1942) more than half a century ago. Young innovative firms induce technical change and create new and more productive jobs (while causing the replacement of established actors), thereby enhancing a region's innovative capacity and global competitiveness as well as long-term economic growth perspectives.

- *Productivity*: VC has helped financing technologies that have had a truly changing impact on how daily business processes are conducted. VCs supported businesses in fields like web-based technologies and personal computing as well as largely funded businesses related to the scaling up of the Internet. Many of these products have had a tremendous impact on the productivity of workers.

- *Competition*: Companies that innovate often gain competitive advantages providing them with a leading-edge position compared to less innovative competitors. This increases company survival. In addition, the emergence of competitors brings larger, more mature corporations under competitive pressure. Referring to economic theory, increased competition turns into better products, more product variety as well as lower prices compared to

an oligopolistic or monopolistic market, which increases social welfare.

- *Sustainability*: Many products developed in VC-backed firms target the improvement of environmental sustainability. There has been an investment boom in CleanTech technologies such as wind and solar energy projects and clean fuels as well as startups in the electrical vehicle field (e.g. Tesla). These businesses have the potential to facilitate a better utilization of resources and contribute to more eco-friendly new technologies mitigating the emission of greenhouse gases.

1.11 Methodology

In order to approach the knowledge gaps specified in Section 1.8 and find an answer to the four research questions posed in Section 1.9, the dissertation entails four empirical studies. Each of them is applying a different quantitative methodology, which I will briefly explain in this section. For a more detailed discussion of the research design that is used per study, I refer to the methodology section of the respective chapter.

In the first article - *On the Internationalization of Venture Capital: Is the 'Death of Distance' near?* - a gravity model approach is chosen. Researchers regularly use gravity models to investigate interactions between countries and regions. Such models are commonly found in the literature on international trade (Boulhol & de Serres, 2010; Redding & Venables, 2004), but also concerning financial transactions such as foreign direct investment (Blonigen, Davies, Waddell, & Naughton, 2007). When estimating the number of deals between countries, we are dealing with count data (any number is always a non-negative amount). For such data, it is in general appropriate to assume that it follows a Poisson (or negative binomial) distribution rather than a normal distribution. Consequently, to examine the magnitude and direction of aggregated bilateral VC transactions quasi-Poisson

modelling techniques are used.

In a second empirical study - *Time is Money! Effects of Air Transport Accessibility on International Venture Capital Flows* - it is modeled in how far differences in transport accessibility are responsible for trade frictions in cross-border VC investments. Information were collected on the intermodal travel time between New York City (location of VC investor) and 252 NUTS 3 regions across eight European countries (location of target firm). The dependent variable in this study is the aggregated number of cross-border investments a NUTS 3 region has attracted between 2005 and 2010 from NYC based investment funds. The main predictor variable is travel time. I also take care that results are robust with respect to any differences between regions in their local entrepreneurial ecosystem as well as the institutional environment related to the exploitation of entrepreneurial activities and variations in macroeconomic conditions between countries. To test the predicted negative relationship between travel time increases and the size of cross-border VC inflows, negative binomial regression analysis is employed.

In the third article - *Venture Capital: The Effect of Local and Global Social Ties on Firm Performance* – a random slope multilevel regression model is utilized to quantify the effect of structural and geographic syndication network patterns on the growth evolution of 51 young, technology based firms in Belgium that have used VC as means of financing. To determine and assess relational ties of and between startups and their VC investors, I use Social Network Analysis [SNA]. To measure relations between different actors and their embeddedness in a network, SNA is commonly employed in a wide range of fields including sociology, economics, geography and business studies. So far, however only few studies exist that apply network analyses to venture capital data (see Hochberg et al., 2007; Sorenson & Stuart, 2001).

The fourth article - *Born or grown global? New Venture Internationalization and the Role of International Knowledge Resources* – is dedicated to assessing in how far new ventures are founded as or, rather, evolve into internationalizing businesses. For

this, I traced the evolution of business activities of 99 high technology IT ventures in Belgium and constructed a cross-sectional dataset. Various hypotheses related to startup founders' initial international experiences (congenital knowledge) and ex post foundation international knowledge acquisitions including VC funding on new venture internationalization were tested using multiple logistic regression and ordinary least square regression techniques.

1.12 Data

In this section, I briefly introduce the VC data sources that are referred to in the different studies in this dissertation. Figure 1.12.1 provides a schematic overview of the different databases and their sources. In general, reliable VC data is difficult to obtain. VC deals only rarely get fully publicly disclosed, aggravating the collection of comprehensive VC information. The collection of VC data is complicated by the fact that up until now, there is no ubiquitous definition of VC. Consequently, in most databases a wide range of deals such as angel investments, seed financing, development capital, VC, management buyouts, and investments by private equity funds are classified as VC. Often there is also no precise definition of the type of VC investor involved in the deal (professional firm, corporation, bank etc.) as well as any information concerning the investor that leads the deal (Chen, Chu, & Billota, 2011; Chen & Marchioni, 2008; Fritsch & Schilder, 2012).

Studies focusing on US VC investments commonly make use of commercial databases like Thomson One by Thomson Reuters (previously VentureXpert), PricewaterhouseCoopers MoneyTree survey, and to a lesser extent Pratt's Guide to Venture Capital Sources. With respect to European deals, in the past, there was a lack of any comprehensive database (Martin et al., 2002). Most studies analyzing VC investment in a European context therefore rely on data provided by either InvestEurope (previously European Venture Capital Association (EVCA)) or the respective national associations (see Fritsch & Schilder, 2008; Lutz et al., 2013; Martin

et al., 2002; Martin et al., 2005). More recently, the Zephyr database provided by Bureau van Dijk as well as the access restricted VICO database have emerged as popular data alternatives for VC-related research concentrated particularly on the European market.

Zephyr

The only commercial databases that particularly focuses on VC deals involving a European counterpart (acquirer or target) is Zephyr provided by Bureau van Dijk. The database includes information on investees and investors' details (name, address, sector), deal values and sort of financing. As the database only lists total deal values, a precise distribution of investors' contribution per deal is not possible. Deal details in this database are collected from press releases and national VC associations such as the Belgian Venture Capital Private Equity Association [BVA] as well as the InvestEurope. However, so far, only few studies refer to this dataset (see Devigne et al., 2013). A major shortcoming of the dataset is its short history. Only from 2004 on, data is available on a more comprehensive level, whereas similar US centered databases go back as far as 1969.

Thomson One (previously VentureXpert)

Thomson One provides extensive data on VC activity from as early as 1969. It also includes VC investments in European portfolio companies. As in the case of Zephyr, data is collected from national VC associations as well as InvestEurope (Alhorr et al., 2008). Before the 1980s, data is however based on the retrospective self-reporting of investment companies and might therefore be prone to self-selection bias. Consequently, I only use this data from the 1990s on in the following analysis, when data collection has become more systematic.

Assessing the quality of data of the SDC Platinum environment (where Venture-

Xpert has been a division of) for pre-2000 deals, Ljungqvist (2002) states that there is some inaccurateness with respect to the coverage of VC deals and firm capitalization. Comparing a manually collected sample of VC investments with the SDC database, the author detects that there are some VC deals backed by prominent VC firms that are not included in SDC Platinum. In contrast, some deals initiated by buy-out funds were falsely classified as VC investments. In addition, firm capitalization before an initial public offering [IPO] is in many cases underestimated whereas the reverse is true for portfolio firms' post-IPO market capitalization (see also Ritter, 2013). With respect to merger and acquisition data, Rossi and Volpin (2004) find that SDC Platinum has a better coverage concerning the UK and US than on smaller countries that often have less developed VC markets.

Other Sources for VC data

PricewaterhouseCoopers MoneyTree survey is a database providing information about VC investments in the US on a quarterly base from 1995 on. It is based on data provided by Thomson Reuters and the National VC Association [NVCA] in the US. Another US database that is often used to identify investors' contact details and investment preferences is *Pratt's Guide to Venture Capital Sources* published by Thomson Reuters (Chen et al., 2010; Powell et al., 2002; Zook, 2002). Primarily, it can be regarded as directory to VC and private equity investors. Its predominant aim is to facilitate entrepreneurs' search for suitable investment partners (Gupta & Sapienza, 1992). Data on actual investments included in the database is taken from Thomson One. In addition to deal details, Pratt's Guide provides information concerning investor's investment preferences in terms of geographic and industry scope as well as investment size. Also details related to the professional and educational background of VC fund managers are included in the database.

A more recent data alternative is the startup database *CrunchBase*. Founded in 2007, the CrunchBase platform provides information on innovative companies

from the startup stage to Fortune 1000 level. It provides individual profiles per company or investment firm including investors, number of financing rounds, deal value, exit valuation as well as IPO details. CrunchBase functions mostly on a self-reporting basis whereby founders and investors can upload details on a specific company's status quo. Data is consequently verified by machine learning techniques. Though CrunchBase is US-based, its envisaged coverage is global in scope. A disadvantage in this respect is nevertheless that self-reporting rates depend highly on the popularity of the platform in the respective country. With respect to the US, the coverage of CrunchBase has been reported to be similar to that of the National Venture Capital Association (Block & Sandner, 2011). Given the novelty of the database and its short historical observation period, it has only been scarcely used in VC-related academic publications. The few articles that have taken notice of CrunchBase data for VC research include for example Alexy, Block, Sandner, & Ter Wal, 2012; Bertoni & Tykvová, 2015; Block & Sandner, 2011; and Hellmann & Thiele, 2015.

Another more recent database, *VICO*, provides information on VC and angel investments in seven European countries (Belgium, Finland, France, Germany, Italy, Spain, and the United Kingdom) and Israel. VC investments are traced from 1988 onwards. The VICO data collection is resulting from the European Commission funded project "RISIS – Research Infrastructure for Research and Innovation" under the Seventh Framework Program. VICO is based on information retrieved from a wide number of sources such as annual reports, Web sites, press releases, VC association data, CrunchBase and the commercial databases Zephyr, ThomsonOne, Orbis (Croce, D'Adda, & Ughetto, 2015). It includes investor and investment level information on a total of 6,128 VC investors. Besides its limited geographical coverage, the main disadvantage of the database is that its access is restricted to "on location" usage at Politecnico di Milano, Milan, Italy. In addition, user licenses are restricted to a small number annually (VICO, 2017).

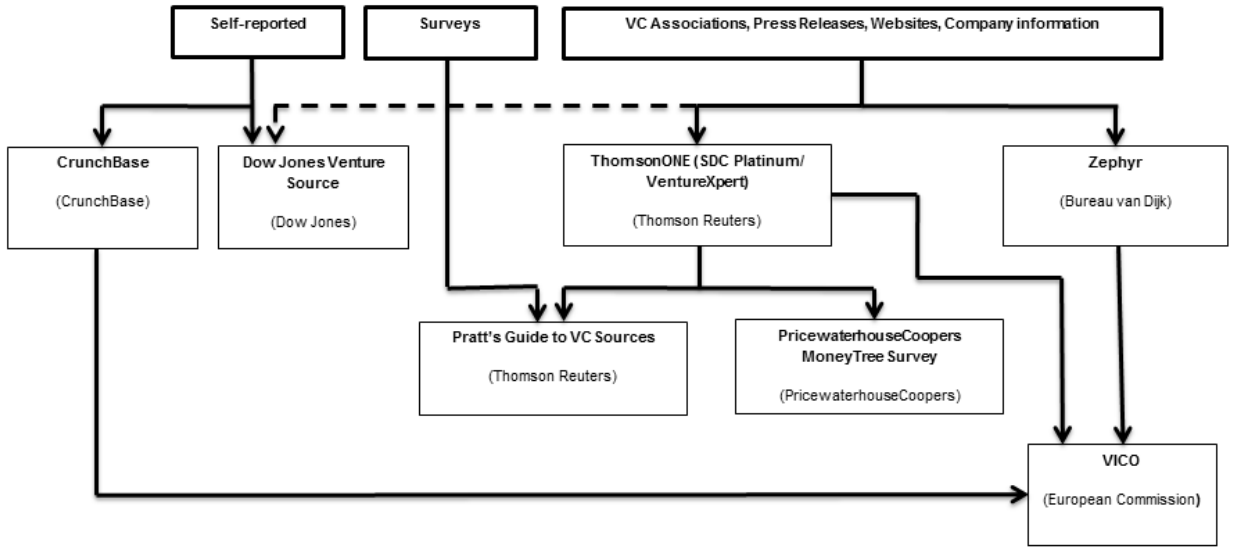


Figure 1.12.1: VC data sources

Figure 1.12.1 offers a schematic overview showing in a simplified way the commonalities and differences of databases with respect to their underlying data sources. It is apparent that ThomsonOne and Zephyr are based on data from national VC associations, press releases, websites and company information. PricewaterhouseCoopers MoneyTree, in turn, refers to data collected by ThomsonOne. Also Pratt's Guide on Venture Capital Sources obtains deal information from ThomsonOne. However, it is complemented with details obtained from surveys sent to a sample of VC firms (Gupta & Sapienza, 1992). On the contrary, Venture Source by Dow Jones VentureONE mainly relies on deal information that is directly provided for by investors (Lutz et al., 2013).

Summing up, in this section, a number of different databases containing information on VC investments have been elaborated on. It has been shown that the most comprehensive databases (ThomsonOne, Zephyr) to a large extent collect information from the same sources: industry associations, press releases, websites, and company information. However, despite being global in scope, they vary slightly with respect to their geographic focus. Zephyr is more oriented towards the European playing field, whereas ThomsonOne caters to the US market. The latter also has a wide coverage on global VC deals and especially those undertaken by US investors.

Data limitations

Both databases that are employed in the consecutive empirical studies (Chapter 2, 3 and 4), Thomson One and Zephyr, make use of information provided by industry associations. These associations collect data concerning VC activity of their member institutions. In that, investments undertaken by VC firms that have no membership with the association remain unobserved. Given that especially smaller VC firms are often not affiliated with any industry organization, their investments are in general not incorporated into the datasets leading to a bias of these

databases towards larger VC providers. Related, Mason (2007) criticizes that commercial databases on VC investment overproportionally represent larger deals and in that are insufficient with regard to their overall coverage (Kaplan, Strömberg, & Sensoy, 2002).

Common to all studies focusing on geographical aspects of VC activity is their need for precise data on the location of the respective actors. Databases however are often only providing the address of the headquarter of an entity. In the case of multi-entity firms that are spread across space, it is consequently difficult to detect the location of the specific branch involved in the operation, leading to measurement errors if an investment is undertaken by an subdivision located in a different place than the headquarter. Especially with respect to cross-border transactions, it would be of interest to know if the VC firm has decided to set up a sub-division outside of its home market in the respective market.

Another major shortcoming of most data sources on VC activity is that no information is given with respect to the degree of involvement of the respective investor. Nevertheless previous studies have frequently stressed that investors attach more importance to being located in proximity to the portfolio firm in cases where they act as lead investors (Fritsch & Schilder, 2008).

1.13 Readers' Guide

The remainder of this PhD dissertation proceeds as follows. Chapters 2 to 5 include four empirical studies. In Chapter 6, I provide a brief discussion of the overall findings per study, the theoretical and practical contributions, as well as point out limitations of the studies that might open up avenues for future research. A schematic overview illustrating the interrelation between the different chapters is presented in Figure 1.13.1.

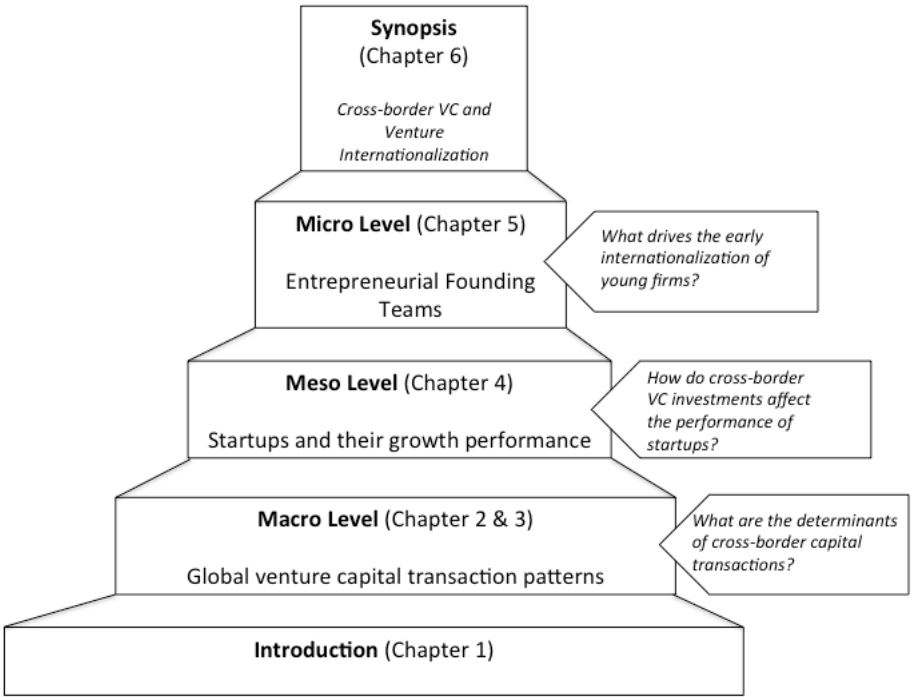


Figure 1.13.1: Structure of dissertation

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We should eschew the simplistic view that better long-distance communication will reduce our desire and need to be near one another.

Edward Glaeser

2

On the Internationalization of Venture Capital: Is the 'Death of Distance' near?

How global are financial markets? A distinguishing feature of venture capital has for long been its local bias. This contradicts notions of an increasing globalization of financial markets and popular 'death of distance' claims. In this Chapter, the extent to which international venture capital transactions still depend on physical distance is examined.

2.1 Introduction

The negative effect of distance on trade belongs to the most robust findings in international economics. Results of prior research are nevertheless mainly based on the analysis of trade in manufacturing goods. However, there is evidence that also 'weightless' financial asset transactions are subject to gravitational forces and investors' portfolio choice tends to be homeward biased (Portes & Rey, 2005). Venture capital, an important financial vehicle for the growth of highly innovative businesses, appears to be unevenly distributed and geographically concentrated in only a few high tech clusters and financial centers around the globe (Chen, Gompers, Kovner, & Lerner, 2010; Florida & Kenney, 1988; Lindgaard Christensen, 2007; Martin, Sunley & Turner, 2002; Mason & Harrison, 2002; Powell, Koput, Bowie & Smith-Doerr, 2002; Zook, 2002).

The preference of investors for funding opportunities in their immediate neighborhood has coined the concept of a 'one-hour driving rule' of venture capital investing[1]. However, during the past years, this 'rule' seems to dilute. VC transactions at a distance have been increasing in volume, frequency, and geographical diversity (Tykvová & Schertler, 2014). Since the millennium, about half of VC deals in Europe denote the participation of a non-local investor. In the US, one in two VC firms is searching for funding opportunities beyond national borders (EY, 2011). This apparent renunciation of the localism of VC activity suggests the re-evaluation of the geographic fundamentals of VC with a focus on global transaction patterns[2].

A counterfactual to the often acclaimed 'death of distance' and the consequent assumption that goods and services can be produced and provided in any location

[1] The 'one hour driving rule' indicates that investors prefer investment targets that are located within a radius equivalent to no more than one hour driving time by car. Other authors even speak of a '20-minute driving rule' (Dai & Cumming, 2010).

[2] Cross-border VC is hereby defined as financial participation of an investor from country A in a portfolio company located in country B.

is the observation that even in a globalizing economy clustering of economic activities persists (Rodriguez-Pose & Crescenzi, 2008). For example, IT startups continue to be attracted to San Francisco, New York, Cambridge and Berlin. Despite digitalization, firms in these hubs still benefit from an array of agglomeration economies ranging from a well-developed local research infrastructure, access to business networks and inter- organizational relationships, specialized knowledge and information as well as a skilled labour market. The co-location of economic actors continues to foster face-to-face communication and collaboration facilitating complex knowledge diffusion and innovative outcomes (Fleming, King & Juda, 2007). In that, even in the face of highly developed communication technologies, more open markets and decreasing transportation costs, location still matters for competition. Some authors, especially in the field of evolutionary theories of innovation, go as far as claiming that with rapid technological progress physical proximity is still increasing in importance (Morgan, 2004). Or as Edward Glaeser (2012) points out: "Proximity has become ever more valuable as the cost of connecting across long distances has fallen" (p. 6).

To examine the effect of physical distance on international venture capital flows, we use a set of annually aggregated bilateral data on cross-border VC transaction flows from 82 countries including major VC markets (United States, Europe, and Asia). The data is collected for the period 1990 to 2010. The size of the trade barrier effect of geography for capital mobility is consequently estimated by gravity equations commonly applied to measure goods trade flows. We find that even in the view of rapid technological change, geographic distance still matters for investment portfolio choices. This implies that global capital markets, and more specifically, international VC investments are not as frictionless as often proposed.

Our study contributes to the growing literature that explores deviation from the parochial bias of VC investments (Fritsch & Schilder, 2008; Griffith, Yam & Subramaniam, 2007; Sorenson & Stuart, 2001). Additionally, we believe that the findings of this study have implications for the literature on capital mobility and

asset trading. They reinforce the existence of the 'home bias puzzle' (French & Poterba, 1991; Werner & Tesar, 1997), the preference for investments closer to home, with respect to international venture capital firms' portfolios. By that, this study complements prior work on the economic significance of geography (Coval & Moskowitz, 1999).

Also from a public policy perspective, in the light of recent policy efforts by the European Commission to improve conditions for cross-border VC activity (European Commission, 2013), a better understanding of the determinants of the direction of international VC transactions is imperative. Given the uneven spatial development of VC, large variations exist in the liquidity of VC markets and the ability of regions and countries to attract foreign investors. Given the important role of VC as financing vehicle for small and medium-sized young firms in innovative industries, unequal patterns of VC activity may impact the longer-term innovative development and competitiveness of regions and countries.

The paper proceeds as follows. In Section 2 we review theoretical arguments regarding the interaction of geography and VC. Section 3 describes the data and specifies variables. Section 4 elaborates on the gravity model. The main empirical findings from the gravity estimations are presented in Section 5. Section 6 offers a conclusion and lays out limitations constituting avenues for prospective research.

2.2 Cross-border Venture Capital and Geography

On part of the VC investor, mainly two rationales can explain the long prevailing parochial bias of VC: (1) the existence of information asymmetries with respect to deal selection and (2) the importance of monitoring and knowledge transfer following deal closure. In contrast to most financial instruments such as bank loans etc., venture capitalists' involvement does not slacken after money has been granted to a firm. Rather, investors obtain a seat in the Board of Directors and be-

come actively involved in the development and management of their target companies (De Clercq & Manigart, 2007; Gorman & Sahlman, 1989; Sapienza, 1992; Sapienza, Manigart & Vermeir, 1996). In view of the high investment risk that is inherent to many venture capital deals, the direct involvement of an investor curtails financial and business hazards, diminishes principal – agent related problems and offers the possibility to actively steer the development of the target firm in the course of the investment. With respect to the generation of these beneficial synergies, physical proximity between the venture capital firm and the portfolio company is crucial (Florida & Kenney, 1988).

Despite information asymmetries, benefits from international investment diversification are widely acknowledged in the financial literature (French & Poterba, 1991). International equity holdings appear less prone to country specific macroeconomic shocks and business cycles. Thus, the risk of an investment portfolio can be reduced by diversification across financial markets. Notwithstanding vast theoretical evidence of gains from geographically diversified investment portfolios, most investors have for long shown a preference for domestic assets (Tesar & Werner, 1995). Only since the past decade, the distance between creditor and borrowers has been growing in financial sectors like small business lending (Petersen & Rajan, 2002). The differences between small business lending and VC is that the former involves more mature firms and bases decisions on 'hard', codified and public available information which are more easily transferable over larger distances.

Since the late 1990s, an increasing frequency and volume of longer distance, cross-border investments has however also been observed for VC. US investors were the first to venture overseas, but during the past years also European investors have begun to cross regional and national borders in their search for promising funding opportunities. Here especially outflows are denoted in in relative terms smaller countries and markets like Sweden, Finland and The Netherlands (Hall & Tu, 2003).

Since the remark of Wright, Pruthi, and Lockett (2005) that the literature on VC

pays only limited attention to the acceleration of international transactions, there has been a growing interest in studying cross-border VC deals and how recipient country characteristics, institutions and human capital facilitate cross-border VC inflows (Alhorr, Moore & Payne, 2008; Guler & Guillén, 2010; Iriyama, Li & Madhavan, 2010; Wang & Wang, 2012). A gap still exists for research focusing on the geographical pattern of global VC activity in detail. The broad disregard of spatial considerations with respect to international VC transactions is particularly striking in light of the large emphasis of the geographical particularities of VC funding at the domestic level (Sorenson & Stuart, 2001).

Portes and Rey (2005) analyze determinants of international capital flows with a focus on securities. Their study is one of the first to forward the usefulness and applicability of gravity model structures for capital flows[3]. In addition, they stress the explanatory power of the geography of information for the distribution patterns of international equity transactions. Overall, a negative effect of distance on capital flows is forwarded. In that, their findings comply with studies on international trade flows in goods. Subsequently, other studies have shown that gravity models are of similar explanatory power regarding cross border asset transactions including bonds, equity and banking assets (Coeurdacier & Martin, 2009), and foreign direct investments (Alcacer & Ingram, 2013; Blonigen, Davies, Waddell & Naughton, 2007).

We start our analysis by revisiting the distance effect for 'intangible' global cross-border VC investments. Given the higher transaction costs associated with further distance and based on the observation at the local level that investors show a preference for investment opportunities in their neighborhood, we hypothesize that the negative relation between distance and likelihood of an investment deal also holds for cross-border VC activities. That is, in case of cross-border investments,

[3] In the international trade literature, the gravity equation is widely applied to estimate the effect size of good flows between countries. The gravity model calculates bilateral trade as a function of the economic mass of two countries and their bilateral distance. Commonly, it is also accounted for trade barriers and trade facilitators such as customs unions as well as linguistic and historical ties.

investors prefer neighboring countries to equally attractive, however geographically more distant destinations. Consequently,

Hypothesis 1: Physical distance between investor country of origin and investment destination is negatively related to the amount of cross-border VC flows between the country dyad.

In case of cross-border VC transactions, it still remains unclear how the negative effect of spatial distance on trade evolved over time. According to widespread claims, advancing globalization should render distance less and less important, in other words, the world becomes 'smaller' or 'flatter'. Technological change and especially advances in technologically mediated communication like videoconferencing and emailing facilitate long-distance business communication and let conjecture that the hampering effect of distance has been diminishing over time. Consequently, we should observe a decrease in the estimated elasticity of bilateral capital trade with respect to distance.

Assessing the direct impact of videoconferencing on business travelling, many studies however only find a limited effect (Beaverstock et al., 2009; Lee & Mokhtarian, 2008). Gallié and Guichard (2005) forward that a small substitution effect arises for interactions between partners with already well-established and trusting relations. Videoconferencing appears complementary to business air travel, which rejects the popular assumption that advances in ICT have replaced in-person meetings (Denstadli, 2004). Emerging business sectors producing weightless goods such as the software industry, heavily rely on both physical mobility and virtual communication (Haynes, 2010). Thus, business travelling remains an important components of many business relations, especially those in knowledge-intensive sectors (Storme, Faulconbridge, Beaverstock, Derudder & Witlox, 2016) which involve the exchange of tacit knowledge (Aguilera, 2008).

Given the large interpersonal component in VC financing and the limited substituting effect of virtual communication for in-person encounters, it is likely that

not the magnitude, but the spatial distribution of cross-border VC activity has remained largely unaffected by technological change. Consequently,

Hypothesis 2: The negative effect of physical distance on cross-border VC flows has remained constant over time.

2.3 Data

To estimate how geographic distance between the country of the investor and that of the target company relates to the number of VC flows between the country pair, we collected annual data on cross-border VC transactions for a set of 82 industrial and developing market economies[4] from 1990 to 2010 using Thomson Reuters' VentureXpert database. The database contains information on VC deals, initial public offerings, and limited partners and is widely used in VC research. The global sample covers 139.482 possible bilateral investment dyads between 82 times 81 country pairs over a period of two decades. Effectively, we obtain complete yearly observations for 136.616 dyads, whereby actual VC activity is denoted between 4.641 dyads (3.4 per cent).

In addition, in order to test the robustness of our results, we construct a subset which only includes records of international investors' participation in first round deals. This sample includes again 82 countries and 136.616 dyads with full observations, whereby however only 1.958 dyads denote VC transactions. Expressed in percentage terms, 1.43 per cent of all country dyads exhibit an investment link during the period of observations.

Besides the global sample, which is largely dominated by the US as source and target for cross-border VC transactions, we also test the results using a European sub sample. Differences in investment patterns between European and US VC in-

[4]We eliminated all transactions involving dependent states or entities, offshore financial centers, unallocated data, and observations where there is insufficient data.

vestors include ex ante screening capacities as well as execution of control rights after deal closure (Hege, Palomino & Schwienbacher, 2003). Also investment stage preferences vary between European and US investors, whereby in Europe independent VC investors more frequently select later stage deals (Bertoni, Colombo & Quas, 2011). In addition, at a macroeconomic level, market characteristics are far more homogeneous between EU member states than on a global level. The European integration process has led to the liberalization of trade barriers and a decreasing fragmentation of markets resulting also in a higher conformity in legal practices (e.g. patent application, intellectual property protection). Consequently, given a reduction in economic and legal uncertainties across EU member states, European investors may be less sensitive to distance in their investment choices. Thus, we test if the expected distance decay also holds in case of intra-European cross-border transactions.

For the European subset 17 countries are considered (EU 15, Norway and Switzerland) resulting in 5.712 bilateral investment dyads whereby 22.6 per cent of the dyads denote VC activity. Although they are not EU members, two additional countries are included in the sample, Norway and Switzerland, as they maintain strong economic ties with EU Member States. The longitudinal nature of the data over two decades allows for tracing the long-term development and capturing the dynamics of the VC internationalization process over time.

Thomson Reuters reports VC activity from the 1960s onward. Data before 1980 is however collected in a non-systematic way, based solely on the retrospective self-reporting of selected industry participants, and thus it is prone to severe selection bias. An additional reason for limiting the starting date of the sample to 1990 is the geopolitical division of countries as consequence of the 'Iron Curtain' which caused a severe structural distortion of bilateral trade flows. Taking 1990 as starting year, we ensure that states in Europe, next to the US, the largest VC market, are consistent in their geographic area over time.

2.3.1 Dependent Variable

To capture the number of cross-border VC investments a country attracts during a given year, we use the natural logarithm of the sum of VC participations of investors in country i in target firms located in country j in year t ($VC\ transactions_{ijt}$). In case of investment syndicates, the involvement of two or more investors in the same deal, each participation is counted separately. If firms secure follow-up investment rounds, the consecutive involvement of an investor generates an additional count. As cross-border deals are frequently conducted in syndication, the number of investment flows in the sample is largely exceeding the number of target firms as well as that of individual investment firms.

2.3.2 Independent Variable

Geographic distance (D_{ij}) is measured as the logarithm of the geographic distance in kilometers between the capital city in country i and country j, taking into account the curvature of the earth. The geographic location of each city is identified using latitude and longitude coordinates. The mean radius of the earth, equating to 6371 kilometers, is used as constant R. Formally, geographic distance is expressed by:

$$d_{ij} = log\big(R * [arccos[sin(lat_i) * sin(lat_j) * cos(lat_i) * cos(lat_j) * cos(i-j)]]\big) \quad (2.1)$$

2.3.3 Control Variables

Investment flows are influenced by institutional and macroeconomic developments and cultural factors. We control for the market size of source country i and destination country j by using the natural logarithm of their respective GDP ($ln\ GDP_i$ and $ln\ GDP_j$) expressed in constant 2005 US dollars (WDI, 2015). In addition to bilateral distance, we include several other standard specifications of trade-related

gravity equations: *Border* equals 1 when the country dyad shares a border and zero otherwise. *Language* takes on the value of 1 if country *i* and country *j* share a common language, and zero otherwise. To account for historical ties in form of a common colonial past, we introduce the dummy variable *Historical Ties*. The data is obtained from both the World Bank and the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

Previous studies forward that cultural proximity between financial markets facilitates communication and trust and consequently increases the likelihood of bilateral investments (Jääskeläinen & Maula, 2014). Cultural distance is likely to increase information asymmetries and transaction costs, leading to a higher country specific investment risk. Aggarwal, Kearney, and Lucey (2012) suggest treating cultural effects in addition to conventional gravitational variables. A positive relationship between trust and trade has been forwarded, among others, for mergers and acquisitions (Ahern, Daminelli & Fracassi, 2015) and technology transfer (Kerr, 2008).

A widely applied instrument for measuring cultural distance in the international management literature are Hofstede's scores of national cultures (Taras, Rowney & Steel, 2009). Hofstede ranks cultural differences along (originally) four distinct dimensions: Power distance, Individualism-Collectivism, Masculinity-Feminity and Uncertainty avoidance (Hofstede, 1984). Generally, the larger the cultural divide between a country pair, the less investment relations we would expect.

To approach cross-country cultural differences, Hofstede's metric of cultural distance is used. Despite the growing popularity of cultural indices in the international business literature (Zaheer, Schomaker, & Nachum, 2012), they are nevertheless not without criticism (Shenkar, 2001, 2012). Especially, the implicit congruence between national culture and corporate culture is frequently debated as well as the oftentimes quite boldly assumed symmetry of bilateral cultural distances (perception of citizens of country A about country B is not necessarily reciprocal) (Shenkar, 2001). Overall, defining and measuring cultural traits remains

difficult and alternative measures have been emerging, most prominently, the World Value Survey (Inglehart & Baker, 2000) and the GLOBE (Global Leadership and Organizational Behaviour) project. Hofstede's originally four and now six cultural dimensions nevertheless continue to be the standard tool for approaching socio-legal differences between bilateral country pairs (Chakrabarti, Gupta-Mukherjee, & Jayaraman, 2009).

To capture bilateral socio-legal differences, we calculate the distance from the numerical values of four Hofstede dimensions (power distance, individualism-collectivism, masculinity-feminity, uncertainty avoidance) for each bilateral dyad. Taking the dimension 'power distance' as example, the computation is as follows: *Power distance*$_{ij} = \sqrt{(S_{i,PD} - S_{j,PD})^2}$ where $S_{i,PD}$ is country i's (unilateral) power distance score and $S_{j,PD}$ is the (unilateral) power distance score of country j.

In addition to measuring bilateral cultural differences between country dyads, we include unilateral values at the country level for the power distance and uncertainty avoidance dimensions. Unilateral scores per country depict a proxy for the general legal and entrepreneurial climate within the jurisdiction. Countries with lower power distance and uncertainty avoidance scores are supposed to provide more fruitful grounds for innovative entrepreneurship and show a higher level of cross-border investment activity. Following, the four Hofstede dimensions used in the subsequent analysis are elaborated on in more detail.

Power distance is included as differential value to estimate the trade barrier effect of culture at the country dyad level and as unilateral value on the target country side, where it represents a proxy for the level of business uncertainty and untrustworthiness in legal institutions. Power distance proxies the role and acceptance of hierarchies and authority in a society. Corruption is more frequent in countries showing high power distance scores compared to more equality minded societies. Power distance scores are low for Germanic countries like Denmark and high in Latin America and Asia. Legal uncertainty is expected to have a negative effect on cross-border investments.

The *Individualism-Collectivism* category refers to the relationship between individuals in a society. In an investment context, the regular outing of personal opinions is customary in individualistic societies. Societies that put emphasis on collectivist values are conscious to avoid individual exposure on costs of in-group harmony. In addition, collectivist societies rely more on informal relationships than formal institutions. Similar to power distance, European countries and the US score overall high on individualism, whereas Eastern societies and Latin America value more collectivist traits. Li and Zahra (2012) argue that collectivism is negatively related to entrepreneurial activity and the level of VC activity within a country.

The *Masculinity-Feminity* index deals with the dominant values in a society. 'Masculine' societies put a high valuation on achievements and assertiveness. Gender inequalities are much more pronounced in masculine societies. Whereas Sweden has one of the lowest masculinity scores globally, other European countries e.g. Germany and the UK are more affected by masculine imprints. The effect of this dimension on business relation is ambiguous. Shenkar and Zeira (1992) find that diverging values act complementary and result in a performance enhancing effect for international joint ventures. Focusing on a similar context, Barkema and Vermeulen (1997), in contrast, reveal a significant negative effect of the masculinity dimension on the survival chances of international joint ventures.

Uncertainty Avoidance measures the degree to which individuals can cope with ambiguities and uncertainty. Weak uncertainty avoidance minded societies show a higher tolerance for deviant ideas and a preference for self-control. Regarding the entrepreneurial context this suggests that weak uncertainty avoidance societies offer a fertile environment to deploy high risk entrepreneurial ideas and opportunities for innovation. Uncertainty avoidance is high in Belgium, France and relatively low in Scandinavian countries, the UK, and the US. Uncertainty avoidance is included as differential on the dyad level as well as inform of unilateral scores for sender and receiver countries. On side of the investor, uncertainty avoidance proxies the degree of risk aversion. More risk-averse investors might resile from the

additional hazards of cross-border deals. Target countries with a high uncertainty avoidance index may have a less fertile entrepreneurial environment and thus be less attractive for international investors.

In the sample of European countries, we also consider if countries are part of the *Euro area* i.e. share a common currency. Given VC deals involve the mobility of investors, we implement the variable *Schengen Area*. Schengen member countries have abolished passport and border controls to facilitate the free movement of people. Both variables proxy trade liberalization and are expected to exert a positive effect on cross-border investment activity.

Year fixed effects capture macroeconomic effects such as global shocks that apply to all countries in a given year. Most importantly, we also control in this way for the market disruption effect of the 'dotcom bubble' and its consequent burst in 2000-2001.

Table 2.3.1 and Table 2.3.2 present some descriptive statistics. Correlation coefficients of the variables used in the empirical analyses are reported in Table 2.3.3 and Table 2.3.4. One might worry about multicollinearity issues between the different variables, especially the cultural determinants. However, small standard errors and stable estimation coefficient across different specifications suggest that the non-independence assumption is not severely infringed. Overall, Table 2.3.3 shows acceptable levels of correlation between variables.

Table 2.3.1: Descriptive statistics: Global

Statistic	N	Mean	St. Dev.	Min	Max
Historical Ties	136,616	0.026	0.159	0	1
Border	136,616	0.027	0.163	0	1
Language	136,616	0.109	0.312	0	1
Ln Distance (km)	136,616	8.637	0.900	4.094	9.892
Ln GDP_i(in bn \$)	136,616	4.619	1.802	0.189	9.524
Ln GDP_j(in bn \$)	136,616	4.619	1.802	0.189	9.525
VC Transactions (all rounds)	136,616	0.492	10.585	0	885
VC Transactions (first round)	136,616	0.051	0.888	0	108
Power distance	136,616	24.389	17.799	0	89
Power $distance_j$	136,616	60.691	21.218	11	100
Individualism	136,616	26.667	19.441	0	85
Masculinity	136,616	21.289	16.527	0	95
Uncertainty Avoidance	136,616	25.012	18.334	0	92
Uncertainty $Avoidance_i$	136,616	65.985	21.794	8	100
Uncertainty $Avoidance_j$	136,616	65.985	21.794	8	100
US $Dummy_i$	136,616	0.012	0.110	0	1
US $Dummy_j$	136,616	0.012	0.110	0	1

Note: The global sample includes 82 countries. Only complete yearly observations are taken into account.

Table 2.3.2: Descriptive statistics: Europe

Statistic	N	Mean	St. Dev.	Min	Max
Historical Ties	5,712	0.051	0.221	0	1
Border	5,712	0.162	0.368	0	1
Language	5,712	0.125	0.331	0	1
Ln Distance (km)	5,712	7.019	0.623	5.153	8.121
Ln GDP_i(in bn \$)	5,712	6.008	1.154	2.968	8.037
Ln GDP_j(in bn \$)	5,712	6.008	1.154	2.968	8.036
VC Transactions (all rounds)	5,712	1.508	6.835	0	176
Currency	5,712	0.270	0.444	0	1
Schengen	5,712	0.402	0.490	0	1
Power distance	5,712	19.265	13.744	0	57
Power $distance_j$	5,712	41.00	16.235	11	68
Individualism	5,712	16.926	14.166	0	62
Masculinity	5,712	28.353	19.292	0	74
Uncertainty Avoidance	5,712	28.824	19.050	0	77
Uncertainty $Avoidance_i$	5,712	63.941	23.702	23	100
Uncertainty $Avoidance_j$	5,712	63.941	23.702	23	100
UK $Dummy_i$	5,712	0.059	0.235	0	1
UK $Dummy_j$	5,712	0.059	0.235	0	1

Note: The European sample contains 17 countries. Only complete yearly observations are taken into account.

Table 2.3.3: Correlations of model variables (Global)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1. Ln Distance$_{ij}$(km)	1											
2. Ln GDP$_i$(bn \$)	-0.025	1										
3. Ln GDP$_j$(bn \$)	-0.025	0.001	1									
4. Cross-border VC Transactions (All)	-0.029	0.095	0.069	1								
5. Cross-border VC Transactions (First Round)	-0.021	0.096	0.085	0.624	1							
6. Power distance	-0.014	0.021	0.021	-0.031	-0.027	1						
7. Individualism	0.181	0.123	0.123	-0.012	-0.001	0.373	1					
8. Masculinity	-0.123	0.023	0.023	-0.017	-0.019	0.182	0.074	1				
9. Uncertainty avoidance	0.108	0.019	0.019	-0.015	-0.006	0.055	0.011	0.012	1			
10. Power distance$_j$	0.096	0.003	-0.221	-0.038	-0.046	-0.091	-0.152	-0.146	0.005	1		
11. Uncertainty avoidance$_j$	-0.070	0.001	-0.054	-0.025	-0.029	-0.085	-0.075	-0.055	-0.177	0.228	1	
12. Uncertainty avoidance$_i$	-0.070	-0.054	0.001	-0.015	-0.041	-0.085	-0.075	-0.055	-0.177	-0.003	-0.012	1
13. Border	0.079	-0.051	-0.051	-0.065	-0.031	0.021	0.113	0.043	0.085	-0.001	-0.040	-0.040
14. Language	0.073	0.027	0.027	-0.061	-0.054	0.035	0.026	0.175	0.107	0.030	0.097	0.097
15. Historical Ties	0.079	-0.082	-0.082	-0.065	-0.068	-0.003	-0.039	0.043	0.043	0.039	0.015	0.015
16. US Dummy$_i$	-0.032	-0.291	0.004	-0.240	-0.188	-0.005	-0.134	0.023	-0.001	-0.001	-0.001	0.102
17. US Dummy$_j$	-0.032	0.004	-0.291	-0.082	-0.140	-0.005	-0.134	0.023	-0.001	0.109	0.102	-0.001

	(13)	(14)	(15)	(16)	(17)
13. Border	1				
14. Language	0.135	1			
15. Historical Ties	0.141	0.213	1		
16. US Dummy$_i$	0.001	0.050	0.023	1	
17. US Dummy$_j$	0.001	0.050	0.023	0.012	1

Note: For pairs of continuous variables Pearson product-moment correlation coefficients are used. Cramer's V correlation coefficients are presented in case of nominal variables and Point-biserial correlation analysis is applied for mixed pairs.

Table 2.3.4: Correlations of model variables (Europe)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1. Ln Distance$_{ij}(km)$	1										
2. Ln GDP$_i$(bn \$)	-0.076	1									
3. Ln GDP$_j$(bn \$)	-0.076	-0.043	1								
4. Cross-border VC Transactions (All)	-0.211	0.189	0.176	1							
5. Power distance	0.161	-0.003	-0.003	-0.072	1						
6. Individualism	0.419	-0.045	-0.045	-0.029	0.159	1					
7. Masculinity	0.154	-0.028	-0.028	-0.063	-0.003	-0.138	1				
8. Uncertainty avoidance	0.243	-0.049	-0.049	-0.002	0.583	0.332	0.088	1			
9. Power distance$_j$	0.090	-0.013	0.205	0.024	0.089	0.238	-0.216	0.060	1		
10. Uncertainty avoidance$_j$	0.144	-0.002	0.029	-0.035	0.185	0.272	-0.201	-0.051	0.784	1	
11. Uncertainty avoidance$_i$	0.144	0.029	-0.002	-0.137	0.185	0.272	-0.201	-0.051	-0.049	-0.063	1
12. Border	0.552	-0.137	-0.137	-0.069	0.101	0.220	0.273	0.292	-0.044	-0.066	-0.066
13. Language	0.546	0.022	0.022	-0.031	-0.028	0.210	0.260	0.229	-0.002	-0.081	-0.081
14. Currency	-0.046	-0.059	-0.059	0.026	-0.063	-0.063	0.155	0.183	-0.168	-0.258	-0.258
15. Schengen	0.014	-0.077	-0.077	0.025	-0.085	-0.030	0.028	0.110	-0.136	-0.210	-0.210
16. UK Dummy$_i$	0.091	-0.351	0.022	-0.403	0.100	-0.156	0.041	-0.055	-0.006	-0.020	0.305
17. UK Dummy$_j$	0.091	0.022	-0.351	-0.065	0.100	-0.156	0.041	-0.055	0.092	0.305	0.020

	(12)	(13)	(14)	(15)	(16)	(17)
12. Border	1					
13. Language	0.618	1				
14. Currency	0.067	0.027	1			
15. Schengen	0.132	0.048	0.503	1		
16. UK Dummy$_i$	0.066	0.046	0.151	0.204	1	
17. UK Dummy$_j$	0.066	0.046	0.151	0.204	0.061	1

Note: For pairs of continuous variables Pearson product-moment correlation coefficients are used. Cramer's V correlation coefficients are presented in case of nominal variables and Point-biserial correlation analysis is applied for mixed pairs.

2.4 Methodology: Gravity Modeling

We use gravity modeling to examine geographic patterns of annually aggregated bilateral VC transactions. Based on Newton's law of universal gravitation, the attraction of any two bodies is a function of their mass and, respectively, inverse relation of the distance between them. Since Tinbergen (1962) the model has been augmented and widely used in the trade literature to explain the magnitude and direction of bilateral trade flows (e.g. Anderson & Van Wincoop, 2003). The mass of the bodies is hereby often converted into the GDP of country *i* and, respectively, country *j*.

The basic standard gravity specification model is represented by:

$$Y_{ij} = \beta_0 X_i^{\beta_1} X_j^{\beta_2} D_{ij}^{\beta_3} X_i j^{\beta_4} \eta_{ij} \tag{2.2}$$

where Y_{ij} resembles bilateral VC flows between country i and country j, the parameters $\beta_0, \beta_1, \beta_2, \beta_3$ are unknown parameters and to be estimated, X_i and X_j are source and destination country specific variables (e.g. GDP). The variable D_{ij} captures the distance between dyadic country pairs, whereas X_{ij} is a vector referring to additional dyadic country pair variables such as common language, common financial system tradition or adjacency of territories. An error term denoted by η_{ij} is introduced to the equation to account for the fact that variables are unlikely to fit the data on financial flows exactly. The error term is statistically independent of X_i, X_j and D_{ij} and formally expressed by $E\left[\eta_{ij} \mid X_i, X_j, D_{ij}\right] = 1$. If we rewrite equation (1) in a log linear form, we obtain:

$$ln(Y_{ij}) = ln\beta_0 + \beta_1 lnX_i + \beta_2 lnX_j + \beta_3 lnD_{ij} + \beta_4 X_{ij} + ln\,\eta_i j \tag{2.3}$$

Integrating our explanatory variables in equation (2) and rewriting yields:

$$ln(\text{transactions}_{ijt}) = \beta_0 + \beta_1 ln(GDP_{it}) + \beta_2 ln(GDP_{jt}) + \beta_3 ln(distance_{ij}) + \sum \lambda X_{ij} + time\ dummies + \varepsilon_{ijt} \quad (2.4)$$

Silva and Tenreyro (2006) stress the deficiencies of applying Ordinary Least Squares [OLS] estimation methods to the log-linearized gravity equation. The heteroskedastic nature of the error term and the occurrence of dyads denoting zero-investment flows cause inconsistent and biased results when using OLS. Especially the elasticities associated with the distance term get highly inflated using standard OLS estimation techniques. Also the augmented gravity model controlling for fixed effects introduced by Anderson and Van Wincoop (2003) is prone to Jensens's inequality in the case of OLS. As an alternative way, the authors therefore suggest applying Poisson pseudo-maximum likelihood estimators. Given the count data nature of the dependent variables and a small degree of overdispersion, we employ Quasi-Poisson Maximum Likelihood Estimators to measure the size of the trade barrier effect of geographical distance and a number of control variables on aggregate bilateral VC flows.

2.5 Empirical Results

2.5.1 Global Sample

Table 2.5.1 reports the estimated coefficients based on quasi-Poisson modeling of variables associated with the number of cross-border VC transactions. In all models, we account for traditional gravitational variables such as cultural proximity, the degree of bilateral economic integration and differences in macroeconomic factors, which affect bilateral capital movement between countries. Models 1-3 solely include first round cross-border investments as dependent variable. Models 4-6 also include later stage and consecutive cross-border investor involvements.

Model 1 in Table 2.5.1 represents the baseline gravity model for first round deals. The effect of distance operates as expected. Physical separation reduces the number of cross-border investments. Hypothesis 1 posits that distance has a negative effect on cross-border VC flows. The estimated coefficient of distance is negative ($p < 0.001$) in all models, also those including all investment rounds, supporting Hypothesis 1.

Given quasi-Poisson models use a log link, we interpret the estimated coefficients as multiplicative effects. Thus, with every standard deviation increase in a variable, the coefficient shows the multiplicative effect e^{β} on the mean of dyadic cross-border VC transactions. The parameter estimates suggest that a doubling in distance leads to a decline in cross-border transaction by a factors of 0.58 $\left(e^{[-0.794*ln(2)]}\right)$ in the baseline specification for first round deals (Model 1) and a factor of 0.64 $\left(e^{[-0.643*ln(2)}\right)$ in the full model (Model 2), whereby the latter corresponds to a 36 per cent decrease in first round cross-border transactions. Though a doubling in distance is unlikely given the relatively high mean dyadic distance in the sample and a natural limit of the earth's surface, even a 10 per cent increase in the average physical separation between trading partners still leads to a decrease of about 6 per cent of capital flows. If considering all investment rounds, i.e. also later stage deals, a similar elasticity of distance is observed (Model 5).

Table 2.5.1: Gravity estimates - Global 1990-2010

	Dependent variable: Cross-border transactions					
	(1)	(2)	(3)	(4)	(5)	(6)
	First Round	First Round	First Round	All Rounds	All Rounds	All Rounds
Ln GDP$_i$	0.814***	0.783***	0.783***	0.874***	0.832***	0.830***
	(0.022)	(0.015)	(0.015)	(0.0151)	(0.011)	(0.011)
Ln GDP$_j$	0.749***	0.675***	0.675***	0.847***	0.770***	0.768***
	(0.021)	(0.014)	(0.014)	(0.012)	(0.008)	(0.008)
US Dummy$_i$	1.722***	1.371***	1.372***	2.661***	2.323***	2.333***
	(0.092)	(0.060)	(0.061)	(0.056)	(0.040)	(0.040)
US Dummy$_j$	1.624***	1.394***	1.395***	1.701***	1.494***	1.502***
	(0.091)	(0.061)	(0.061)	(0.053)	(0.038)	(0.038)
Geographical Proximity						
Ln Distance$_{ij}(km)$	−0.794***	−0.643***	−0.535**	−1.020***	−0.798***	−0.491***
	(0.033)	(0.022)	(0.168)	(0.020)	(0.016)	(0.112)
Border$_{ij}$	−1.490***	−0.904***	−0.906***	−1.039***	−0.374***	−0.373***
	(0.110)	(0.073)	(0.073)	(0.056)	(0.041)	(0.041)
Cultural Proximity						
Language$_{ij}$	1.375***	0.933***	0.931***	1.370***	0.996***	0.989***
	(0.059)	(0.049)	(0.049)	(0.031)	(0.029)	(0.029)
Historical ties$_{ij}$	−0.065	0.003	−0.006	0.087**	0.114***	0.123***
	(0.071)	(0.048)	(0.048)	(0.036)	(0.026)	(0.026)
Power distance$_{ij}$		−0.012***	−0.012***		−0.011***	−0.011***
		(0.001)	(0.001)		(0.001)	(0.001)
Individualism$_{ij}$		0.003***	0.003***		−0.002***	−0.002***
		(0.001)	(0.001)		(0.001)	(0.001)
Masculinity$_{ij}$		−0.006***	−0.006***		−0.001**	0.001*
		(0.001)	(0.001)		(0.001)	(0.001)
Uncertainty avoidance$_{ij}$		0.014***	0.014***		0.014***	0.014***
		(0.001)	(0.001)		(0.001)	(0.001)
Uncertainty avoidance$_i$		−0.022***	−0.022***		−0.023***	−0.023***
		(0.001)	(0.001)		(0.001)	(0.001)
Uncertainty avoidance$_j$		−0.006***	−0.006***		−0.007***	−0.007***
		(0.001)	(0.001)		(0.001)	(0.001)
Power distance$_j$		−0.021***	−0.021***		−0.017***	−0.017***
		(0.001)	(0.001)		(0.001)	(0.001)
Time x Distance	No	No	Yes	No	No	Yes
Observations	136,616	136,616	136,616	136,616	136,616	136,616

Note: Estimation using Poisson-QMLE estimators. Significance at the 1, 5, and, respectively, 10 per cent level is denoted by *p<0.1; **p<0.05; ***p<0.01. Standard errors are in parentheses. All models include year dummies from 1990 - 2010. Interaction effects are statistically significant in model (6). McFadden pseudo R-squared scores range between 0.63 and 0.85, indicating a good model fit.

A country's GDP is positively related to its cross-border VC engagement both as source and target. In line with trade models, economically larger countries attract a higher number of foreign investors. In turn, they are also more prone to outflows of domestic VC. In the case of VC, differences in market capitalization exist between countries with similar GDP per capita levels. The US is home to the largest and most developed VC market worldwide. To ensure robustness of the results and to eliminate the possibility that findings are solely driven by a US effect, dummy variables for the US as source and, respectively, target country are added. The dominance of the US has been denoted in previous studies on VC (e.g. Espenlaub, Khurshed & Mohamed, 2015).

The positive and significant coefficients of the US dummy variables throughout all models suggest that country dyads that include the US denote a larger number of bilateral transactions. The inclusion of the US as source country in a dyad quintuples the number of first round transactions. The larger coefficient of the US source dummy in case of all deals compared to first round deals only, suggests that especially later stage deals benefit from US cross-border investments. US investors are above average involved in later stage cross-border investments. In dyads where the US enters as source country, cross-border transactions are multiplied by a factor of 9 considering all investment rounds. The US also attracts a large share of international VC. Targeting US businesses quadruples outflows from any source country.

Not surprisingly, isolating the US effect is impacting the distance coefficient, which remains negative, but increases (model unreported). The US is separated from most of its key trading partners (except Canada) by the Atlantic Ocean. In that, investors have to overcome a threshold distance to reach any foreign investment destination. This specific geographic reality, combined with the exposed position of the US VC market in terms of capitalization, decreases the average trade barrier effect of geographical distance. In contrast, as we will see in the next section, non-US investors appear much more responsive to distance in their investment choices.

One of the largest trade facilitating effects between two countries is speaking the same official language. A one-unit increase in *Language* increases the number of cross-border transactions by a factor of 1.9 or about 90 per cent. Model 2 incorporates additional proxies, apart from language, for differences in (business) culture between target and recipient countries. Also unilateral values on uncertainty avoidance and power distance are taken into account offering valuable clues as to the entrepreneurial milieu in a country and its effect on foreign investments.

Variations in the perception of power distance between countries decrease investors' inclination to get involved in a deal. Individualism and masculinity traits, though statistically significant, have only a relatively small effect on bilateral business activities. In contrast, differences in uncertainty avoidance slightly increase the volume of cross-border transactions. A doubling in the uncertainty avoidance gap between countries increases transactions by a factor of 1.01 or about 1 per cent. One possible explanation is that in more risk-averse surroundings also the local venture capital industry lacks behind. Thus, entrepreneurs start searching early on elsewhere for money. This is supported by the results from separately estimating the uncertainty avoidance variables for both, source and destination. There is less VC flowing out of countries with a higher absolute uncertainty avoidance score. At the same time, including a recipient country with a high uncertainty avoidance score in a dyad also leads to less cross-border transactions. This could point towards a less favorable entrepreneurial climate with a smaller number of potential target firms as well as a more complex institutional and legal system limiting business hazards in countries emphasizing highly risk evasive societal behavior. In that, cultural differences intensify liability of foreignness issues associated with doing business abroad.

The overall impact of cultural values on cross-border equity transactions, in addition to accounts of a common official language, is rather limited. One explanation for the relatively small impact of culture is that the majority of international VC flows take place between the US and Europe, countries that are characterized by

similar occidental social norms, ethical values, and traditions.

Model 3 and Model 6 examine the extent to which there is any evidence of the evolution towards the 'death of distance' in our data. For that, we add an interaction effect between geographic distance and time. Instinctively, we would expect that technological change is diminishing obstacles to the diffusion of knowledge and information arising from geographical distance. However, prior studies focusing on the use of modern communication technologies in long-distance business relations have forwarded conflicting evidence.

Most studies make use of separate estimations of the distance coefficient across cross-sections of the data for different years to evaluate the robustness of the negative effect of distance on trade over time. We suggest that the inclusion of time-varying covariate effects for the distance variable potentially makes better use of the rich panel data structure underlying most trade models. The coefficients of the interaction terms are statistically insignificant in case of the global sample including first investment rounds only (Model 3), suggesting a constant negative effect of distance over time in support of Hypothesis 2. When also considering consecutive investment rounds (Model 6), positive and statistically significant interaction terms are observed, rejecting Hypothesis 2.

With respect to distance, investors' responsiveness slightly increases considering the full range of deals. A doubling in distance decreases cross-border VC transactions by a factor of 0.49 in the baseline specification and a factor of 0.58 in the full model. This is equal to a percentage change of about 51 per cent and, respectively, 42 per cent. Multiplying time by distance in Model 6, produces statistically significant coefficients for the interaction terms, suggesting that the negative effect of distance has been fortifying since the 1990s. Figure 2.5.1 illustrates the evolution of the distance decay effect. The graph shows the partial effect of distance time interaction estimates, which have to be considered in addition to the estimates of the main effects.

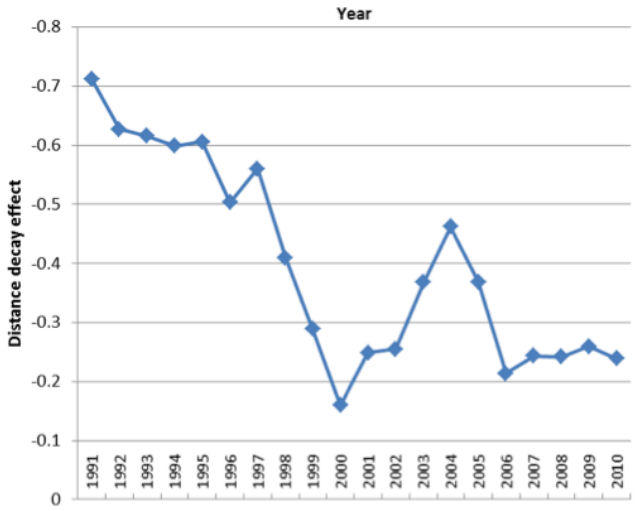

Figure 2.5.1: Evolution of distance decay effect 1990-2010 (All deals)

We find evidence in support for the strengthening of physical distance as barrier to trade over time. Especially cross-border VC transactions after the millennium became more sensitive to geographical diversification. This points towards a sustaining clustering bias with respect to global VC activity. However, in light of the overall mixed evidence, depending highly on the development stage of firms, we can only partially adopt Hypothesis 2 for global VC transaction patterns.

2.5.2 European Sample

Table 2.5.2 reports results from regression analyses making use of a sample solely considering intra-European cross-border VC flows. In the baseline specification, physical distance exercises a strong and negative effect on the number of cross-border transactions. The parameter estimate suggest that a 10 per cent increase in distance decreases the number of cross-border VC transaction by roughly 9 per cent in the baseline model and a factor of 0.9 or 10 per cent in the full model. Compared to the global sample, this is approximately a 70 per cent increase in

the estimated semi-elasticity of cross-border transactions with respect to distance. European investors appear much more impacted by spatial consideration in their investment distribution than the average investor in the global sample.

Other traditional gravitational variables show the expected signs with as exception the language variable. Speaking the same official language has a negative effect on VC flows. The effect is less surprising when considering the country pairs that share a common language, Belgium – The Netherlands, Belgium – France, and Austria – Germany, and their respective geographical location. They all share a common border. Integration of the *Border* variable already captures the trade enhancing effect of sharing a border. The negative and statistically significant coefficient of *Language* in turn suggests that there are less deal participations between these dyads as would be anticipated from their geographic location. Note that the effect of *Border* remains unchanged when leaving out language, in contrast, the coefficient of *Language* slightly decreases when excluding the common border variable. Also the relatively high correlation coefficients suggest some degree of association between these two variables. For theoretical reasons, given the variables approach different concepts, we nevertheless decide to keep both variables in the model. Besides, English maintains the status of lingua franca for business relations in Europe, especially in the financial and high tech industry. Language issues are consequently assumed to be a negligible factor for venture capitalists of the sampled countries when doing business within Europe.

Similar to the US in the global sample, the UK is the most mature and largest VC market in Europe in terms of volume and number of transactions. Estimation results may get biased given the UK's specific role in the European integration process (the UK has neither been a Schengen nor Eurozone member) and her particular geographic position as an island and by that not sharing any borders with countries in the sample except Ireland. Indeed, we observe considerable differences in size with respect to the coefficients of the *Border* variable when including or excluding the UK. Excluding the UK leads to a large increase in magnitude of

the coefficient. The zero approaching coefficients for the border variable in models without UK dummies account for the fact that the UK is not adjacent to any of the included countries besides Ireland, however acts as a key source of intra-European cross-border VC. Also the statistically significant and positive effect on bilateral investment flows of sharing a currency is more than twice as pronounced when the UK is left out. Same applies to the effect of a shared visa policy easing the free movement of people where the effect triples (models available on request). To account for this special status, UK source and destination dummy variables are added. The estimated coefficient emphasizes the role of the UK as source of international VC within Europe. In contrast, UK businesses only attract a small number of European investors.

Similar to English being the lingua franca in a business context, business culture is relatively homogeneous across Europe. Consequently, cultural differences and values play only a minor role in explaining the direction of cross-border VC investments. Model 3 and 4 add two trade liberalization variables. Being part of the Schengen area or the Euro zone has a large positive effect on capital mobility. Sharing a common currency doubles cross-border VC deals, whereas being part of Schengen triples transactions. This shows that the EU Commission's effort to integrate markets and reduce barriers to the free movement of capital facilitates cross-border VC flows.

In Model 5, we test for the moderating impact of time on distance as barrier to trade. Interaction effects are negative during the entire period and only get statistically significant from 2000 onwards. This suggests that the capital mobility obstructing effect of distance remains constant over time until the millennium. From 2000, the trade decreasing effect of distance appears to have strengthened. This effect is similar to the one observed in the global model.

Table 2.5.2: Gravity estimates - Europe 1990-2010

	Dependent variable: Cross-border VC transactions				
	(1)	(2)	(3)	(4)	(5)
	All Rounds	All Rounds	All Rounds	All Rounds	All Rounds
Ln GDP$_i$	0.247***	0.356***	0.358***	0.350***	0.358***
	(0.024)	(0.025)	(0.025)	(0.025)	(0.025)
Ln GDP$_j$	0.656***	0.830***	0.820***	0.807***	0.832***
	(0.020)	(0.023)	(0.023)	(0.023)	(0.023)
UK dummy$i$	2.569***	1.856***	2.058***	3.010***	1.853***
	(0.064)	(0.092)	(0.095)	(0.124)	(0.091)
UK dummy$_j$	0.753***	−0.499***	−0.264***	0.736***	−0.502***
	(0.069)	(0.098)	(0.102)	(0.131)	(0.097)
Geographical Proximity					
Ln Distance$_{ij}$(km)	−0.974***	−1.117***	−1.094***	−1.016***	−2.104***
	(0.033)	(0.041)	(0.041)	(0.041)	(0.542)
Border$_{ij}$	0.768***	0.488***	0.492***	0.341***	0.488***
	(0.072)	(0.069)	(0.071)	(0.071)	(0.069)
Cultural Proximity					
Language$_{ij}$	−0.293***	−0.163**	−0.062	0.086	−0.166**
	(0.077)	(0.076)	(0.080)	(0.080)	(0.076)
Power distance$_{ij}$		−0.014***	−0.017***	−0.014***	−0.014***
		(0.002)	(0.002)	(0.002)	(0.002)
Individualism$_{ij}$		0.005*	0.003	−0.001	0.005**
		(0.003)	(0.003)	(0.003)	(0.003)
Masculinity$_{ij}$		−0.007***	−0.008***	−0.007***	−0.007***
		(0.001)	(0.001)	(0.001)	(0.001)
Uncertainty avoidance$_{ij}$		0.006***	0.013***	0.009***	0.005***
		(0.002)	(0.002)	(0.002)	(0.002)
Uncertainty avoidance$_i$		−0.009***	−0.015***	−0.012***	−0.009***
		(0.001)	(0.001)	(0.001)	(0.001)
Uncertainty avoidance$_j$		−0.032***	−0.038***	−0.032***	−0.032***
		(0.002)	(0.002)	(0.002)	(0.002)
Power distance$_j$		0.018***	0.020***	0.018***	0.018***
		(0.003)	(0.003)	(0.003)	(0.003)
Trade Integration					
Currency$_{ij}$			0.740***		
			(0.074)		
Schengen$_{ij}$				1.484***	
				(0.098)	
Time x Distance	No	No	No	No	Yes
Observations	5,712	5,712	5,712	5,712	5,712

Note: Estimation using Poisson-QMLE estimators. Dependent variable are cross-border VC transactions (all rounds). Significance at the 1, 5, and, respectively, 10 per cent level is denoted by *p<0.1; **p<0.05; ***p<0.01. Standard errors are in parentheses. All models include year dummies from 1990 - 2010. In model (5) interaction effects are significant from 2000-2010. McFadden pseudo R-squared scores range between 0.67 and 0.72, indicating a good model fit.

2.5.3 Robustness Tests

The following sections provide a number of additional analyses intended to scrutinize the robustness of the previous findings.

VC market capitalization vs. GDP

The results in Table 2.5.1 and Table 2.5.3 Model 1 show that the economic size of a country (in gravity model terms, its 'economic mass') is associated with a higher level of cross-border transactions. However, we consider the possibility that a country's VC market development is not proportional to its GDP growth. Consequently, in Table 2.5.3 Model 2 and 3, we compare results using VC market capitalization data versus GDP numbers. To do this, the natural logarithm of the annually aggregated numbers of domestic VC transactions are calculated per country ($ln\ VC\ marketcap_i$,$ln\ VC\ marketcap_j$).

Besides, VC market size could be used as an indicator to gauge the development of a country's entrepreneurial ecosystem and to capture its 'entrepreneurial mass'. To attract foreign investors, a country needs to supply a critical mass of high-tech entrepreneurs or at least an environment where high-tech entrepreneurship can potentially thrive. It is likely that larger VC markets offer more funding targets as well as exit opportunities and consequently attract a higher share of cross-border investments.

We observe a similar positive effect of VC market capitalization on cross-border transactions (Model 2) as in the case of GDP. Increasing market size facilitates both incoming and outgoing cross-border investments. However, the effect is more prominent for outgoing cross-border VC transactions than for incoming ones. This implies that cross-border VC investments are not necessarily directed towards infant VC markets. Rather, more developed VC markets do not only denote a higher level of outgoing VC flows, but also have an advantage in attracting international

VC investors.

We also test for lags of one (Model 3) and two years (not reported) of the market capitalization variables. It is possible that investors choose foreign target markets based on past performance. Thus, potentially, VC market size in a particular year will cause more foreign VC inflows in following years. Portes and Rey (2005) use in their model on cross-border equity flows beginning-of-period market capitalization to represent financial size. Essentially, in our model, the variable $marketcap_{t-1}$ serves as the latter. The results are similar for lagging the variable by one year or taking the respective current year value. In contrast, lagging VC market development by two years has a negligible effect on the future value of cross-border transactions. Given the small effect in case of the two-year lag, we abstain from testing further lags.

Country Fixed Effects

By using country fixed effects (Table 2.5.3, Model 4), we are able to account for any across country differences which are not yet taken into consideration by the set of variables included in the baseline model (Model 1). Unobserved variables across countries impacting the stock of cross-border VC flows refer to, for example, differences in entrepreneurial climate, VC market development and market sophistication. Not incorporating these factors (omitted variable bias) may lead to endogeneity bias.

The results show that the coefficient of the distance variable remains robust across models using either GDP, VC market capitalization or country fixed effects. A change in magnitude is however observed in case of the *Border* and *Language* variables. A noteworthy observation in Table 2.5.1 Model 1, 3 and 4 has been the persistent negative effect of the *Border* variable. Commonly it is assumed that countries that are adjacent also trade more actively. A possible mechanism explaining the reversed sign is that some of the largest VC markets (US, Canada and

the UK) are relatively geographically secluded in their location and border few of their trading partners. The model using fixed effects appears to better approximate the large difference in VC market development between the US and UK and other economies and their dominant effect in prior models. In that way, the geographic reality of the US and UK not sharing a border with most of their trading partners becomes less pronounced in the model results. Consequently, the direction of the sign of the *Border* variable changes in Model 2 compared to the baseline specification applying GDP instead (Model 1). Applying country fixed effects, we arrive again at the widely propagated fact that neighbouring countries (ceteris paribus) enjoy a higher level of bilateral trading relations.

Fixed effects estimation nevertheless has some disadvantages. It subsumes all variables that are constant over time within countries or, in other words, across a country and a set of destination countries. Country specific variables like GDP (which generally does not vary much in consecutive years for a single country), unilateral uncertainty avoidance as well as power distance scores get dropped from the analysis. Country pair fixed effects, in contrast, cannot be introduced as our major interest concerns the distance variable which remain constant over time for a specific country dyad.

Syndication vs. Single Investments

Prior studies, albeit focusing solely on the domestic level, forward that syndication constitutes a mean for VC investors to overcome distance constraints (Sorenson & Stuart, 2001). Interfirm networks lead to the exchange of information and consequently enhance investors' geographic investment scale. To test whether this observation also holds for cross-border deals, we perform robustness checks including only syndicated cross-border VC deals (Table 2.5.3 Model 5) and, respectively, single investor lead transactions (Table 2.5.3 Model 6).

As expected, the effect of geographic distance is slightly more pronounced for cross-

border deals undertaken by a single investment fund. This underlines the findings by Sorenson and Stuart (2001) stating that physical distance and associated information asymmetries can, to some degree, be overcome by the expansion of inter-firm networks based on co-investment connections.

Nevertheless, the positive effect of syndicate ties is not as pronounced in our models as in the latter study. A potential reason is that we do not explicitly account for the investment funds' structural position, i.e. centrality, in the syndication network. Instead, we solely denote whether a specific deal took place in syndication or not. Hochberg, Ljungqvist, and Lu (2007) suggest that the positive effect of inter-firm network ties continues to persist even to stand-alone deals that take place consecutively and in later years. Hence, the positive effect of syndication on the likelihood of more geographically dispersed VC deals may appear more pronounced between well-integrated VC funds as opposed to, at the most extreme, peripheral single investors. Further research on cross-border investment networks and their implications is highly encouraged to collect stronger empirical evidence for the aforementioned mechanism.

Source vs. Destination Effects

The selected trade determinants might differently affect incoming and outgoing capital flows. Consequently, we estimated the basic specification for each country individually, treating them separately as both source and target of cross-border VC flows. This will give us an indication if country-by-country behaviour is consistent to the overall estimates. In Table 2.5.3 Models 7 and 8 the findings for this set of regressions is exemplified by means of the US. For example, in Model 8, US outgoing cross-border transactions to each of the 81 destination countries for the period 1990-2010 constitutes the dependent variable. The estimated coefficients of the individual models perform relatively similar to those in the full model. Solely incoming US investments seem to be less sensitive to distance compared to overall

Table 2.5.3: Robustness tests (Global)

	Dependent variable:							
	Cross-border transactions				Syndicated	Stand-alone	US Target	US Source
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln GDP$_i$	1.403***						0.842***	
	(0.014)						(0.035)	
Ln GDP$_j$	0.969***							0.753***
	(0.012)							(0.032)
Ln marketcap$_j$		0.657***						
		(0.005)						
Ln marketcap$_i$		0.851***						
		(0.005)						
Ln marketcap$_j$($lag1$)			0.639***					
			(0.005)					
Ln marketcap$_i$($lag1$)			0.835***					
			(0.005)					
Language$_{ij}$	1.833***	0.545***	0.461***	−0.001	0.003	0.020	2.252***	1.044***
	(0.052)	(0.031)	(0.033)	(0.055)	(0.040)	(0.047)	(0.124)	(0.110)
Border$_{ij}$	−0.468***	−0.558***	−0.520***	0.358***	0.339***	0.467***	−0.197	−0.257
	(0.071)	(0.050)	(0.052)	(0.076)	(0.058)	(0.057)	(0.335)	(0.262)
Historical ties$_{ij}$	−0.043	0.128***	0.168***	0.082*	0.082**	−0.011	−0.227*	0.106
	(0.050)	(0.030)	(0.031)	(0.047)	(0.034)	(0.040)	(0.128)	(0.104)
Ln Distance$_{ij}$	−0.626***	−0.482***	−0.469***	−0.656***	−0.603***	−0.720***	−0.224*	−0.729***
	(0.023)	(0.016)	(0.016)	(0.026)	(0.020)	(0.020)	(0.121)	(0.102)
Power distance$_{ij}$	−0.025***	−0.013***	−0.013***	−0.010***	−0.006***	−0.010***	−0.020***	−0.007*
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.004)	(0.004)
Individualism$_{ij}$	0.008***	−0.001	−0.002***	0.005***	0.006***	0.002***	−0.009***	−0.014***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.002)
Masculinity$_{ij}$	0.002*	−0.005***	−0.006***	−0.012***	−0.012***	−0.010***	0.023***	0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)
Uncertainty avoidance$_{ij}$	0.003***	0.009***	0.009***	0.003**	0.005***	−0.003***	0.025***	−0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)
Constant	−12.668***	−2.169***	−1.817***	−22.628	−39.123	−20.557	−3.112***	2.722***
	(0.303)	(0.186)	(0.183)	(897.326)	(1,095.858)	(577.378)	(1.057)	(0.966)
Observations	136,616	136,616	136,616	130,764	136,616	136,616	1,683	1,683

Note: Estimation using Poisson-QMLE estimators. Significance at the 1, 5, and, respectively, 10 per cent level is denoted by *p<0.1; **p<0.05; ***p<0.01. Standard errors are in parentheses. Time fixed effects included. Models 4-6 include country fixed effects.Model 7 and 8 only include dyads with either the US as source country or, respectively, target country.

cross-border transactions (Model 7). Key explanatory factors here are the aforementioned geographic location of the US and the attractiveness of it vanguard VC environment.Given the diversity of source countries for incoming US VC transactions, also the *Language* variables decreases in magnitude compared to the baseline model.

Silicon Valley vs. Washington D.C.

It is common in gravity models estimating bilateral trade flows to express the distance coefficient in terms of great circle distance between capital cities. In some cases, most prominently in the US, the capital city and the city with the greatest financial significance for VC are however not the same. To test the robustness of the models using capital-capital distance, Washington D.C. gets replaced by Silicon Valley as geographic location of US investors and target firms in Table 2.5.4. Consequently, for US VC flows, *Ln Distance SV*, takes as point of origin and destination Mountain View (Silicon Valley) instead of the US capital, Washington DC.

Taking Silicon Valley instead of Washington D.C. as point of origin increases the average distance between the US and target and source markets in Europe as well as to Canada (represented by the capital Ottawa). The distance to the UK (London) increases by 0.46 per cent, whereas the distance to Canada (Ottawa) increases by 434 per cent. The distance to some of the, in VC transaction volumes, smaller Asian markets in turn becomes shorter.

Model 1 shows that the Silicon Valley distance coefficient decreases in magnitude compared to the models using capital-capital distance in Table 2.5.1. The effect is mainly ascribed to the considerably larger distance between the key trading dyads US - Canada and US - Europe when taking Silicon Valley as starting point. Investors appear to be less sensitive to distance with respect to their cross-border investment decisions in the newly calculated models in Table 2.5.4.

Also the coefficient of the sharing border variable largely changes in magnitude when using Silicon Valley as point of origin and destination instead of the US capital. Naturally, there exists some correlation between the distance variable and the adjacency variable, countries sharing a common border also often have capital cities that are more proximate. Empirical evidence for this claim is provided by the fact that omitting the border variable (see Model 2) increases the trade impeding effect of distance ($\beta = -0,290$). Again, the size of the border coefficient is largely driven by the proportionally high share of Canada-US cross-border transactions. Testing a sub-sample where Canada is omitted (Model 3), the border coefficient decreases as factor facilitating economic exchange, exhibiting the geographically rather secluded position of the US towards its key destination and source partners in Europe.

Table 2.5.4: Silicon Valley distance

	Dependent variable:		
	Cross-border VC transactions		
	(1)	(2)	(3)
Ln GDP$_i$	1.273***	1.292***	1.170***
	(0.012)	(0.013)	(0.011)
Ln GDP$_j$	0.876***	0.929***	0.859***
	(0.011)	(0.012)	(0.011)
Ln SV Distance$_{ij}$	−0.101***	−0.290***	−0.146***
	(0.021)	(0.019)	(0.019)
Border$_{ij}$	1.124***		0.381***
	(0.048)		(0.067)
Language$_{ij}$	1.048***	1.416***	0.906***
	(0.050)	(0.047)	(0.047)
Historical ties$_{ij}$	−0.028	−0.537***	0.130***
	(0.049)	(0.044)	(0.046)
Power distance$_{ij}$	−0.018***	−0.021***	−0.016***
	(0.002)	(0.002)	(0.001)
Individualism$_{ij}$	−0.001	−0.005***	−0.003***
	(0.001)	(0.001)	(0.001)
Masculinity$_{ij}$	0.003***	0.005***	0.002
	(0.001)	(0.001)	(0.001)
Uncertainty avoidance$_{ij}$	0.013***	0.007***	0.012***
	(0.001)	(0.001)	(0.001)
Uncertainty avoidance$_i$	−0.030***	−0.029***	−0.028***
	(0.001)	(0.001)	(0.001)
Uncertainty avoidance$_j$	−0.010***	−0.008***	−0.009***
	(0.001)	(0.001)	(0.001)
Power distance$_j$	−0.022***	−0.018***	−0.022***
	(0.001)	(0.001)	(0.001)
Constant	−12.161***	−11.064***	−10.746***
	(0.328)	(0.321)	(0.293)
Observations	136,616	136,616	133,250

Note: Significance at the 1, 5, and, respectively, 10 per cent level is denoted by *p<0.1; **p<0.05; ***p<0.01. Standard errors are in parentheses. Time fixed effects included. In Model (3) Canada is omitted.

2.6 Discussion and Conclusion

With this article, we contribute to the literature assessing the 'death of distance' for international financial activity. Using a panel gravity model approach, we reject the assumption that due to decreasing transportation costs and advancing digitalization, spatial distance has lost its role as a barrier to trade – even in case of 'weightless' capital. Instead, we reveal a statistically significant distance decay effect with respect to cross-border VC investments. Against the rationales of the frictionless market paradigm, which remains the dominating concept in the international finance discourse, the 'home bias' effect emphasized already for domestic VC activity is confirmed also concerning international VC transactions.

The size of a country's economy, political and legal proximity between county pairs and, in particular, their geographic proximity, are important determinants of bilateral VC flows. The results from the models disprove any claim of the irrelevancy of geographical distance for international capital transactions. The consistently negative distance coefficient implies that the global VC market remains highly fragmented. Similar to their geographic bias in the home market, also when investing abroad, investors prefer targets close to their home market. The findings are in line with the results of Disdier and Head (2008) on international trade flows.

The distance decay effect is enduring and observable over the entire period of observation. This becomes apparent when allowing the distance effect to vary over time. Only few prior studies have introduced time-varying covariate effects in the case of trade in goods. The distance decay effect is more prominent in the sample of European countries compared to the global cross-section, which is mainly explained by the dominant role of the US as largest exporter of VC and her relatively secluded geographic position.

An avenue for further research provides the fact that for the current study we have regarded as 'source' country *i* of a cross-border transaction the country where the

investment firm, and thus the fund, is headquartered. Larger VC firms however may maintain subsidiary offices in several locations spread across the globe. A limitation of the current sample (and VentureXpert in general) is that it only registers headquarter addresses, also in cases of VC firms with branch offices[5]. For future analyses it is therefore suggested to make a more granulated distinction between a VC firm's subsidiary and headquarter locations [6].

Furthermore, the continuing importance of interpersonal ties during the VC investment process provides ground for further analysis. We suggest a more detailed analysis of human networks and how they steer the emergence of international VC activity. There is need for research that investigates the mechanisms of the formation of international investment ties at the micro-level. A good starting point here is the literature on transnational technical communities (Madhavan & Iriyama, 2009; Saxenian, 2002). It also closely relates to studies on the social structure of the VC industry by Sorenson and Stuart (2001) who find that social ties help overcoming local investment biases in case of domestic investors and Tykvová and Schertler (2011) who attribute tie density among local investors to the size and style of cross-border VC flows. Prior research also points out that syndication with local investors can help to overcome some of the barriers associated with cross-border VC investing. Prospectively, the refinement of models to also take into account the role investors play in a deal (lead versus no-lead) as well as the facilitating role of VC firms' local branch offices, would further advance our understanding of the distance sensitivity of VC investments.

[5] Sorenson and Stuart (2001) encounter and point out a similar issue for VC firms with several domestic offices (p.1563).

[6] However, it is unlikely that this will change the overall findings of our analyses. Similar factors are likely to account for a firm's location decision when setting up a subsidiary office outside of its home market as for selecting a foreign target market to invest. Furthermore, setting up a branch office abroad i.e. being more proximate to (potential) foreign portfolio companies shows once more the continuing importance of geography even in case of technological progress and 'weightless" (international) capital transactions.

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Time is the longest distance between two places.

Tennessee Williams

3

Time is Money! Effects of Air Transport Accessibility on International Venture Capital Flows

International business travel constitutes a key element for face-to-face meetings, which facilitate innovation and knowledge diffusion. Better air accessibility benefits regional economies with respect to employment growth, rate of innovation, and FDI. In this chapter, we complement findings from Chapter 2 on the importance of geography for cross-border VC by analyzing in more detail the impact of transport accessibility on the likelihood of foreign VC inflows at the regional level.

3.1 Introduction

Recently, it has been forwarded that financial flows are shaped by the spatial structure of airline networks. Bannò and Redondi (2014) estimate that the likelihood of foreign direct investments (FDI) increases with the launch of a direct flight connection reducing time spend in transit. A similar effect is observed for domestic venture capital [VC]. A reduction in travel time between investor and investee increases the likelihood that a business gets selected for funding (Lutz, Bender, Achleitner, & Kaserer, 2013) as well as improves its consequent innovative and exit performance (Bernstein, Giroud, & Townsend, 2015). In practice, VC investors routinely visit their target firms to oversee the development of business activities and to consult with the company's managers on strategic, financial and operational issues. Remoteness decreases the likelihood of social interaction and tacit knowledge exchange, curbs the awareness of investment opportunities and aggravates information asymmetries as well as agency related problems. For long, vicinity has therefore been regarded as key prerequisite for successful VC investments (Gupta & Sapienza, 1992). Given the extensive non-monetary component of VC investments and the need for face-to-face interaction, we analyze in this study if better accessibility by air travel of a region is positively impacting the number of cross-border VC inflows.

Spatial separation of business activities, similar to the geographic spread of VC funds and their portfolio firms in international VC deals, is most commonly observed in the case of multinational enterprises and has been a recurring topic in the international business literature (Bel & Fageda, 2008). Though production plants are globally spread, on site visits of management teams and other staff is common as well as frequent travelling from branches to the head office. Given the importance of air travel for business travelling, the location choice of headquarters is often influenced by the degree of accessibility of airport facilities and the availability of (intercontinental) nonstop routes (Bel & Fageda, 2008; Beaverstock, Derudder, Faulconbridge & Witlox, 2009).

There exists a strong link between transportation connectivity and regional economic activity as well as location specific economic growth (Bruinsma & Rietveld, 1993; Zhu, Zhang & Zhang, 2017). More specifically, air accessibility impacts GDP (Sellner & Nagl, 2010), foreign direct investment [FDI] inflows (Bannò & Redondi, 2014), and appears to have a positive effect on regional employment (Blonigen & Cristea, 2012; Button & Taylor, 2000). Air travel has eased interpersonal communication between distant actors. Face-to-face interaction, in turn, promotes the exchange of complex tacit knowledge, which is at the base of R&D intensive business activities (Cristea, 2011).

Although empirical results remain scarce on the importance of journey timesaving and non-stop service in air travel for the emergence of international VC activity, there exits some anecdotal evidence. For example, Ireland's inward investment promotion agency (IDA) lobbied to reinstate a direct flight connection between Dublin and San Francisco in 2014 to increase the collaboration among Silicon Valley companies and Ireland. The flight route allows managers to commute between the two places "without lengthy and expensive stopovers" (IDA, 2014). Similarly, British Airways introduced a new route to Mineta San Jose International Airport in May 2016. The flight is expected to "strengthen London's strong commercial ties with the West Coast" and caters to the long lasting demand of San Jose and Silicon Valley tech companies for a direct connection to London (British Airways, 2015). Virgin Atlantics scheduled a connection between Manchester and San Francisco and, respectively, Boston for 2017. Entrepreneurs located in northern England had remarked that they were missing out on Silicon Valley VCs given the latter's reluctance to spend extra time in transit to reach the wider Manchester region after their inevitable stopover in London (Financial Times, 2016).

To examine the effect of transport accessibility on international VC flows, we use a set of annually aggregated bilateral data on cross-border VC transactions from New York City based investors to eight European countries. To determine whether transport accessibility affects the volume of incoming venture capital flows, we ex-

ploit a cross-sectional panel of intermodal travel time data between New York City, a global hub of financial activity, and 252 NUTS 3 regions across eight European countries.

The data reveals a high sensitivity of bilateral investment flows to spatial transaction costs. In that, we provide evidence that despite the suggested 'weightlessness' of financial assets, trade models need to reintegrate transportation cost parameters i.e. in the form of travel time. So far, in the literature, mainly the existence of information asymmetries gets emphasized as driver for geographical investment preferences favouring more proximate firms. This research in contrast posits that it is useful to more directly model barriers to face-to-face interaction and knowledge exchange, which so far only got captured implicitly by approaching geographic distance as hurdle to information flow, by taking into account spatial interaction costs such as travel time.

3.2 Cross-border Venture Capital and Transport Accessibility

In the course of their engagement, VC investors frequently visit their portfolio companies to obtain an objective on site view of the business progress. On average, investors spend one day per month at the target firm (Fritsch & Schilder, 2008). Gorman and Sahlman (1989) find that investors spend roughly 80 hours on site of co-located companies and 30 hours on the phone annually to provide advice. In addition to the easier monitoring, face-to-face encounters provide important opportunities for the exchange of uncodified tacit knowledge and experience between investor and entrepreneur.

As travel time increases, investors tend to spend less time at their target companies. The reduction in contact hours is mainly ascribed to the longer time spend in transit and the related increase in opportunity costs. Bernstein et al. (2015) for-

ward that the introduction of a non-stop flight connection, shortening transit time, increases investors' direct involvement in the target company in form of more frequent on-site visits. Furthermore, they find the higher frequency of face-to-face contacts to have a small, though positive effect on the performance of the portfolio company with respect to quantity of patents, patent citations and likelihood of a successful exit. Fritsch and Schilder (2008) hypothesize that the lower degree of spatial clustering of VC suppliers in Germany can potentially be attributed to the efficient high-speed transport infrastructure making business travelling faster and more convenient.

In general, physical separation reduces interpersonal contacts, which impedes information flows and leads to information asymmetries negatively affecting economic outcomes. Multi-national firms, i.e. firms that operate in different locations, therefore have to cope with 'spatial transaction costs' (Dunning, 1998). The further the distance between two entities, the more difficult it becomes to oversee business activities and the higher the associated coordination costs (e.g. increasing transportation costs and information transmission costs). For multinational enterprises and their location choice, transport accessibility therefore plays a crucial role (Bel & Fageda, 2008).

Regardless the continuing digitalization of many business tasks, the mobility of managers appears to have neither become irrelevant nor have opportunity costs related to travel time ceased to exist for international businesses (Boeh & Beamish, 2012). Instead, costs related to the movement of employees remain high, even more in the light of rising incomes and time becoming an ever more scarce resource in managers' daily routines (Glaeser & Kohlhase, 2004).

Prior studies, especially those applying a gravity approach to international trade, have instrumentalized physical distance as a proxy for transport costs. With the decline in transport costs causing an unprecedented rise in trade movements since the 1950s, transportation issues have become an increasingly neglected factor in international trade models where transport costs commonly get equated to zero.

At present, geographic friction is primarily addressed as proxy representing a large variety of information asymmetries. Longer distance increases transit time and consequently aggravates interpersonal exchange and the transfer of tacit knowledge. Thus, it is not so much the marginal cost of distance for trade that affects long-distance, cross-border transactions nowadays, but rather the value of time.

The concept of accessibility reflects the ease of people to reach a specific place by means of a certain transport mode or a combination of them. A wide variety of approaches and indicators to express accessibility, ranging from transportation costs and travel time to travel convenience, are used in the literature (Bruinsma & Rietveld, 1993; Vickerman, 1974). In our analysis, we confine to intermodal travel time as indicator conceptualizing accessibility.

For financial transactions, a gap however exists for studies that explicitly dissect spatial transaction costs related to the movement of people, i.e. the time component, from general measures of geographic distance. This gap becomes even more striking in the light of studies showing that geographic distance only roughly approximates for transit time. Some places are more accessible than others, despite their larger dyadic distance. Examples of remote, though still comparably well-connected capitals are Canberra (Australia) and Wellington (New Zealand) (Zook & Brunn, 2006). The next section elaborates on the data and methodology applied to estimate the effect of travel time on the volume of international VC inflows.

3.3 Data and Methodology

The data used to estimate the effect of travel time on the volume of international VC inflows are collected from various sources (ESPON and Thomson Reuters' VentureXpert database). The geographical scope of the dataset is restricted by data availability. Intermodal travel time is estimated from New York City to eight Euro-

pean countries (Belgium, Denmark, Finland, Germany, Luxembourg, The Netherlands, Sweden and the UK) on the level of NUTS 3 regions. New York City constitutes one of the main global financial centers and is home to a vivid VC community. The NUTS 3 level is commonly used as unit of analysis in transport research. Information on intermodal travel time refer to the year 2011 and are provided by the European Observation Network for Territorial Development and Cohesion (ESPON). After merging the datasets, our final sample includes 252 observations.

Cross-border VC transactions. Our main variable of interest is the number of VC investments undertaken by New York based investors in a NUTS 3 region in Europe. Data on VC investments is retrieved from the Thomson Reuters Ven-tureXpert database. VC transactions are accumulated over a 6-year time span (2005-2010) to increase the number of observations and validity of the analysis. 'New York based investors' are defined as those investment firms enlisting a headquarter office in the New York Metropolitan Statistical Area.

Travel time. To approach travel time, we use global accessibility indicators provided by ESPON that measure the total intermodal travel time between NUTS 3 regions and New York City. Shortest travel time includes transit time to reach an airport with intercontinental flight connections to New York City by road or train as well as the flight time between the airport and one of the airports in the New York metropolitan area. In addition, transfer time between that airport and downtown Manhattan is included.

VC Investments (NUTS 3). The size of the local VC ecosystem is likely to affect the attractiveness of a region for new investors. For this reason, we include the number of incoming domestic and European VC transactions per NUTS 3 region. As in the case of the dependent variable, the number is aggregated over the period 2005-2010. Aggregation ensures that also regions with limited annual VC activity are included in the sample and increases sample size. The variable is comparable in its function to GDP as proxy for a country's economic mass in traditional gravity model specifications.

Institutions. To control for unobserved heterogeneity in entrepreneurial environment and institutional differences between countries, country specific dummy variables are added.

Following, we first provide a descriptive analysis of the interplay between regional air transport accessibility and international VC flows. Consequently, regression analysis is used to estimate the effect of travel time on the size of cross-border VC flows quantitatively.

3.4 Descriptive Analysis

Mapping intercontinental travel time from one of the key global financial centers, New York City, we demonstrate that there prevail large differences in accessibility between European regions. Regional differences in transportation connectivity do not only correspond to disparities between the core and some economically weaker periphery, rather large variations in intercontinental accessibility are observed also between regions that are home to a striving entrepreneurial ecosystem with many young and innovative companies.

Figure 3.4.1 shows the intermodal travel time between downtown Manhattan (New York City) to NUTS 3 regions where at least one company is located that has received VC between 2005-2010. NUTS 3 regions that did not register any VC activity in the observed period are indicated in white. Only the most developed domestic VC markets in Europe are considered for this analysis. These include: Belgium, Denmark, Finland, Germany, Luxembourg, The Netherlands, Sweden, and the United Kingdom[1].

NUTS 3 regions with the best accessibility include the metropolitan regions of

[1] France has been left out of the analysis due to incongruent data provided by Eurostat on NUTS 3 regions and their respective zip code areas.

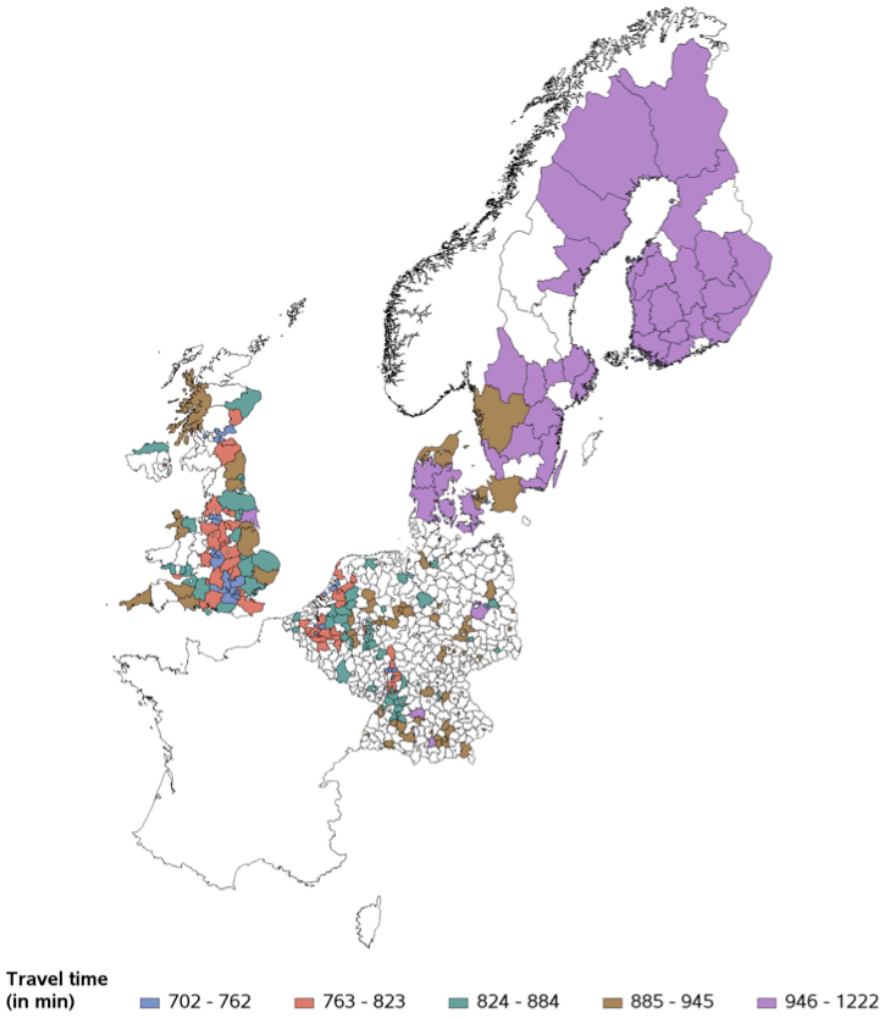

Figure 3.4.1: Intermodal travel time between New York City and NUTS 3 regions (2011)

London, where it takes between 702 and 737 minutes to travel from New York City. Distance timewise the best accessible region is Frankfurt (Germany). Intermodal travel time from downtown New York City to Frankfurt amounts to 744 minutes. Home to Germany's largest airport, Frankfurt airport, offering frequent direct flight connections to all of New York City's airports as well as a well-integrated

local public transportation system, the region is a central global economic and transportation hub.

Figure 3.4.2 displays the number of intra-European VC transactions per NUTS 3 region between 2005 and 2010. The number of VC investments within a NUTS 3 entity provides an indication as to the region's innovative milieu. Large discrepancies between international transport accessibility and the entrepreneurial potential of a region exist in the case of Stockholm (Table 3.4.1). For the Stockholm region, 398 domestic and inter-European VC investments were registered between 2005 and 2010. Nevertheless, the region appears relatively disconnected from global financial hubs. Travelling to New York City takes about 16 hours, whereas its estimated optimal travel time to New York City is about 12.5 hours. We estimate the minimum (optimal) travel time between a region *i* and New York City in Table 3.4.1 by taking $C_{ig}* = max\,speed\,(i, NYC) * D_{ig}$, whereby D_{ig} is the geographical distance between a NUTS 3 region *i* and John F. Kennedy Airport g, the main airport for intercontinental flights in the catchment area of New York City. A similar situation is observed in the case of Helsinki. Despite an international airport in the region, the area shows a difference between actual and optimal travel time of 167 minutes. One potential explanation for this large gap may be the restricted availability of direct flight connections to New York City.

If we compare the number of domestic and intra-European VC transactions in a region and its attractiveness for New York City based investors, we see that in the case of London, there is a vivid domestic VC scene as well as large interest from US investors. In contrast, Munich, home to a vivid entrepreneurial ecosystem and an international airport, denotes only one investment from a New York City based investor during the period of observation. In the latter case, a considerable discrepancy between the actual and theoretical travel time (126 minutes) is apparent.

Summing up, a first descriptive comparative analysis has delivered mixed results

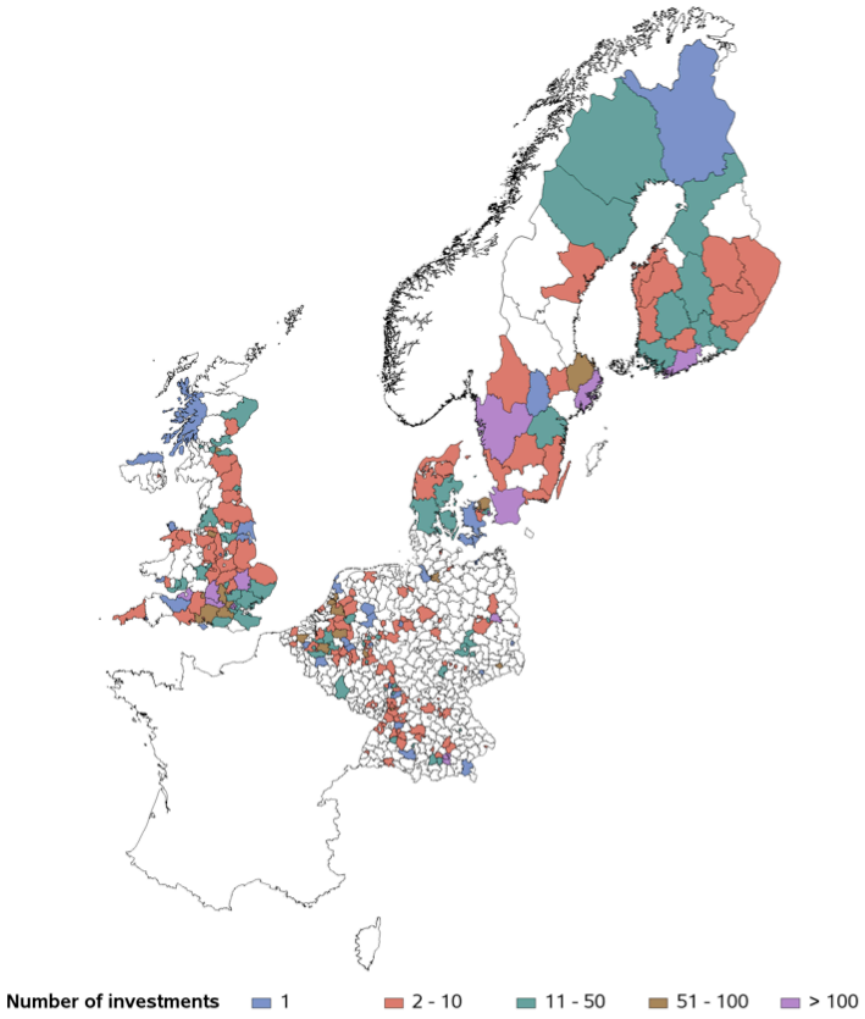

Figure 3.4.2: Venture capital ecosystem per NUTS 3 region (2005-2010)

for the relation between accessibility and international investor attractiveness of a region. Some regions denote a striving local innovative milieu, however, they are less conveniently reachable from New York City. Either because they do not have an international airport close by or because the local airport does not provide direct connections to New York City. In other cases, regions function as a hub for transatlantic flights, however do not rank high domestically as hotbeds for innova-

Table 3.4.1: NUTS 3 regions with largest travel time saving potential

	NUTS 3 Region	Optimal Travel Time
1.	Bath	212
2.	Stockholm area	197
3.	Gothenburg	179
4.	Cambridgeshire	177
5.	Uusimaa (Helsinki)	167
6.	Munich area	142
7.	Copenhagen	134
8.	Munich	126
9.	Oxfordshire (Oxford)	108
10.	Berlin	103

tive entrepreneurship. These regions also show a low attractiveness for New York City based investors.

3.5 Empirical results

In the previous section we figuratively compared the distribution of domestic and intra-European VC investments across regions, their accessibility (proxied by travel time) for New York City based investors and the number of VC investments they attract from the latter. We also showed that there exist large discrepancies in actual travel time and the theoretically fasted connection for some regions. In this section, we aim at quantitatively testing if there exists any systematic association between regions' accessibility and the number of cross-border transactions. Estimations are based on a cross-section of 252 NUTS 3 regions and are reported in Table 3.5.1. A negative binomial distribution is chosen to address overdispersion problems in the data.

Table 3.5.1: Intercontinental VC transactions and travel time

	Dependent variable:
	Cross-border VC transactions (NYC)
Ln Travel time	-6.549^{**}
	(2.812)
VC Investments (NUTS3)	0.023^{***}
	(0.002)
Sweden	0.805
	(0.969)
Belgium	-0.280
	(0.785)
Germany	0.253
	(0.494)
Denmark	0.694
	(0.989)
Finland	-1.560
	(1.757)
Luxembourg	2.643
	(1.828)
The Netherlands	0.819
	(0.620)
Constant	41.990^{**}
	(18.779)
Observations	252
Log Likelihood	-180.028
”θ	0.345^{***}
	(0.084)
Akaike Inf. Crit.	380.057

Note: *p<0.1; **p<0.05; ***p<0.01. Reference category is the UK.

The coefficient of travel time is significantly and positively related to the amount of overseas VC inflows in a region. The mean travel time in our sample between a foreign investor and a young firm is 872 minutes. Consequently, an hour increase in intermodal travel time is associated with a decrease in the amount of cross-border

transactions of about 36 per cent. This result is consistent with the notion that opportunity costs of air travel matter for business activities.

A regions entrepreneurial ecosystem is positively related to the inflow of cross-border VC. Nevertheless, the effect is much smaller in magnitude than the effect of travel time. The parameter estimates suggest that a doubling in VC deals in a region inflates overseas VC inflows by a factor of 1.02 ($p < .01$) or expressed differently, by about 2 per cent. Country dummy variables do not point out any a priori differences between countries included in the sample and the UK as reference category. This suggests that within the EU, investment conditions and macroeconomic characteristics are relatively homogeneous and do not bias the investment choice of overseas investors.

A limitation of the analysis is that travel time data is collected for the year 2011, whereas VC data refers to the period 2005-2010. Though far from optimal, the staggered periods of observation are unlikely to exercise a large impact on the overall result of our study. Despite continuously growing air passenger numbers, changes in the geographical structure of airline networks are inert. Transport network configuration alterations constitute major strategic decisions of airline operators that involve large investments and long term planning. Consequently, they do not happen regularly. Also the advent of numerous low-cost carriers in recent years is unlikely to affect our results as they mainly operate on short and medium routes and their supply of long-haul flights is still limited (Graham, 2010; Macário & Reis, 2011).

3.6 Conclusion

A key driver to the globalization of manufacturing goods has been the reduction of transportation costs. In a similar fashion, new information technologies have lead to a decrease in (tele-) communication costs. Coordination costs of face-to-face

interaction have nevertheless remained nearly unaffected by these developments as we show in this chapter. In-person meetings constitute a crucial ingredient of many business activities and financial transactions. Especially in the case of VC financing, direct personal interaction and regular company visits are common. By taking intermodal transport time between investor and portfolio company into account, we have shown that the opportunity costs of face-to-face interaction induce trade frictions. The effect is sizeable and statistically significant. In that, we provide evidence that investment location choices are not only influenced by much observed macroeconomic conditions, but that the conventional wisdom 'time is money' still applies. Direct flights, reducing time spent in transit, consequently could promote overseas investment inflows.

McCann (2011) claims that distance costs have not disappeared over the past years, rather they have changed. Transport and transmission costs have enormously decreased, whereas opportunity costs associated with time have tremendously increased. The importance of distance-time costs is most apparent in case of high-value knowledge activities that involve face-to-face interaction. We complement these results by providing detailed empirical evidence of the continuing importance of distance costs also for intangible goods such as cross-border VC transactions.

Caution has however to be exercised in interpreting the association between transport accessibility and economic growth at the regional level. Improving transport accessibility does not necessarily lead to the attraction of foreign VC investments and regional economic development. Regions deprived of global hub connections might also lack skilled labor, agglomeration economies and other growth relevant dynamics. Improvements in transport accessibility leading to travel time reduction are therefore rather complementing regional development than being a conditio sine qua non. We have partially taken account of these issues by solely analyzing the impact of transport accessibility for regions that denote a minimum level of local VC activity.

For entrepreneurs, a practical implication from this study is that they should pay attention to where they locate and how the place is linked to global financial hubs. Many entrepreneurs consider opening their businesses close to their home (Dahl & Sorenson, 2009). Important to consider is then if the necessary transport infrastructure is available in that place to connect to international financial networks.

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He who is different from me does not impoverish me - he enriches me.

Antoine de Saint-Exupéry

4

Venture Capital: The Effect of Local and Global Social Ties on Firm Performance

Firm financing literature has been dominated by a relatively 'undersocialized' and 'aspatial' view. In this Chapter, this gap is approached by applying a social capital and economic geography informed lens to financial transactions. It is explored if and how the early growth performance of venture capital backed organizations varies with the structural and physical location of their investors in syndication networks.

4.1 Introduction

The importance of network ties instead of arm's length transactions between atomistic financial actors is forwarded in a growing number of studies (Granovetter 1985; Podolny 1993; 2001). Looking at mutual fund portfolio profits, Cohen et al. (2008) find that portfolios where managers share a strong educational bond outperform those investments where no such link exists. Similarly, for mergers and acquisitions, social ties between acquirer and target executives established via a shared educational or employment background reduce the occurrence of strongly deviant returns (Ishii and Xuan 2014). In both cases, the interaction between actors leads to the dissemination of information and knowledge, reducing information asymmetries (Inkpen and Tsang 2005; Uzzi 1997).

Besides a common employment or educational background, social ties between actors take a wide range of modes including more formal alliances such as trade associations and interlocking board memberships and informal friendship contacts (Inkpen and Tsang 2005). In the venture capital [VC] industry, social networks among actors are prevalent in the form of syndication linkages (the joint investment of two or more venture capitalists in the same financing round of a specific target firm). Benefits from the maintenance of a multitude of co-investment ties with other VC investors, and especially those that are well-networked themselves, get reflected in higher fund returns and earlier exits of portfolio companies (Hochberg et al. 2007).

Social capital theory suggests that in many networks access to knowledge flows is asymmetrical and largely dependent on the structural network position of an actor (see also Gulati et al. 2006; Uzzi 1996; Zaheer and Bell 2005). A vocal assumption in social network theory is that an actor's position in a network is a reflection of its

°This article has been published as Bringmann, K., Vanoutrive, T., Verhetsel, A. (2016). Venture capital: The effect of local and global social ties on firm performance. Papers in Regional Science.

power. In that, a central location in a network facilitates actors to access and to exploit the knowledge and information flows that exist between network partners (Gulati et al. 2006; Podolny 2001; Tsai 2001). On the contrary, a peripheral position impedes and largely deprives actors from benefiting from the capabilities and resources exchanged between network parties. Hence, their structural position affects the ability of an actor to leverage network ties in order to source knowledge and skills (Ibarra and Andrews 1993; Tsai 2001; Whittington et al. 2009). The concept of centrality hereby often gets measured in two contrasting ways: A rather straightforward approach is to regard those actors as most central who maintain the largest number of links to other nodes in the network. Secondly, centrality is associated with an actor's capability to bridge structural holes, meaning the actor's attainment in connecting otherwise detached actors (Burt 1995).

Similar to economics, also the field of economic geography has for long been 'undersocialized' and dominated by a neglect of micro-level socio-political factors that shape regional disparities. More recently, however, increasing attention is paid to the analysis of linkages and networks between firms. Central to the 'relational turn' in economic geography (Bathelt and Glückler 2003; Boggs and Rantisis 2003) is the observation that relationships between actors and their embeddedness in space impact economic activities. It is therefore suggested that, in addition to the social topography, also the geographical configurations of social networks matter for economic actions. For example, formal and informal network relations of the entrepreneur in foreign target markets are found to positively impact the likelihood of international expansion and the consequent performance of small firms (Bell 1995; Coviello and Munro 1997; Ellis 2000; Majkgard and Sharma 1998; Sharma and Blomstermo 2003).

The growing importance of finance in economies, which also extends to the regional level, makes it indispensable to incorporate the analysis of the role and spatial patterns of finance into the regional economics literature. In addition to a 'relational turn', the economic geography literature has lately devoted increasing atten-

tion to the 'financialization debate' (Engelen and Faulconbridge 2009; Krippner 2005), recognizing the proceeding dominance of financial relations for economic development. The exploration of a distinct financial instrument, namely venture capital, and how VC networks are geographically shaped as well as the implications of their patterns for small firm performance, delivers an important contribution to this debate.

The aim of this article is to explore if and how structural and spatial patterns of investment syndication networks are advantageous for VC backed young firms, consequently referred to as 'portfolio companies', or, interchangeably, 'target companies', in their early growth phase. It is tested whether domestic and international relational linkages are qualitatively different in scope, making it essential to analyze them independently. We argue that especially international relational ties, bridging structural holes, are transmitters of non-redundant information and innovation-triggering knowledge which strengthen the resource-base of a firm and increase organizational performance. Contrary to the traditional focus on US ventures in the existing literature on venture performance, Belgian portfolio companies are at the center of our analysis. The Belgian VC market is characterized by openness towards foreign investors, while at the same time registering an active domestic VC scene (see Table 4.3.1)(Avdeitchikova 2012), providing us with the opportunity to observe both domestic and international syndication networks. In addition, given the small size of the country compared to the US, the local and domestic sphere can be regarded as congruent, facilitating the comparison of local and, respectively, domestic versus international social capital.

Linking structural and spatial network characteristics of VC co-investment networks to the early growth performance of portfolio companies, this article also makes several distinct contributions to the entrepreneurship and economic geography literature: Taking into account cross-border syndication ties, our research broadens the geographical scope of earlier analyzes focusing on the structure and performance implications of domestic VC co-investment networks (Hochberg et

al. 2007; Sorenson and Stuart 2001). In line with work on relational issues in economic geography, we detail that not only the social topography of a network, but also the spatial diversification of relational ties shape financial action. By using longitudinal data on the performance-related parameter employment growth, we also provide unique evidence about the early growth trajectory of start-ups that transcends the focus on survival related performance measures, such as the event of an initial public offering [IPO] or an acquisition, dominating existing studies (Das et al. 2011).

The article proceeds in the following way. In the next section, an overview is provided of the VC investment process and the role attributed to social capital in this context. In addition the section includes a detailed description of network analysis techniques referred to in this paper. The data and our empirical strategy to address the effect of local and global networking on portfolio firm performance are described in Section 3. Finally, Section 4 discusses the empirical results and Section 5 concludes and proposes future research directions.

4.2 Social Networks, Knowledge Transmission and Geography

VC is regarded as a special form or subset of private equity. Gompers and Lerner (2001) define VC as 'independent, professionally managed, dedicated pools of capital that focus on equity or equity-linked investments in privately held, high growth companies' (p. 146). Besides supplying incumbent innovative firms with funds, venture capitalists[1] provide advisory and monitoring services to the firms in their portfolio ('portfolio companies') including the identification of poten-

[1] In accordance with the literature, we use the terms 'venture capitalist' and 'investor' interchangeably in this article. Both terms refer to the VC fund and its managers that are participating in a deal with a target company. This is not to be confused with the 'limited partners', the investors of the fund including pension funds, large corporations, insurance companies, and family offices, which, in turn, equip the VC fund with capital to invest.

tial business partners, customers, market opportunities, and the development of business-related skills and capabilities (Bygrave 1988; Gorman and Sahlman 1989; Sapienza 1992; Sapienza et al. 1996). Reverting to their vast professional knowledge and personal contacts, their 'social capital', venture capitalists frequently facilitate the entry of startups into existing industry networks (Gorman and Sahlman 1989; Steier and Greenwood 1995). Especially in the early growth phase of a portfolio company, when making first experiences in the market environment, 'liability of newness' related problems (Stinchcombe 1965) such as low levels of legitimacy, strong competition from established businesses and frequent strategy adaptations are common. In this phase the abundant expertise and resources of the venture capitalist are of particular importance (Brander et al. 2002; Freeman 2002; Devigne et al. 2013).

In order to spread financial risk and reduce investment uncertainties, investors often invest in form of a consortium counting two or more VC funds (Lerner 1994; Lockett and Wright 2001). The syndication of investments leads to the establishment of social networks among venture capitalists (Bygrave 1988). Previous studies have found performance enhancing effects for portfolio companies resulting from receiving funding from an investor syndicate as opposed to a stand-alone investor (Brander et al. 2002; Das et al. 2011; De Clercq and Dimov 2008). In the case of syndication, the combination of different sets of capabilities and resources aids the coaching and monitoring of the portfolio company after a deal has been closed (Gorman and Sahlman 1989; Macmillan et al. 1989; Timmons and Bygrave 1986).

A distinction has to be made between investment syndication and network integration (embeddedness). Hochberg et al. (2007) forward robust results showing that rather the syndicate underlying factors such as the increased interconnectedness of actors than the fact that a portfolio firm is supported by an investor syndicate is positively associated with organizational performance. In that, portfolio companies benefit from syndication linkages of their investors even in cases where

the investment at hand is not syndicated, but where the investor jointly invested with other venture capitalists during previous deals in other firms. This implies that investors do not only source knowledge from those partners they currently invest with. Instead, they rely on their entire network consisting of former and current investment relations to obtain resources. Consequently, the social web resulting from past and present syndication can be taken as proxy for the overall information network of a venture capitalist.

Knowledge transmissions between network partners are nevertheless not space blind. The diffusion of knowledge, and particularly that of non-codified tacit information, is more vivid between geographically localized or 'proximate' actors as the co-location of actors facilitates (personal) interaction and by that promotes knowledge exchange (Maskell and Malmberg 1999). Besides geographic proximity, also other dimensions of proximity are found to facilitate collaboration and knowledge transfer between actors. Boschma (2005) disentangles five types of proximity: social, cognitive, organizational, institutional and geographical, whereby the former act mutually reinforcing and partially substitute geographical proximity in the interactive learning process. In this paper, we concentrate on the first and the last type, namely the socio-spatial dimension of co-investment relations between VC funds. To better understand the role that the geographic configuration of relational ties plays for economic transactions and firm performance, we augment social network theory by insights from economic geography in the following sections. The notion of 'relational tie' hereby refers to the connection that arises between two VC funds i.e. their managers, through the joint investment in a company.

4.2.1 Local linkages

The insight that geographical proximity is still important for knowledge transfer, despite a reduction in communication costs during the last decennia, gets reflected in a number of recent studies (Morgan 2004; Whittington et al. 2009). Empiri-

cal work using patent data has shown that knowledge spillovers between inventors are more frequent when they are co-located than when agents are separated by large spatial distances (Jaffe et al. 1992). When exchanging critical and, particularly, tacit resources, agents are inclined to rely on those connections that are more parochial in nature and with whom they subsequently interact on a more frequent base, than on their, in geographical terms, extended network contacts (Feldman 2000; Jaffe et al. 1992; McPherson et al. 2001; Whittington et al. 2009).

Also in the case of VC activity, a tendency towards space sensitivity is observed. For the VC investment process to be successful, the need for physical proximity between investors and investees is repeatedly emphasized (Mäkelä and Maula 2006; Zook 2004). The co-location of investors and investees facilitates regular face-to-face encounters, which ease the tapping of 'nonmonetary' resources such as the investors' social capital (Mason and Harrison 1995; Powell et al. 2002; Sunley et al. 2005). Geographic distance between a venture capitalist and the entrepreneurial firm, instead, increases transaction costs associated with the exchange of knowledge and causes information asymmetries (Sorenson and Stuart 2001). Given the lower intensity of interaction between more geographically distant partners, distance between a portfolio company and its investors is negatively related to the startup's probability of a successful exit (Cumming and Dai 2010).

4.2.2 Global linkages

The antagonism between the importance of geographic proximity for knowledge spillovers and the peril of lock-in or overembeddedness due to too restricted contacts is repeatedly stressed in the regional economics literature on industrial clusters (see Bathelt et al. 2004; Bathelt and Taylor 2002; Uzzi 1997). Besides relying on local networks, successful dynamic clusters are dependent on external, international linkages. Global contacts are important in that they feed local clusters with new knowledge generated in innovative hubs elsewhere. By inducting 'new

knowledge', outside relations guard to some extent against lock-in and too rigid, innovation hampering networks (Bathelt et al. 2004; Uzzi 1997).

Most prominently, in his seminal work, Granovetter (1973) emphasized the importance of 'weak ties' for innovative processes. Open networks, which are characterized by a multitude of 'weak ties' appear to be less prone to problems such as innovative lock-in associated with predominantly inwards oriented networks. Though originally rooted in the realm of sociology, the concept got quickly adopted in economic geography work on learning and knowledge flows. Here, Granovetter-like 'weak ties' often get ascribed to the global context, whereas 'strong ties' are equated to the local context. Also more recently, benefits for innovation and learning arising from non-local ties are stressed (see Grabher and Ibert 2014).

Local and international linkages are not only different in a geographical context, also their formation process and aim is diverging (Bathelt et al. 2004). Whereas local knowledge flows are a relatively automatic process triggered by the co-presence of actors in a cluster, international linkages, also referred to as 'international pipelines', are consciously established connections with partners situated in more distant innovative hot spots around the world. Due to the distance constraints associated with the transmission of knowledge, it is unlikely that new knowledge created elsewhere finds its way to the cluster in a timely manner, if it were not for directly established contacts with those distant innovative hubs. The industrial district literature therefore regards 'international pipelines' as particularly value-adding for firms with respect to innovation, growth and the achievement of competitive advantages.

The local buzz (Storper and Venables 2004) and global pipeline concept (Bathelt et al. 2004) is nevertheless not without its criticism. In more recent studies (Moodysson 2008), it is contested that knowledge is free flowing at the local level, i.e. an open and all-embracing local buzz exists, whereas more distant knowledge linkages are planned and consciously established. In other words, a shortcoming of the buzz-pipeline approach is its oversimplified distinction between knowledge

linkages mainly on basis of their degree of formalization (Trippl, Tödtling and Lengauer 2009). We address this gap by focusing on a single type of formalized knowledge linkages namely co-investment relations of VC investors and by assessing their effect on knowledge creation, and, in turn, firm performance, on different spatial levels. Besides fuzziness regarding the formalization and mechanism of knowledge diffusion, dissensions also exist with regard to the interplay of local and global knowledge linkages. Are the different knowledge sources complementary, accumulative, interchangeable or mutually exclusive for innovative activities? Traditionally, studies have pointed at the interplay of knowledge connections (Wolfe and Gertler 2004; Maskell, Bathelt and Malmberg 2006). More recently, a growing body of work however regards specifically 'international pipelines' as value-adding for firms with respect to innovation, growth and the achievement of competitive advantages (Moodysson 2008; Fitjar and Rodríguez-Pose 2011).

The buzz-pipeline approach is closely related to social network theory, where we find evidence of the benefits associated with 'weak ties' (Burt 1995) or 'outside' relations. More diversified and broader networks offer more varied information, consequently, actors that possess a more diverse network oftentimes perform better (Molina-Morales and Martìnez-Fernàndez 2008a; 2008b; Taheri and van Geenhuizen 2011). Also agents that are able to bridge 'structural holes' between different network players or separated clusters of interconnected actors generally show an accelerated performance (Burt 2004). Their structural position enables them to tap resources from otherwise peripheral or weakly connected parts of the network (Burt 2000). The generally more diversified and non-redundant knowledge, in turn, has the potential to bring fresh impetus to the individual or organization and increase its innovative capacity (Zaheer and Bell 2005).

Given their distinct knowledge content, domestic and international linkages may act complementary. Therefore, we suppose that investors that maintain local co-investment linkages as well as ties with non-domestic investors have a more diverse knowledge base and are consequently better equipped to support the early-growth

process of their portfolio companies. At first instance we therefore hypothesize that the interconnectedness of VC investors within the VC syndication network is positively related to the initial growth performance of their portfolio companies. Given the originality of the knowledge and information acquired from international ties, we nevertheless expect international linkages to be of a slightly higher value addition with respect to venture performance than their domestic counterparts.

4.2.3 Network Analysis

A network is established when actors (nodes) are connected via direct or indirect linkages (edges) (Wasserman and Faust 1994). In this paper, we suppose that VC investors who co-invest in the same portfolio company (event) establish a relational tie. The network underlying is a binary adjacency matrix where $x_{ijt} = 0$ represents the absence of a tie between investors i and j in year t and $x_{ijt} = 1$ refers to the existence of a co-investment relation. Given that investors are mutually aware of their presence in the syndicate, the network graph is undirected.

The concept of degree centrality (Freeman 1978), offering an uncomplicated indication of the total amount of connections an actor maintains, is applied to estimate the network centrality of investors quantitatively (Hanneman and Riddle 2005). Actor i's degree centrality is defined by

$$C_D(i) = \sum_{j}^{N} x_{ijt}, \tag{4.1}$$

whereby N reflects the total number of nodes in the network. To take into account the changing nature of co-investment relations over time when some investors drop out and new investors enter the market, an actor's degree centrality is normalized by the maximum number of connections in the network n in year t.

Formally, the normalized degree centrality of an actor is described by:

$$\frac{C_D(i) = \sum_{j}^{N} x_{ij}}{(n_t - 1)}. \tag{4.2}$$

4.3 Data and Methodology

4.3.1 Data

To estimate the effect of the structural and spatial network position of an investor on the economic performance of its venture, we obtained data on VC investments from Zephyr, a collection of publicly available information on private equity and VC deals, initial public offerings and merger and acquisitions around the world with a focus on Europe (Bureau van Dijk 2014). A comprehensive set of VC deals involving portfolio firms headquartered in Belgium that have received their initial VC financing round between 2001 and 2008 is developed based on this data. Zephyr provides data on VC deals since 1997, however, the selected time frame coincides with a broader availability of data on Belgian VC deals and the development of the Belgian VC market (Table 4.3.1). The Belgian VC market, like the continental European VC market in general, solely chronicles a negligible number of VC investments before the millennium with as exception the investment hype in Internet-based firms at the end of the 1990s, eventually leading to the 'dotcom bubble' of the year 2000. Given the relatively small size of our dataset, the exceptional circumstances of the dot-com boom (1997-2000), causing a severe distortion in global VC investment patterns, potentially strain the robustness of any statistical analysis and provide another rational for choosing the post-crisis year 2001 as starting date.

VC deals were identified as follows: We searched the Zephyr database for deals

Table 4.3.1: VC activity in Belgium (1997-2013)

Year	Total VC (Number of Investments)	Incoming VC (Number of Investments)	Incoming VC (Percentage)	Domestic VC (Number of Investments)	Domestic VC (Percentage)	Number of Portfolio companies
1997	4	1	25	3	75	3
1998	18	4	22	14	78	9
1999	63	15	24	48	76	27
2000	90	27	30	63	70	39
2001	90	35	39	55	61	36
2002	65	23	35	42	65	17
2003	61	25	41	36	59	17
2004	36	15	42	21	58	11
2005	9	3	33	6	67	3
2006	41	10	24	31	76	14
2007	46	11	24	35	76	18
2008	36	6	17	30	83	11
2009	39	7	18	32	82	10
2010	18	4	22	14	78	9
2011	30	6	20	24	80	11
2012	37	16	43	21	57	12
2013	51	6	12	45	88	16
Grand Total	734	214	29	520	71	263

Data Source: Zephyr (2014)

categorized as "venture capital". Not included are thus deals that indicate a more advanced development stage of the target company like mergers and acquisitions, buyouts and other types of investments that are generally subsumed under the category of private equity. Furthermore, we excluded investors with missing Bureau van Dijk identification numbers (non-identifiable investors). This step also eliminated any remaining business angel investors. After cleaning the data using these restrictions, we obtained a sample of 200 eligible investor-target company relations, compared to the initial dataset including 248 cases.

Our sample consist of both private and public sources of VC, whereby private investors prevail. Of the 200 times investors were involved in Belgian target firms (132 unique investors), 32 investor-target dyads (13 unique funds) are ascribed to public VC investors, including the Flemish Innovation Fund, the investment company of the Belgian region of Limburg and several university funds. Public VC funds were part of the consortium of venture capital investors in 19 Belgian target companies. The low share of public VC funds is ascribed to the general tendency of Zephyr to underreport public deals (see Bringmann and Verhetsel 2014).

A restriction of the Zephyr data set is that it solely provides information on the VC fund that underwrites a deal. No details are available concerning the broader corporate structure a fund belongs to; consequently, we consider networks of VC *funds* in this study and not VC *firms*. Potentially, this might lead to an underestimation of the size of investors' social capital. It is assumed that VC fund managers' knowledge and contacts diffuse in the VC firm rather than that they remain limited to the individual fund under their management.

For information on target firm performance, we consulted financial statement data provided by the National Bank of Belgium [NBB] resulting in a unique dataset of employment growth as performance related indicator of young private firms. Closing the period of observation at 2008 allows us to measure growth performance over a 4-year period including the year of the initial VC round for any given company. For the full 4-year period or at least two consecutive years, employment

data was available for 51 companies leading to a total of 161 observations (see Table 4.3.2). No distinction is made between portfolio firms that successfully exit (trade sale or IPO) during this time and those that fail (bankruptcy). In that, our dataset is unlikely to entail any survivorship bias.

Overall, it is assumed that focusing on young ventures allows for a relatively homogeneous sample of firms in terms of business development, their business orientation on often highly innovative new technologies and processes, and firm size. The geographical focus on Belgian portfolio firms ensures that external economic conditions such as labor market regulations are alike. Given the similar context of venture-backed startups in contrast to non-VC financed young firms, we consider the early development paths of portfolio companies as generally comparable (Davila et al. 2003). To further increase the comparability of firms, industry sector variations in growth cycles are accounted for. Consequently, it is regarded reasonable to compare the growth performance of the sample firms and to test by means of the obtained data whether there is an association between network integration, spatiality and firm growth.

4.3.2 Variables

In the following sections, variables applied to test the hypotheses advanced in Section 2.2 are presented. Table 4.3.2 provides descriptive statistics of our data. Spearman rank correlation coefficients showing the statistical dependence between key variables are presented in Table 4.3.3.

Table 4.3.2: Descriptive statistics

Statistic	N	Mean	St. Dev.	Min	Max
1. Employment (FTE)	161	19.042	26.802	0.100	158.800
2. Local Embeddedness	161	0.410	0.474	0.000	2.919
3. International Embeddedness	161	0.026	0.045	0.000	0.246
4. Deal size (in 1000 USD)	161	9,973	13,983	125	70,000
5. Age Target (days)	161	972	1,327	1	6,064

Dependent Variable: Portfolio Company Performance

The goal of the dependent variable is to reflect firm performance. Earlier studies on firm performance have stressed that companies exhibit diverging growth patterns depending on the growth measure that has been chosen (Delmar et al. 2003). To account for heterogeneity in growth trajectories, it is therefore suggested to include different types of performance measures in the analysis (Wiklund and Shepherd 2005). With respect to small and unquoted firms, growth-related financial data is nevertheless sparse (Davila et al. 2003). Though often the event of a successful exit or the time it takes a company until that day are taken as outcome proxies, such data is only sparsely available in our case. Given the currentness of the Zephyr data, many firms in the dataset have not yet reached the stage of maturity where an exit is feasible. Taking only into account companies that launched an IPO or trade sale severely impacts data availability. An alternative proxy for young venture performance is *employment growth* (Bruton and Rubanik 2002), which has been found to be closely related to equity valuation (Davila et al. 2003). We take the natural logarithm of the absolute change in the number of full-time equivalents [FTEs] as dependent variable. All data is collected for the period 2001-11.

Table 4.3.3: Correlation matrix (Spearman's rho)

	1	2	3	4
1. Employment (FTE)				
2. Local Integration	−0.226			
3. International Integration	0.373	−0.066		
4. Deal size	0.516	0.035	0.612	
5. Age (Target)	0.474	−0.324	0.197	0.192

Independent Variables

Local integration. We distinguish between local and international structural network characteristics of a stand-alone investor or investor syndicate. The distinction between local and international syndication partners is necessary in order to clearly determine the importance of local versus international social capital on portfolio company performance. As local integration we understand the number of ties of domestic investors to other domestic (Belgian-based) VC investors, whereby the nationality of a VC fund is defined by means of its headquarter. Degree centrality scores are calculated over trailing 4-year periods with the first window ending in t-1, the year preceding the initial deal. By applying 4-year windows, we account for the fact that ties once established through a common investment are likely to be extant also after several years. Local integration scores are consequently constructed annually per portfolio company, reflecting the sum of the normalized degree centrality scores of all Belgian investors involved in the company. The average local integration score equals 0.41 (see Table 4.3.2).

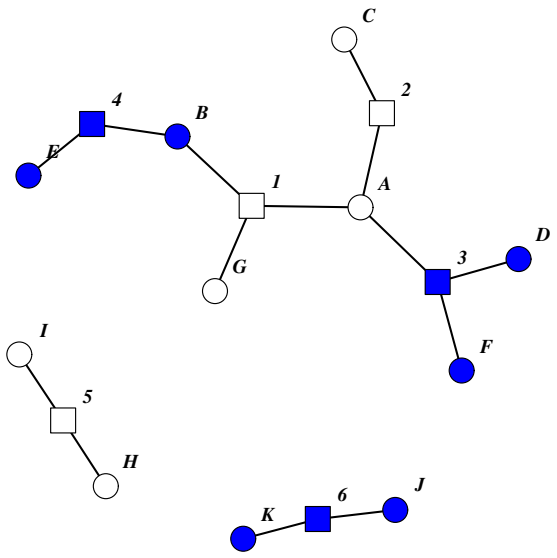

Figure 4.3.1: Network Analysis example

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Figure 4.3.1 shows a simplified VC investment network including both investors and portfolio companies in a given year t. VC funds, resembled by a circle, invest in portfolio companies represented by a square, whereby blank nodes describe local actors and filled forms their international counterparts. Lines depict investment ties. The local co-investment network (one-mode network) derived from the two-mode network graph in Figure 4.3.1 is displayed in Figure 4.3.2. Through its local investor A, portfolio company 1 possesses over relational ties to investors C and G. Investor C solely co-invests with investor A. In that, the local degree centrality of the investor syndicate of portfolio company 1 equals 0.75, the sum of

the normalized degree centrality scores of its domestic investors A ($C_{Dloc}(A) = \sum(x_{ij}/(n-1) = 0.5)$) and C ($C_{Dloc}(C) = 0.25$).

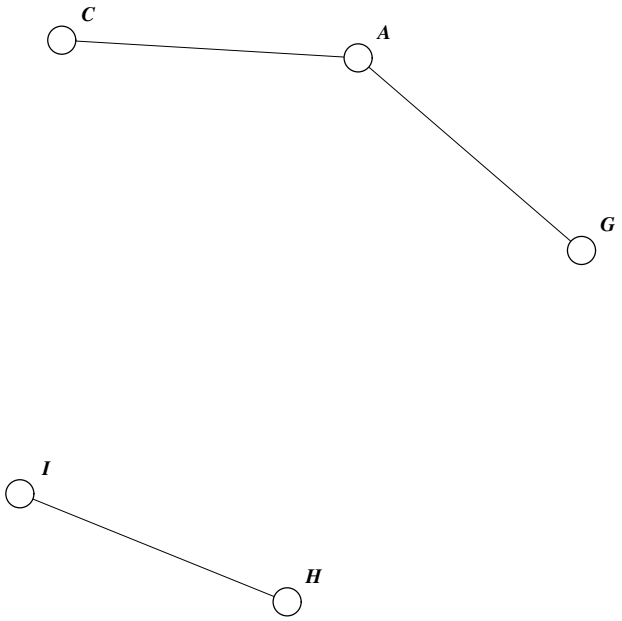

Figure 4.3.2: Local syndication network

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International integration. A co-investment network is constructed including VC investors active in Belgium (domestic and foreign) and their respective syndication partners in investment deals involving non-Belgian portfolio companies. On basis of the attained network, centrality scores are estimated in the same way as described above. From the perspective of portfolio company 1, the international network integration score of its investor syndicate equals 0.5. This is the sum of the co-investment ties its investors maintain through portfolio companies not headquar-

tered in Belgium and their non-Belgian investors (see Figure 4.3.3 for the investor-investor network). Investment fund A co-invests with foreign investors D and F in foreign target company 3, consequently its normalized international degree centrality is $C_{Dint}(A) = 2/6$. Investor B forms a syndicate with investor E to finance foreign portfolio company 4. His international normalized degree centrality is $C_{Dint}(B) = 1/6$.

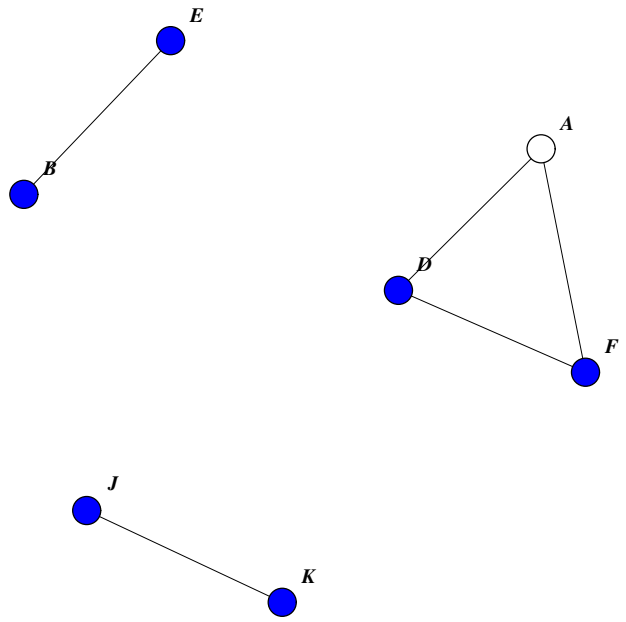

Figure 4.3.3: International syndication network

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Control Variables

Besides the network topology related key independent variables, a range of other factors are potentially affecting firm performance. As control variable we therefore include firm age, deal size and an industry dummy variable.

Firm age. It is anticipated that younger businesses have a tendency to grow faster than more mature firms (Evans 1987; Hart 2000). Thus, we control for firm age in our model. Age is measured in the number of days between the incorporation of the portfolio company and the closing date of the VC deal. In cases where only the year of incorporation was available, June 30 of that year is stipulated as day of incorporation. The natural logarithm is taken to account for any non-linear effects.

Deal size. We anticipate a positive relation between deal volume and early growth performance. Firms receiving a higher amount of capital are found to be better able to secure resources crucial for their further development process such as skilled labor, specialized equipment, and product advertisement. (Devigne et al. 2013; Lee et al. 2001). The variable deal size is the amount of VC the portfolio company obtained during the full 4-year period of observation. Deal volumes appear to be highly heterogeneous in our sample (Table 4.3.2). On average, portfolio firms received about 9.97 million Euros for their first VC round or in additional VC rounds up until 3 years after the year of their initial VC injection, however as indicated by the large standard deviation, there exists much variation in the sample. We use the natural logarithm to take into account any non-linear effects.

Industry. To control for industry effects we add a biotech dummy variable (Biotech) to our model that takes on the value of one if the portfolio company is primarily active in the biotech sector and zero otherwise. Due to the necessity of often long-standing clinical trials, biotech startups are characterized by longer development phases than startups in other knowledge-intensive sectors, which, in some cases, defers their growth pattern. Consequently, we anticipate a negative effect on growth if a portfolio company belongs to the biotech sector.

4.3.3 Empirical Strategy

A longitudinal multilevel model of change[2] is employed to estimate the effect of structural and geographical VC syndication network characteristics on the growth behavior of portfolio companies (Bliese and Ployhart 2002; Pinheiro et al. 2014; Singer and Willet 2003). In contrast to conventional multilevel models that regard individuals to be nested within groups, we view the observations over time of a distinct variable to be nested within a subject (portfolio company) (Hox, 2010). See Figure 4.3.4 for a simplified graphic example of the model structure.

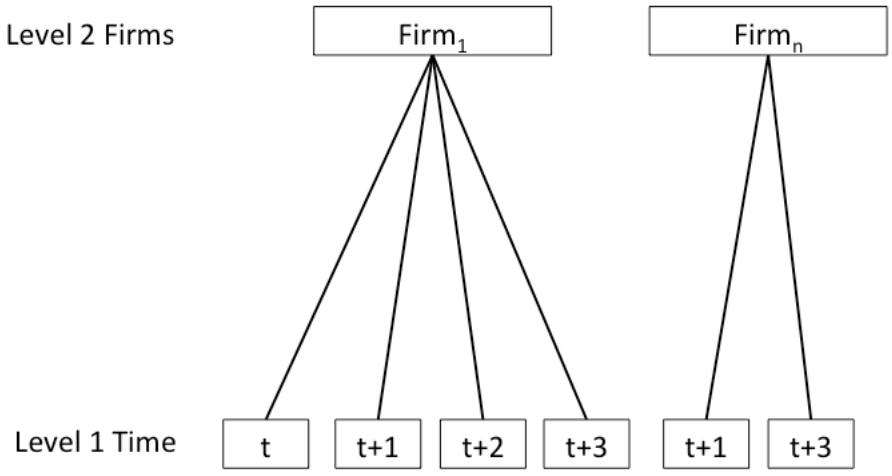

Figure 4.3.4: Multilevel structure of repeated measurements of firms over time

[2] In the literature a variety of names exist for this type of models: random coefficient models, mixed effects or mixed models, hierarchical linear models etc. (Hox, 2010)

The performance of portfolio company i,...n_t at time t (t=0,1,2,3) is estimated as a random slope multilevel regression model taking the form:

$$Y_{it} = \alpha_0 + \beta_{10} T_{it} + \beta_{20} X'_{it} + \beta_{01} D'_{i+} u_{1i} T_{ti} + u_{0i} + e_{it}, \qquad (4.3)$$

where α_0 is the regression intercept. Time varying covariates, most importantly, the degree centrality score per investor syndicate of portfolio company i at time t are given by vector X'_{it}. A vector of time-invariant covariates that solely fluctuate across firms including deal size, age at the initial investment and industry scope is represented by D'_i. The residual error at the occasion level is represented by e_{it}. To reflect differences in the initial development and performance level of startups, a random intercept term u_{01} is introduced at the firm level. To account for the fact that firms exhibit different growth rates over time, the random term u_{1i} is added to the coefficient of time. This allows the growth curve of each firm to differ in slope. Said differently, for some firms the explanatory variable has a larger effect on the response than for others.

Figure 4.3.5 provides a visual clarification of the random slope and random intercept terms. The intercept for the overall regression is α_0. The term u_0 represents the difference between the intercept for the overall line and the group (firm) line. The term u_1 indicates the difference between the slope for the individual firm line and the slope for the overall line.

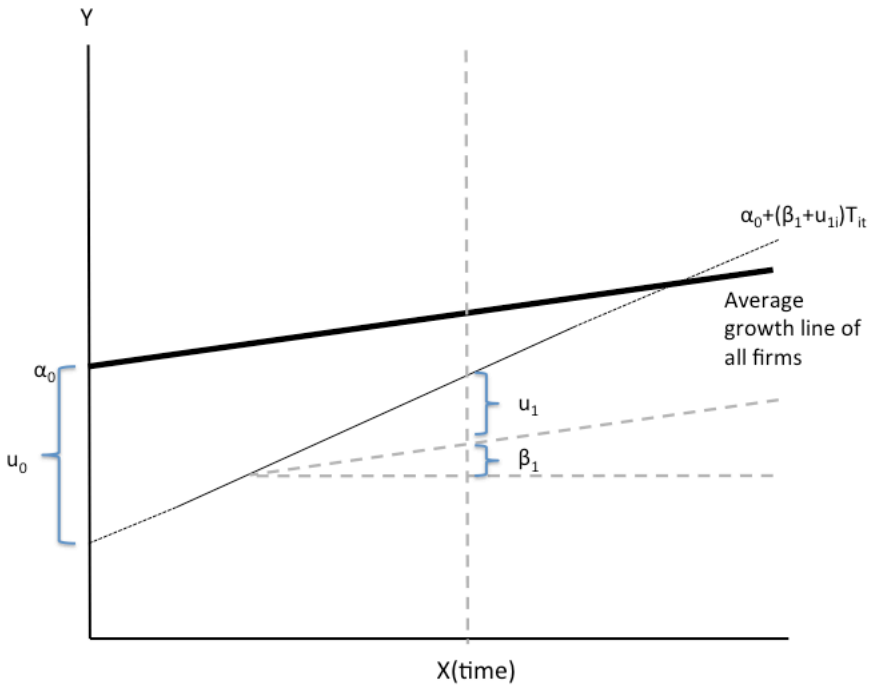

Figure 4.3.5: Random slope and random intercept model

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A model contrasting approach based on chi-square likelihood-ratio testing is applied to establish the goodness of fit on a model-per-model basis and to arrive at the most parsimonious model.

4.4 Results

Table 4.4.1 report the results from the regression analyses. The negative correlation between the intercept and slope (model not reported here[3]) shows that portfolio companies with a higher number of employees at the time of their initial VC investment demonstrate a smaller employment growth (weaker slope) in the

[3] All models are available on request from the authors.

years following the investment than companies that only recorded few employees (steeper slope). Also the size of the VC deal as well as the age of a portfolio company at its initial VC round have a statistically significant and positive effect on FTE growth. In accordance to our expectations, biotechnology-related firms are characterized by slower initial growth in employment after their first round of VC.

The positive and statistically significant coefficient of the domestic degree centrality score in Model 2 signals that portfolio companies supported by locally more embedded VC investors denote on average a higher growth in FTEs than those businesses financed by less locally interconnected VC funds. This suggests that geographically proximate domestic ties offer opportunities for the exchange of information, accelerate growth and constitute a competitive advantage for the venture. Also the coefficient of the international degree centrality score is positive and statistically significant. The access, via their investors, to non-local social capital improves the organizational outcome of a portfolio company in form of employment growth. The correlation coefficients in Table 4.3.3 do not point out any multicollinearity issues between local and international centrality scores that may impact the estimation of parameters when included in the same model.

The standardized coefficients in Model 3 Table 4.4.1 indicate that, although the control variables age and deal size have a larger effect on firm performance, international as well as local co-investment ties also have a non-negligible impact. Here, international linkages are almost twice as value-adding for organizational outcome than domestic investment ties. It is proposed that the larger effect on portfolio company growth of international ties compared to local co-investment linkages results from the lower degree of resource redundancy in international networks and the 'bridging' character of these ties. Thus, in cases where portfolio companies, via their VC investors, gain access to both local and global knowledge flows, we presume that more benefits are arising from the international relatedness.

Model 4 includes an interaction effect between the local and international inte-

Table 4.4.1: Multilevel models of employment growth

	(1)	(2)	(3)	(4)	(5)
Fixed Effects					
Intercept	1.97^{***}	-2.72^{**}	-0.01	-2.80^{**}	-2.57^{*}
	(0.18)	(0.97)	(0.11)	(0.98)	(0.99)
Time	0.21^{***}	0.11	0.10	0.10	0.11
	(0.04)	(0.07)	(0.06)	(0.07)	(0.07)
Ln int'l. integration[b]		6.77^{*}	0.23^{*}	10.09^{**}	6.32^{*}
		(3.01)	(0.10)	(3.74)	(3.10)
Ln local integration[b]		0.59^{+}	0.13^{+}	0.87^{*}	0.62^{+}
		(0.33)	(0.07)	(0.37)	(0.33)
Ln age target		0.27^{**}	0.37^{**}	0.27^{**}	0.26^{**}
		(0.08)	(0.12)	(0.08)	(0.08)
Ln deal size		0.37^{**}	0.41^{**}	0.37^{**}	0.35^{**}
		(0.13)	(0.14)	(0.13)	(0.13)
Industry (target)		-0.74^{+}	-0.27^{+}	-0.80^{*}	-0.79
(=1 if Biotech, 0 otherwise)		(0.39)	(0.14)	(0.39)	(0.40)
Int'l. × Local Embeddedness				-8.77	
				(5.99)	
Market					0.28
(=1, if US & UK, 0 otherwise)					(0.43)
Random Effects	**Variance**[a]				
Intercept	1.24 (1.11)	1.01 (1.01)	0.65 (0.81)	1.03 (1.01)	1.02 (1.01)
Time		0.16 (0.40)	0.11 (0.32)	0.16 (0.40)	0.16 (0.40)
Residual	0.32 (0.46)	0.07 (0.26)	0.05 (0.21)	0.07 (0.26)	0.07 (0.26)
AIC	409.30	326.31	256.11	326.12	327.88
BIC	421.63	360.21	290.01	363.09	364.86
Log Likelihood	-200.65	-152.16	-117.06	-151.06	-151.94
Num. obs.	161	161	161	161	161
Num. groups	51	51	51	51	51

Note: $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{+}p < 0.1$. Standard errors are in parentheses. All models are estimated using hierarchical linear models with random intercepts and slopes. Model (3) shows standardized regression coefficients using grand mean centering.

[a] Standard deviances in brackets.

[b] A constant of 1 has been added before logarithmic transformation

gration scores. We estimate this model in order to assess if domestic and international investment ties act complementary. The coefficient of the interaction term enters negatively, but not statistically significant. This suggests that the effect of either local or global ties on the dependent variable does not vary with changes in value of the respective other included variable. Said differently, the effect of 'global pipelines' on organizational outcome does not vary with the local centrality of an investor syndicate and vice versa. This suggests that domestic and international co-investment ties are distinct in their value creating capacities.

We also test if there is a difference in outcome between social ties established with investors situated in more developed and liquid VC markets by introducing a dummy variable distinguishing between the US and UK market and other VC markets (Model 5). Given the positive though statistically insignificant coefficient, there are no signs that portfolio companies benefit more from ties connecting them to more mature markets. At first sight, the statistically insignificant positive result appears counterintuitive. The US has for long been regarded as the most mature and largest VC market worldwide, subsequently valuable knowledge and experience spillovers are expected. A possible explanation is however that ventures growth strategy matches their investors' value-adding capacities. Consequently, there are no a priori differences in value addition between investor networks that are US or UK based and, respectively, European, as the choice of investors is depending on their usefulness for and alignment with a company's strategy. This also fits to the conclusions of the buzz-pipeline literature, where it is forwarded that maintaining extra-regional knowledge ties, 'global pipelines', is more laborious than local connections and their formation is therefore a more selective, target-oriented decision. Further research on this issue is however highly advised. A possible avenue for future analyses would be to test if the insignificant relationship also holds for a larger, cross-sectional sample of countries including other developed European VC markets.

Finally, we look at whether the growth enhancing impact of investors' social capital

decreases with increasing maturity of the portfolio company. For this we include interaction terms between the age variable and the local as well as the global degree centrality scores (Model not reported here). There is no indication that the positive impact of investors' social ties changes during the early business development phase of their target firms. The negative sign of the local degree centrality score interaction term, though not statistically significant, is in line with prior studies on 'liability of newness' related problems of starting businesses and the crucial role of VC investors' expertise at this stage (Brander et al. 2002; Freeman 2002; Devigne et al. 2013).

Summing up, the empirical results show that the employment stock of portfolio companies is increasing over time and that both the local and international interconnectedness of venture capital investors have a statistically significant and positive effect on portfolio company growth. By integrating both centrality scores in the same model, we furthermore observe that international and local co-investment ties are not congruent in scope, but seemingly provide portfolio companies with different capabilities. Especially geographically expanded co-investment networks, encompassing cross-border ties, increase economic effectiveness. The findings stress that in denser networks as the domestic VC network, it becomes essential to maintain outside relations or, in other words, to bridge structural holes to improve economic outcome. In that, the results relate to Uzzi (1996; 1999) emphasizing the importance of 'non-embedded' external ties to prevent the innovation hampering perils of too dense, overembedded networks.

4.4.1 Robustness Tests

We test the robustness of the analyses by constructing a number of models that take into account different covariance structures. Due to its longitudinal nature, we expect a large degree of interdependence in the data. First-order autocorrelation is found to be higher in models that solely allow for a random intercept. However, by

integrating a random slope term into the models, autocorrelation problems largely diminish.

A second issue that potentially inflates goodness of fit measures is the existence of heteroscedasticity in the data. A comparison of models accounting for heteroscedasticity and those assuming homoscedasticity by means of log likelihood testing reveals that, at first sight, we have to presume a small degree of heteroscedasticity. However, subsequently introduced more complex models accounting for heteroscedasticity do not fit the data notably better. Visual inspection of the residual plots precludes any severe violation of the homoscedasticity assumption. Hence, the more compact random slope model is kept.

A third concern addresses the issue of reverse causality. It is evident to assume that better networked investors might also be more capable in selecting startups for their portfolio that are already more promising from the outset. After their initial round of VC, these ventures are then likely to continue to show an increased growth performance. In this case however, the largest impact of investor' social capital would have been realized in the selection phase and not during the business development and monitoring phase as assumed in this paper. Prior studies have embraced this problem and concluded that, although the 'selection hypothesis' cannot be neglected, investor syndicates (Brander et al. 2002) as well as better networked funds (Hochberg et al. 2007) are in general not denoting any large advantages in the selection of investment targets. Rather, performance differences between portfolio companies arise ex post deal closure and are linked to differences in investor involvement.

To test for selection bias, we collect performance data of portfolio companies from the two years preceding the year of the initial VC injection. This leads to a sample of 17 firms for which it was possible to obtain pre-deal growth figures. We apply ordinary least square regression analysis [OLS] to test whether firms that show an increased employment growth before their initial VC round where eventually selected by a particular sort of investor. We do not find any statistically significant

estimators confirming a 'selection hypothesis'. Consequently, it is imputed that in the case of our sample of portfolio companies reverse causality problems do not impact the validity of the modeling results.

4.5 Conclusion

There has been a renunciation of the arm's length principle with regard to economic transactions. Instead, the importance of social networks for financial markets is emphasized. In this paper, we contribute to the emerging literature on economic geography and social capital in finance by examining the effect of the structural and spatial network position of VC investors on the early growth evolution of their portfolio companies. Given the accelerated development of international VC activity during the past years, particular attention is hereby paid to the value addition of global co-investment linkages compared to domestic networks. For the analysis, we collected data on Belgian-based VC deals and those investors' international engagements between 2001 and 2008 and traced FTE growth of the involved portfolio firms over a period of 4-years.

Using longitudinal multilevel modeling, we find that early growth trajectories of portfolio companies are impacted by structural as well as geographic co-investment features associated with their respective VC investors. Overall, a higher international integration of domestic VC investors, in form of a larger number of relational ties with foreign investors, impacts the economic performance of a venture positively. A slightly weaker growth enhancing effect is found for local syndication linkages of domestic investors. We propose that the larger effect of international ties on organizational outcome is associated with their properties to serve as sources of novel information, which consequently allow for a better combination of resources, enhancing the competitive advantage of portfolio companies. Whereas knowledge assets stored in the local environment may be taken up via other channels, knowledge and skills acquired through non-local linkages are not

gained if it was not for the international 'bridging' relationship. Following, it is suggested that investors that possess external contacts bridging structural holes are particularly beneficial to organizational performance in that they are able to provide unique resources to their portfolio companies. In the light of the positive effects of international as well as domestic network ties, optimally, firms integrate both sorts of relationships in their network. Given the additivity of domestic and international ties, an investor acting under resource constraints adds more to his social capital by establishing an international co-investment relationship if he only possesses local syndication partners than by adding an additional tie to his local network.

Prior studies investigating the spatiality of VC activity generally assert that the co-location of VC investor and target company is favorable with respect to economic effectiveness. While not disputing the relevance of geographical proximity in the VC investment process, we pointed out that from the perspective of the portfolio company also the social network of its investor matters. Here, contrary to what has been found concerning the physical location of investor and target, local but especially more distant, cross-border relational ties act performance enhancing.

These findings are also in contrast to traditional Marshallian economic geography theories focusing on the importance of local agglomerations and the interaction between proximate, co-located actors for knowledge creation. They are however in line with more recent approaches that accentuate the crucial role of extra-regional and national knowledge exchange and the additivity of local and global knowledge diffusion for dynamic innovation. In congruence with our results, these studies highlight the outstanding role of consciously established global linkages, compared to local interactions, in spurring firm innovation (see Fitjar and Rodríguez-Pose 2011).

For public policy makers these results suggest that both the deepening of networks, but especially the spatial diversification of knowledge linkages are important factors fostering the growth of young and innovative firms. Potential policy actions

should therefore aim at the strengthening of the attractiveness of domestic VC markets to foreign investors, but also at the engagement of domestic VC investors abroad. Both scenarios are probable to lead to a gain in non redundant knowledge flows for high growth firms.

Summing up, this article provides a detailed analysis of the impact of structural and geographical VC syndication network features on portfolio company performance. Many central issues however still remain unresolved and are subject for future discussions. We limit our focus in this study on the Belgian VC market. This raises the question in how far the results are indicative for other countries. Prior research generally emphasizes that VC practices vary across markets analogous to differences in the institutional and cultural context (see Bruton and Ahlstrom 2003). This also affects the degree of investor's ex ante involvement in value-adding activities and, in turn, the importance attached to investor's social capital in the growth process. Nevertheless, large similarities exist between developed VC markets (see Sapienza et al. 1996; Jeng and Wells 2000). Thus, we are confident that the results of this study are also applicable to other European markets as well as the US, nevertheless more detailed research testing this assumption is strongly encouraged. In contrast, social ties seem to play a much larger role still in emerging countries (e.g. China). Performance differences based on diverging social ties may therefore appear even more explicit when investigating emerging VC markets. It is therefore advised that future work validates the results for a larger cross-section of countries including both mature and emerging VC markets.

Prospective research should consider weighting the potential for social capital spillovers between investee and investors proportionally to the latter's stance in the investment. Prior research has shown that in syndicated investment deals not all investors are involved to the same degree. Instead, one investor often acts as lead investor whereas the other investors take on a more passive role. It is likely that portfolio companies benefit more from the capabilities and contacts of the lead investor than from that of more passive coinvestors. Closely linked to the previous

issue is the question whether there are qualitative differences between relational ties and whether ventures benefit more from some ties than from others. Variations in the strength of social ties caused by the frequency of interaction, leading to differences in the level of trust between actors, need to be explored here.

Furthermore, referring to the discussion on overembeddedness, it has to be examined if there exists any threshold level with respect to network integration beyond which value-adding effects are inverted. Lastly, it is worthwhile to look into other forms of relational ties such as a shared professional background or a common educational history and their effect on the value-adding capabilities of VC managers. To provide an answer to these issues, more fine grained VC figures are however needed.

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There is nothing more deceptive than an obvious fact.

Sir Arthur Conan Doyle

5

Born or grown global? New Venture Internationalization and the Role of International Knowledge Resources

What drives the early internationalization of firms? This Chapter adds to the understanding on the international development of new ventures by examining the role of pre-foundation international experiences of founders and ex post foundation international knowledge acquisition through venture capital funding and new manager recruitment. Results suggest that startups appear to be not "born" globals, but rather "grown" globals.

5.1 Introduction

Internationalization marks an important milestone during the evolution of young innovative firms[1]. It provides growth opportunities and access to new knowledge and technologies. Expanding their market, firms are able to serve a broader customer base, leading to scale and scope economies in production as well as increased market power and firm performance. At the national and local level, internationally operating businesses are shown to pay higher salaries and denote faster firm growth than their domestic counterparts (Sleuwaegen & Onkelinx, 2014). Doing business abroad, moving beyond their familiar territory, is thus a crucial competitive move for new ventures. Many start-ups nevertheless struggle with scaling up their activities outside of their home market. What makes some new ventures more successful than others in their quest to expand internationally?

International new venture theory (Oviatt & McDougall, 1994) emphasizes the role of entrepreneurs or entrepreneurial teams and their knowledge and skills obtained through previous working experiences as key determinant for the international expansion of new firms (Jones & Coviello, 2005). In the absence or insufficiency of prior exposure to foreign environments, firms can however also accumulate knowledge and skills from alternative sources such as network partners and other organizations (McDougall & Oviatt, 2003).

In this paper, we analyze the effectiveness of three complementary international knowledge acquisition processes on the early internationalization of new ventures: (1) congenital knowledge transfer, founders' prior international knowledge and experience, (2) venture capital [VC] funding, and (3) grafting, i.e. the acquisition of knowledge through the ex post professionalization of the initial entrepreneurial

[1] We define young innovative firms as those firms that are in their early stages of development and growth (Jin et al., 2016). We use as boundary condition the age of six years (Zahra, Ireland, & Hitt, 2000). The terms 'young innovative firms', 'startups', 'new entrepreneurial firms', and 'new ventures' are used interchangeable in this article.

founding team[2] [EFT] via new manager recruitment.

Many innovative high technology firms rely on VC to finance their business development. Venture capitalists [VCs] do not only constitute a crucial source of funding, but also add important knowledge resources to the young firm as well as providing strategic advice. VCs often deem the replacement of technical founder CEOs or the expansion of the management team as requisite during the (international) development phase of their target firms (Tykvová, 2007).

Augmenting or adjusting EFTs has nevertheless organizational consequences such as changing dynamics at the team level. Dubocage and Galindo (2014) claim that changes and especially replacement decisions of EFT members are not always undertaken in a sophisticated way advocated by strategic rationales, but frequently are executed precipitously and on grounds of 'rationalized myths' instead of actual performance evidences. Oftentimes the momentum of disruption in internal processes caused by the change is destabilizing and harmful for firm performance (Arrow, McGrath, & Berdahl, 2000). Other work, in contrast, regards team turnover as opportunity to restructure and reshuffle resources leading eventually to increased performance (Zellmer-Bruhn, 2003). Overall, empirical insights on EFT dynamics and their implications for new venture internationalization have remained scarce (Ucbasaran et al., 2003). Our aim is to figure out if there exist resource constellations in new ventures' team composition that are more supportive than others for early internationalization attempts.

By that, this article contributes to the international entrepreneurship in the following ways: First, by analyzing the role of founder(s) experiential knowledge in combination with consecutive VC acquisition and grafting, we importantly con-

[2] Entrepreneurial founding teams are defined in accordance with Klotz, Hmieleski, Bradley, and Busenitz (2014) as 'the group of individuals that is chiefly responsible for the strategic decision making and ongoing operation of a new venture' (p. 227). Similar definitions are used in other prior studies e.g. (Ucbasaran, Lockett, Wright, & Westhead, 2003). Conceptually the definition is similar to the more frequently used concept of top management teams. However, by using the specific term 'entrepreneurial founding teams', we intend to draw attention to the fact that this is the team constellation at the time of firm incorporation.

tribute to international stage and international new venture theory. The analysis sheds more light into how different international knowledge acquisition dimensions (separately and in combination) influence the internationalization process, a topic that has been under-researched for long and only recently gained scholarly interest (Casillas, Barbero, & Sapienza, 2015). Second, better insights into EFTs, their dynamics and demographic characteristics are needed against the background that venture capitalists spend much care on team aspects when selecting new investment targets and use founder replacement as an important control mechanism (Baum & Silverman, 2004; Hellmann & Puri, 2002). Similarly, in the ex post deal closure phase, venture capital investors spend much time on forming effective teams to pursue venture internationalization (Autio, 2005). It yet has to be evaluated how these strategies eventually affect new venture internationalization.

The empirical study is based on a unique sample of 99 new entrepreneurial ICT ventures that entered the Belgian business acceleration program iStart between 2012 and 2016. We monitored any outside equity funding, team changes and international activities as well as chronicled prior international knowledge of the founder(s). We focus on a group of firms for which internationalization is an important firm strategy – new high tech ventures. These firms are involved in the development of highly innovative (niche) products. Continuous R&D efforts are crucial for maintaining a competitive advantage in this sector. Consequently, given high R&D costs and a very specific sales market, domestic markets are often too small to break even. Entering foreign markets is thus a necessity for these ICT firms at an early development stage.

The paper proceeds as follows. In the next section we develop the theoretical framework this study is embedded in and derive hypotheses. Subsequently, we describe our sample and set out the applied methodology. After that, the established hypotheses related to firms' prior international resources and ex post resource acquisition and their implication for a firm's internationalization propensity and intensity are quantitatively tested. We then discuss the most important

findings. Some concluding remarks and avenues for further research are pointed out in the last section of this article.

5.2 International knowledge acquisition: Theory and Hypotheses

Newly founded ventures face various resource constraints impeding the scaling up of their business activities beyond their home market such as lack of foreign market knowledge (Eriksson & Chetty, 2003), a lack of internationalization skills and capabilities and 'liabilities of foreignness' issues (Hymer, 1976). Their familiarity with the foreign target market's business culture, laws and customs, as well as institutional settings is often deficient. Thus, a firm's initial international knowledge endowment and later-stage international knowledge acquisition are considered key drivers of international expansion as they help firms to overcome these challenges.

In the international entrepreneurship literature two approaches dominate the thinking on how new ventures overcome resource constraints hampering their international expansion: (1) International process theory (Johanson & Vahlne, 1977) and (2) international new venture theory (Oviatt & McDougall, 1994). In the international process theory (also "stage model" or "Uppsala model") the acquisition of international resources has been treated as an internal and incremental process, leading to the assumption that internationalization is a sequential process (Johanson & Vahlne, 1977). Consequently, only more mature organizations, that had sufficient time to build up international knowledge, are able to venture into foreign markets. A challenge to the international process theory has been the observation that some new high technology firms internationalize at a very young age without any domestic track record, at rapid speed, and without the chance for any 'learning by doing'. Turning away from the assumption that knowledge acquisition is an incremental internal process, international new venture theory assumes instead that entrepreneurs can tap external strategic partners' knowledge resources, their so-

cial networks, in addition to utilizing their own knowledge pool, to acquire the necessary background to discover and exploit internationalization opportunities (Oviatt & McDougall, 1994).

Common ground between the theoretical streams is their emphasis of the role of knowledge acquisition and learning for firm internationalization (Johanson & Vahlne, 2009). However, either model has largely fallen short in identifying how and which alternative knowledge sources, besides congenital learning (founders prior knowledge), experiential learning ('learning-by-doing') and connecting to network partners (vicarious learning), new ventures use to expand their international knowledge resources. Especially the role of external recruitment (grafting) (Huber, 1991) has been largely ignored in both streams (Fletcher & Harris, 2012). The gap persists even though Oviatt and McDougall (2005) declared no less than a decade ago that management teams and their dynamics should receive more attention as subjects under investigation for firm internationalization (McDougall, Oviatt, & Shrader, 2003). In the following sections, we address the interplay between EFTs and venture internationalization by developing testable hypotheses as to the association between early internationalization and the EFT's initial experiential knowledge base and any subsequent (international) knowledge acquisition through the entry of a venture capitalist and new manager recruitment.

Ganotakis and Love (2012) distinguish between two stages of internationalization: the *propensity* to engage in business activities in foreign markets and, consequently, the *intensity* with which the firm gets involved in exporting. They found that different sets of skills and capabilities are demanded from firms to enter and, respectively, succeed in internationalization. Based on their results, we test whether prior international experience and the subsequent resource accumulation through VC funding or EFT changes differently affect a firm's internationalization propensity and success.

5.2.1 Prior international experience of founder or founding team

Individual founders or entrepreneurial teams are at the source of any decision or action taken by a firm. The human capital of the founder imprints[3] a firm's strategic orientation as well as plays a key role for firm performance, e.g. in form of securing venture capital financing (Hsu, 2007) and growth (Colombo & Grilli, 2005). Research suggests that the international experiences obtained by the entrepreneur prior to launching a firm are key determinants of the internationalization behavior of firms later on (Andersson, 2000; Reuber & Fischer, 1997). Having worked or studied abroad enhances managers foreign language capabilities, provides them with access to international networks (Loane, Bell, & Cunningham, 2014) and raises their awareness of foreign markets (Tihanyi, Ellstrand, Daily, & Dalton, 2000). Consequently, it is suggested that any international knowledge accumulated prior to starting the business shapes the entrepreneur's stand towards internationalization strategies. Most prominently, McDougall, Shane, and Oviatt (1994) show that early internationalizing firms generally have founders possessing prior international experience. Bloodgood, Sapienza, and Almeida (1996) find a similar relationship between the EFT's prior international exposure and a firm's subsequent engagement in international activities. Manolova, Brush, Edelman, and Greene (2002) go a step further and dissect international human capital into different dimensions. They find evidence that internationalizing firms have managers with more international business skills (experiential knowledge obtained through international work and study assignments). In contrast, managers' international orientation (time spend abroad, travel experiences, foreign language proficiency) did not appear to be a distinguishing factor between entrepreneurial firms that internationalized and those that focused solely on the domestic market.

Also more recent studies show that different sorts of knowledge are required to enter and, subsequently, succeed in international markets. There is a distinction

[3] Imprinting theory (Baron et al., 2001; Johnson, 2007; Stinchcombe, 1965) describes the persisting impact of founding conditions on organizations' processes, routines, and culture.

between general and specific human capital of founders with respect to its utility for early internationalization. General human capital, acquired through a person's overall educational attainment, is hereby shown to be beneficial for both a firm's export propensity and intensity, whereas specific human capital, e.g. international work experience, only drives export propensity (Knockaert, Ucbasaran, Wright, & Clarysse, 2011; Stucki, 2016). Related, Ganotakis and Love (2012) acknowledge that technical and business education, i.e. general education, constitutes an important determinant for the success of small and medium sized firms in export markets (internationalization intensity). In contrast, international experience only matters for becoming an exporter (internationalization propensity), but not for any subsequent exporting success. Prior international experience enhances the likelihood of firms to start exporting activities mainly by moderating the risk associated with foreign market entry. To scale up firm's international engagement in these markets over a short time period, it is however rather the founder's ability to learn and adopt new capabilities and skills quickly, than reverting to existing international experiences, which appears to drive success. We state,

Hypothesis 1a: A founder's prior international experience positively influences the new venture's internationalization propensity.

Hypothesis 1b: A founder's prior international experience positively influences the number of sales representations a new venture establishes.

Prior international knowledge, e.g. in the form of expat work assignments, is generally highly context-specific. Hence, it is unlikely that we observe a similar directional causal relationship in the case of internationalization intensity, where the literature forwards that rather general management skills are required.

A firm's resource endowment on basis of the capabilities and skills of its founder or founding team members is unlikely to remain static over time. Entrepreneurial founding teams do not constitute steady state constructs, but tend to alter their constellation from a very early development stage on. Ventures often add and dis-

miss team members in order to match new competitive conditions during their development. Thus, a firm's resource composition may change by new managers joining the firm, adding new competences and skills, and founders that leave. In the next sections, we focus on firms' ability to attain international knowledge resources through grafting and the impact on venture internationalization of changes in firms' international knowledge endowment induced by VC entry and team turnover.

5.2.2 Venture Capitalist Entry

So far there is only few research linking the involvement of VCs with firm internationalization. Most obviously, VCs are regarded to provide for the liquidity needed to cover the additional costs related to entering foreign markets. However, VCs generally induce more resources in their target firms than merely monetary assets. Often they obtain a board seat in the company and get directly involved in its strategic business affairs. The value-addition of VCs through their hands-on involvement for firm performance in general has been widely stressed in the literature (De Clercq & Manigart, 2007). Fernhaber and McDougall-Covin (2009) identify two additional mechanisms how VCs may facilitate new venture internationalization besides providing financial resources. First, VC bring in their business experience and knowledge which can also extent to internationalization strategies. Second, VCs may be perceived by foreign business contacts as sign of credibility and thereby substitute for the lacking track record of their target firms.

Moreover, we have shown in the previous chapters of this dissertation, that also VC funds have become more internationally oriented over the past decade. The increasing cross-border experience and international knowledge of VC funds may thus potentially also benefit new ventures to identify foreign target markets and launch activities outside of their home market. Consequently,

Hypothesis 2a: Venture capital funding has a positive effect on a new venture's interna-

tionalization propensity.

There exist also arguments against the internationalization enhancing effect of VC. Entering foreign target markets, despite providing for new market opportunities, increases the risk to firm survival e.g. by encountering difficulties to overcome liability of foreignness related barriers leading to higher costs. Hence, some VC investors might appear reluctant to firm internationalization, or at least towards a rapid version of it. This view is propagated by the study of LiPuma (2006). Also George, Wiklund and Zahra (2005) do not find any statistical significant evidence that VC ownership increases the likelihood of firms to rapidly expand their global reach. However, it seems likely, that the additional monetary resources a VC introduces also allow for a larger internationalization scope of new ventures compared to those firms without these extra financial resources.

Hypothesis 2b: Venture capital funding has a positive effect on a new venture's internationalization scope.

When distinguishing the monetary input from the intangible knowledge resources a VC contributes to his/her target firm, Fernhaber et al. (2009) find that an investor's internationalization knowledge and reputation also support firm's internationalization intensity. In contrast to our sample, they however considered much older firms that underwent already an initial public offering [IPO]. Continuing their argumentation and based on the circumstance that VC-backed firms possess more financial resources to launch a more aggressive foreign market entry strategy, we arrive at the following hypothesis:

Hypothesis 2c: Venture capital funding has a positive effect on a new venture's internationalization scale.

Carpenter, Pollock and Leary regard the recruitment of internationally experienced managers, enabled by the financial injection of the VC, as the key mechanism through which VCs facilitate firm internationalization. The following section therefore deals

with new manager recruitment and its association with venture internationalization.

5.2.3 Grafting

EFTs in newly founded high-tech firms, even if consisting of individuals with prior international experiences, seldom possess the level of managerial and business skills necessary to lead an internationalizing firm. Thus, in practice, firms regularly strengthen their capabilities by recruiting or 'buying in' new team members e.g. functional specialists or marketing and sales experts. Gabrielsson, Kirpalani, Dimitratos, Solberg, and Zucchella (2008) stress in this context "either, the BG [born global] has an experienced founder or then it needs to acquire such experience early on."

Recruitment is supposed to be a quick means to increase the collective knowledge and skills endowment of the EFT (Ucbasaran et al., 2003). Besides member entry, some founders also decide to leave (voluntarily or involuntarily) the venture at an early stage. In this section we consider both, grafting in a traditional sense, in form of human capital recruitment, and changes in EFT's knowledge composition through founder exits and their impact on a startup's decision to enter foreign markets and subsequent international diversification.

Manager entry

New managers are commonly added to existing teams in order to respond to resource needs (Larson & Starr, 1993) and to acquire the human capital that is lacking for the strategies and goals envisaged by the firm (Ucbasaran et al., 2003). For an overview of rationales for new member addition see Forbes, Borchert, Zellmer-Bruhn, and Sapienza (2006). Team member turnover alters the human capital available in a firm. Up until now, prior studies have provided inconclusive re-

sults concerning the relationship between EFT expansion and new venture performance.

Proponents of grafting argue that member entry expands the resource base of a firm, potentially leading to improved venture performance and a higher rate of firm survival (Brinckmann & Hoegl, 2011). Adding team members is regarded as key to knowledge acquisition and knowledge diversity and positively related to the introduction of new strategic approaches (Klotz et al., 2014) and venture performance, at least in highly dynamic environments (Chandler & Lyon, 2009).

Given resource scarcity[4] in new entrepreneurial ventures, new members have the potential to expand the firm's resource and knowledge base and to deliver important inputs for strategic debate. Many startups in the high-tech field originate from academic spin-offs and their founding teams comprise primarily scientific and technically schooled members. EFTs in technology based new ventures are often quite homogeneous in their general and specific knowledge e.g. educational background, industry experience, capabilities and skills. Consequently, the recruitment of an outside manager may lead to more heterogeneous teams. For example, in case of product commercialization, the addition of team members with commercial experience is often used to overcome knowledge gaps (Knockaert et al., 2011). In a similar way, ventures that plan to internationalize may realize their lack of resources and search for managers with international experience to enhance their human capital stock.

Despite the potential of member addition to expand firms' human capital stock, adding a new team member requires firms to undertake additional coordination and integration efforts to effectively accommodate the new member within the existing team. The failure to integrate new members in current team structures may generate restrictions on team cohesion and create adverse effects for venture

[4]In the resource based view firms are regarded as unique bundles of resources, whereby inimitable and unsubstitutional resource combinations built the basis for competitive advantages (Barney, 1991).

performance. Consequently, manager recruitment can harm venture performance by limiting group consensus and dissolving the relational embeddedness between team members (Ensley, Pearson, & Amason, 2002; Messersmith, Lee, Guthrie, & Ji, 2013). However, with respect to the international expansion of large firms, Barkema and Shvyrkov (2007) suggest that management teams overall benefit from the impetus new members generate. New team members introduce new perspectives and resurrect debates on the firm's strategy outlook, which countervails rigidity and strategic inertia.

In summary, for strategic innovation such as a firm's decision to enter foreign markets, EFT turnover in the form of team member entry may increase the firm's knowledge resources through grafting on the skills of the new member, which may positively affect the propensity of firms to engage in international activities. We state,

Hypothesis 3a: Manager recruitment is positively associated with a new venture's internationalization propensity.

Similar to the assumed positive relation between a founder's international human capital and the propensity for firm internationalization, the recruitment of managers with international experience may constitute a larger asset for the firm's early internationalization. Adding specifically members with prior international experience elevates the organization's international resources, potentially facilitating the development and implementation of foreign market expansion strategies. This is also supported by human capital theory, which stresses that a better fit between the human capital deployed and the work context is associated with higher economic benefits. Related, Shrader and Siegel (2007) emphasize the long-term performance benefits for high-tech entrepreneurial ventures arising from a better alignment of the capability composition of the top management team and the venture's strategy. Consequently,

Hypothesis 3b: International experience will moderate the positive effect of manager entry on a new venture's internationalization propensity, such that the effect will be

stronger for EFTs recruiting managers with prior international knowledge.

Hypothesis 3c: International experience will moderate the positive effect of manager entry on a new venture's internationalization scope, such that the effect will be stronger for EFTs recruiting managers with prior international knowledge.

Internationalization intensity, in contrast, is primarily regarded as managing decision requiring managerial knowledge and skills (Ganotakis & Love, 2012). As previously elaborated, specific human capital is found to mainly exert its effect on overcoming the hurdles of entering foreign markets. Once the firm has made the decision to internationalize, it is general human capital that is required to enhance a firm's export success. However, given the assumption that grafting also expands a firm's cumulative knowledge base, manager recruitment is likely to increase a firm's exposure to foreign markets. We state,

Hypothesis 3d: Manager recruitment is positively associated with a new venture's internationalization scale.

Founder exit

The changing resource needs of a growing organization may require the adjustment of its founding team. Although the most commonly studied scenario in this respect is the entry of a new team member, many young startups experience EFT changes in the form of team member exits. The motivation for founder exit is often a misfit between the exiting team members views or capabilities and the firm's new strategic outlook and its altered knowledge and capability needs. Again, like in the case of new member recruitment, entrepreneurship literature has dealt with the phenomenon of founder exits (Bamford, Bruton, & Hinson, 2006; Chandler, Honig, & Wiklund, 2005; Oertel & Walgenbach, 2012), however empirical evidence on how founder succession impacts venture performance and especially venture internationalization is still rare (Guenther, Oertel, & Walgenbach, 2016).

From a resource-based view, succession events imply a loss of skills and capabilities potentially endangering firm growth and performance (Hausknecht & Trevor, 2011; Haveman & Khaire, 2004; Messersmith et al., 2013). Organizational research emphasizes that employment turnover and founder changes are destabilizing routines and adversely affect organizational performance, at least in the short-run. Especially in high-tech startups, turnover is found to be detrimental and CEO changes seem to negatively affect revenue growth (Baron, Hannan, & Burton, 2001). Founder succession may have a particularly pronounced adverse effect in knowledge intensive firms, as those firms' key competitive asset is founders' human capital e.g. technical expertise. If an entrepreneurial academic founder leaves the firm, bottlenecks and delays for the further technical development of the product may arise.

Yet others see a key strategic resource for firm development in founders' social capital (Shane & Stuart, 2002). It increases the likelihood of firm survival. The departure of executives may cause the decline of a firm's social network and the emergence of structural holes in social capital. Overall, founder exits that take place during the first years of firm foundation increase the firm's hazard rate (Guenther et al., 2016).

Much less evidence exists with respect to founder succession in the context of firm internationalization. A notably exception is the study by Loane et al. (2014) where they forward that EFT exits constitute 'critical incidents' in the development of the venture that offer the opportunity to remove redundant resources and reshuffle remaining ones. The more efficient use of existing resources is supposed to lead to a more rapid internationalization process. Thus, member exits affect the knowledge and skill base of ventures, however not necessarily in a restrictive way. They have the potential to create a momentum for growth enhancing resource recombination. Beckman, Burton, and O'Reilly (2007) show that founder exit increases the odds of a young firm to launch an initial public offering. They suggest that it may be the worst performing founder that leaves the firm and therefore founder exit may

have a performance enhancing effect. The results are also congruent with the theoretical prediction of Chandler et al. (2005), who view turnover in management teams as adaptive mechanism to changing external environmental factors. The authors hypothesize that executive departure eventually leads to increased performance, because the poorest performers are most likely to exit the firm first. Nevertheless, their study lacks any significant empirical support for this relationship.

Summing up, organizational researchers have provided vast evidence that succession events entail adverse consequences for firm performance and firm survival by interfering with group processes and leading to a loss in resource capabilities. In contrast, when specifically scrutinizing firm internationalization, executive exit appears in a study by Loane et al. (2014) to constitute a mean for cost savings, redeployment of resources, and strategic reorientation, which positively affect foreign market entry and diversification. Given the overall very inconclusive evidence on the direction of the effects, we refrain from establishing any directional hypotheses concerning founder exit and new ventures' internationalization propensity and intensity.

5.3 Study context, data, and variable definition

The aim of the empirical approach is to assess the effect of different international knowledge acquisition processes on firms' likelihood to internationalize at an early development stage and their consequent international growth path. In order to test our hypotheses, a sample of firms is desirable that is relatively homogeneous in its firm-level characteristics, however differs in their international knowledge acquisition processes and endowment.

The population under study consists of young innovative ICT firms that were part of the iStart business acceleration program of a world-leading independent research institute in the fields of nano-electronics and digital technologies, the Inter Univer-

sity Micro Electronics Center [imec] based in Leuven, Belgium. The iStart program has been set up in 2011 by the Flemish government to stimulate innovation in ICT. It provides young high tech firms with support in R&D, commercial activities, and coaches them during the search for external financing[5]. The initiative provides an interesting context for this study, because it allows for an extensive and detailed data collection on EFTs' international knowledge endowment and acquisition as well as on their internationalization process. Moreover, firms in the sample are relatively homogeneous with respect to industry conditions, initial firm characteristics (i.e. firms entering the accelerator are not older than 2 years, mostly team founded, have developed a proof of concept etc.), and support programs. A similar single site sample selection has been tested in, among others, Knockaert et al. (2011) and has been found to produce valuable results.

Firms in the sample are monitored during their early development phase and were not older than 6 years at the time data collection was finished. All firms entered the business acceleration program no later than 2 years after their incorporation. Both active firms and those that quit their activities are included in the sample, in that, our dataset is unlikely to show any survivorship bias. By exclusively focusing on new ventures that did not have an IPO yet and are independently owned, our sample distinguishes itself from prior studies (Knockaert et al., 2011) on new ventures and EFT characteristics. For data collection reasons, usually it is referred to much older ventures and publicly traded firms where data on firm development, funding and EFT characteristics is more readily and publicly available.

The sample is nevertheless distinct from the general startup population on two related dimensions. First, survival rates among new ventures participating in the acceleration program are around 80 per cent and thus higher than among non-participants. Second, Ganotakis and Love (2012) indicate that firms situated in science parks are generally more likely to engage in exporting activities. A com-

[5] Firms that have a minimal viable product or developed a proof of concept receive 50.000 Euro in seed capital, coaching, mentoring as well as facilities. The portfolio included over 130 companies as of 2017 of which the majority is younger than 2 years.

parable effect can be assumed for incubation and acceleration programs. In that, our sample is prone to slightly overstate the internationalization likelihood of firms compared to the general startup population. Both issues should nevertheless not have any distorting impact on the role of knowledge acquisition for firm internationalization.

The final sample includes information on 99 new ventures founded between 2011 and 2016. Whereby 45 firms reported some international activity and 24 firms received VC. Further, we denoted 21 executive entries and 21 team member exits. 29 EFTs possess prior international experiences. Table 5.3.3 provides an overview of the distribution of firms by international involvement along a number of key indicators.

Performance indicators and team changes were traced by and provided for by the management of the incubator. Biographical information as to the international experience of either founder(s) or newly joining manager(s) were collected through CVs submitted by the startups in course of applying for the accelerator program as well as LinkedIn profiles.

5.3.1 Dependent Variables

We use two dimensions to proxy new venture internationalization: (1) internationalization propensity and (2) internationalization intensity. International activity data is available from 2012 to 2016, nevertheless, the panel is unbalanced given the different starting dates of firms in the sample. Consequently, due to the short longitudinal nature of the data collection, we revert to employing a cross-section representing the status quo of firm internationalization as of 2016. If data was available over several years e.g. for revenues, we calculated an average value.

Internationalization propensity indicates whether the new venture has committed to any international activities. It refers to the decision of a firm to scale up outside

of its home market. For each firm it was investigated if it either denoted international revenues during the period of observation, set up a foreign sales representation, undertook R&D expenditures abroad and/or completed parts or all of its production abroad. The existence of any business activities outside the firm's domestic market is indicated by a dummy variable taking on the value of one, whereas the value of zero is representing cases where the firm has been solely focusing on activities in its home market.

Internationalization intensity measures the extent of a firm's international involvement. Two proxies are introduced to capture a firm's international diversification: First, *international revenues*, representing the ratio of revenues created from international activities to total revenues, is applied. (In case the firm had international revenues over several consecutive years during the period of observation, we take an average value.) It reflects a firm's success in foreign markets. Second, a firm's internationalization scope, the number of markets it has started any sales activity in, is used. As proxy, we construct the variable *sales rep* capturing the number of countries a startup has set up a sales representation in.

5.3.2 Independent Variables

The key independent variables relate to new ventures' (international) knowledge base and knowledge acquisition strategies. We distinguish between three acquisition processes: congenital knowledge transfer, VC entry, and knowledge obtained through ex post foundation grafting. In addition, we also test the effect of EFT exit.

Congenital learning. The variable *Congenital learning* represents the international knowledge base of the firm at foundation. It describes the presence of any work and study experiences abroad that have been accomplished across all founders of the venture. Similar to prior studies, we use this variable in a dichotomous form (Bloodgood et al., 1996; Reuber & Fischer, 1997).

VC entry. The variable *Venture capital* takes on the value of one if the new venture has obtained VC funding before starting international activities and zero otherwise.

Grafting. Learning through the addition of human capital is measured in two ways: (1) We denote if the startup recruited any new members to its team before its first international activity (*EFT entry*). (2) We looked into whether the new manager that joined the firm also brought in any international study or work experience (*EFT entry intl exp*). All variables are expressed as binary dummy variables. Furthermore, any *EFT exit* is considered. If any founders have left the firm before internationalization, the binary variable takes on the value of one.

5.3.3 Control Variables

We include a number of control variables into the model that we believe impact firms' international activities. They are selected based on prior empirical evidence and theoretical considerations.

Firm size. Larger firm size may influence the human capital stock of a firm and its ability to pursue activities outside its home market (Tihanyi et al., 2000). In accordance with prior studies, firm size is measured as the average number of fulltime employees throughout the period of observation (*Ln Employment*). We take the log form to account for any skewness. Often employment growth is also taken as proxy for firm performance. A disadvantage of this measure is nevertheless that new ventures may denote increasing sales performance, however keep operating with a constant employment stock.

Equity funding. The accelerator itself provides firms with up to 50.000 Euro. In addition, startup's can obtain funding from business angels and venture capitalists. The total amount of external capital acquired by the firm is expressed by *Ln (equity) funding*. The natural logarithm is taken to correct for skewness.

Firm performance. Ganotakis and Love (2012) raise the concern that exporting and firm productivity is correlated. Firms that are more productive domestically might be more likely to export and even show a better export performance. To control for this effect, the models include (average) firm revenues (*Ln Revenues*).

Firm foundation year (Firm age). The age of a firm may affect both its decision to internationalize and its performance. Several studies have shown that there exists a positive relationship between firm age and firm internationalization and performance (Autio, Sapienza, & Almeida, 2000). As the firm matures, it gathers more experiences through learning by doing as well as other resources. We therefore control for the year in which the firm was legally incorporated i.e. its foundation year[6]. This allows us to account for any age group differences and ensure that our results are not driven by any age-related or historical processes (Vandenbroucke, Knockaert, & Ucbasaran, 2016).

Team size. We also include controls at the EFT level. Human capital has been identified as important determinant of young firm development and performance (Brüderl, Preisendörfer, & Ziegler, 1992; Teece, Pisano, & Shuen, 1997). We follow Carpenter, Geletkanycz, and Sanders (2004) stressing the important role of the EFT size for firm outcome. Team size can be regarded as proxy for the quantity of human capital resources available to the firm. Clarysse and Moray (2004) find that the optimal team size is around four persons. If more people are involved in a team, inefficiencies are rapidly increasing. Overall, it has been forwarded that firms started by entrepreneurial teams outperform those of single founders. Their better performance tends to be related to their larger collective set of resources as each team member contributes to the human capital stock of the firm (Ucbasaran et al., 2003). *Team* represents a binary variable coded one if the startup was founded by a team and zero if founded by a solo entrepreneur[7].

[6]We also test for firm maturity by coding firm age into six categories, which indicate the years between firm incorporation and the end of the period of observation in 2016. Results for the main effects remain unchanged (Model available on request).

[7]We also test the robustness of the measure by including the exact number of team members at foundation. Results remain stable.

Trade promotion. The accelerator provides counseling with respect to setting up a foreign sales representation. We consequently control for any trade support programs a firm has participated in. Trade support programs are assumed to positively affect internationalization. *Trade promotion* is a binary variable taking on the value of one if firms enrolled in any trade supporting initiative offered by the accelerator and zero otherwise.

A positive relation between firm internationalization and firm age, size, funding, and revenues is expected as larger, older, as well as better performing firms possess more resources and knowledge to expand their market. Also team size and participation in a trade promotion program are expected to enter positively signed in the following models.

Table 5.3.1: Descriptive statistics

Statistic	N	Mean	St. Dev.	Min	Max
Firm characteristics					
Employment	99	3.994	3.813	0.900	29
Firm age	99	1.939	1.490	0	5
Venture capital	99	0.242	0.431	0	1
Ln (equity) funding	99	12.123	1.407	9.619	16.139
Ln revenues	99	8.036	5.132	0	15.225
Trade promotion	99	0.313	0.466	0	1
EFT					
Team	99	0.949	0.220	0	1
Founder (count)	99	2.414	0.729	1	5
Congenital learning	99	0.293	0.457	0	1
EFT entry	99	0.212	0.411	0	1
EFT exit	99	0.212	0.411	0	1
EFT entry intl exp	99	0.141	0.350	0	1
Internationalization					
Firm intl. activities	99	0.455	0.500	0	1
Sales rep	99	0.303	0.942	0	8
International revenues	99	0.394	0.491	0	1
International revenues (share)	99	0.162	0.266	0	1
International R&D	99	0.081	0.274	0	1
International production	99	0.061	0.240	0	1

Table 5.3.2: Correlation coefficients

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Founder (count)	1												
2. Ln revenues	0.070	1											
3. Intl revenues	0.100	0.319	1										
4. Ln employment	0.148	0.805	0.334	1									
5. Sales rep (count)	−0.020	0.825	0.359	0.769	1								
6. EFT entry	−0.010	−0.159	−0.231	−0.212	−0.200	1							
7. EFT entry intl exp	-0.048	−0.125	−0.247	−0.201	−0.208	0.747	1						
8. EFT exit	−0.180	0.055	−0.050	0.009	0.062	0.0632	0.000	1					
9. Congenital learning	−0.061	−0.101	−0.015	0.007	0.019	0.000	0.229	0.090	1				
10. Team	−0.448	0.132	0.111	−0.086	0.024	0.063	0.027	0.063	0.036	1			
11. Trade promotion	−0.124	−0.077	−0.249	−0.386	−0.315	0.049	0.007	0.164	0.000	0.106	1		
12. Venture capital	−0.131	−0.307	−0.445	−0.547	−0.344	0.139	0.075	0.034	0.024	0.000	0.355	1	
13. Ln (equity) funding	0.395	0.221	0.351	0.434	0.179	−0.131	−0.032	0.075	−0.178	−0.165	−0.400	0.710	1

Table 5.3.3: Distribution of population by international involvement

	International		Domestic	
	Freq	Percent	Freq	Percentage
Firm characteristics:				
Firm status				
Acquired	1	2.2	0	0.0
Active	42	93.3	44	81.5
Stopped	2	4.4	10	18.5
Employment (FTE)				
1-5	32	71.1	50	92.6
> 5	13	28.9	4	7.4
Firm age				
0-1 year	15	33.3	30	55.6
2 years	11	24.4	10	18.5
3 years	8	17.8	4	7.4
4 years	9	20.0	8	14.8
5 years	2	4.4	2	3.7
Venture capital				
Yes	21	46.7	3	5.6
No	24	53.3	51	94.4
Trade promotion				
Yes	21	46.7	10	18.5
No	24	53.3	44	81.5
EFT characteristics:				
Founders (count)				
1	3	6.7	2	3.7
2	23	51.1	32	59.3
3	18	40.0	16	29.6
4	1	2.2	2	3.7
5	0	0.0	2	3.7
Total	45	100.0	54	100.0

Distribution of population by international involvement (continued)

	International		Domestic	
	Freq	Percent	Freq	Percentage
Congenital learning				
Yes	14	31.1	15	27.8
No	31	68.9	39	72.2
EFT entry				
Yes	14	31.1	7	13.0
No	31	68.9	47	87.0
EFT exit				
Yes	10	22.2	11	20.4
No	35	77.8	43	79.6
EFT entry intl exp				
Yes	10	22.2	4	7.4
No	35	77.8	50	92.6
Internationalization:				
Firm intl. activities				
Yes	45	100.0	0	0.0
No	0	0.0	54	100.0
Sales representation				
Yes	19	42.2	0	0.0
No	26	57.8	54	100.0
International revenues				
Yes	38	84.4	0	0.0
No	7	15.6	54	100.0
International R&D				
Yes	8	17.8	0	0.0
No	37	82.2	54	100.0
International production				
Yes	6	13.3	0	0.0
No	39	86.7	54	100.0
Total	45	100.0	54	100.0

5.4 Methodology

Given that the dependent variable in the first scenario (firms' internationalization propensity) is dichotomous, we employ multiple logistic regression techniques. Ordinary least square regression is used to analyze the scale of foreign activities and Poisson regression models when predicting a firm's international scope.

5.5 Results

Table 5.3.1 presents descriptive statistics for the variables used in the subsequent analysis. Table 5.3.2 provides correlation coefficients. Multicollinearity may constitute an issue between the variables *Ln employment* and *Ln revenues*. We therefore include them separately in all models. Results remain robust for both specifications. Following, only models using *Ln revenues* are reported as this variable traces more narrowly firm performance for young firms (Bruneel, Clarysse & Autio, 2017). Because we operationalize firm internationalization by three distinct concepts, we estimate two sets of models that are presented in Table 5.5.1 (internationalization propensity) and Table 5.5.3 (internationalization scale) and, respectively, Table 5.5.2 (internationalization scope). Model 1 in each Table represents the baseline model and solely includes control variables.

Internationalization propensity

In contrast to the hypothesized value adding effect of congenital knowledge transfer, founders' prior international human capital has no statistically significant effect on a startup's internationalization propensity (Table 5.5.1 Models 2-7). Hence, no support is found for Hypothesis 1a. This finding contradicts Ganotakis and Love (2012) and Stucki (2016) who find a positive effect of prior specific human

capital in the case of export propensity. Nevertheless, other recent studies have put in doubt the utility of congenital learning in the case of internationalization. Presutti et al. (2007) and Fernhaber and Li (2013) forward that the international experience of founders is not sufficient for startups to engage and succeed in foreign markets. Only the further professionalization of the firm by means of adding outside human capital provides for the conditions to scale-up activities abroad. In that, the internationalization of young high tech ventures can be regarded as a complex process that requires context specific international managerial experience instead of more coincidentally attained international knowledge during prior study or work stays abroad.

Consistent with Hypothesis 2a, VC investor involvement is positively and statistically significant ($p < .05$) associated with the likelihood of a startup to engage in international activities. The effect remains robust also in subsequent models (Models 4-7) where main effect predictor variables are added (congenital knowledge transfer and knowledge acquisition through grafting as well as knowledge reorganization through EFT exits). In contrast, the size of equity funding a firm has obtained is not statistically significantly related with internationalization propensity in our models. This result points towards the finding of other studies that VCs not only provide funding, but also add strategic and management advice. In case of early firm internationalization, it may be especially knowledge resources that are missing in these firms and that prevent them from going abroad. A second rational behind the findings is that the size of equity funding shows not yet a large variation between the samples firms. Consequently the effect may be less pronounced than for later stage firms, where equity funding size shows larger variations.

For early changes in EFT constellations in form of general member recruitment, no statistically significant association with the entry of startups into foreign markets is detected. According to Model 6 in Table 5.5.1, it is rather the entry of new members with prior international experiences that make startups' more likely to engage in business activities outside of their home market. The models do not sup-

Table 5.5.1: Multiple regression results - internationalization propensity

	Dependent variable:						
	Internationalization propensity						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
EFT entry					0.941		
					(0.647)		
EFT entry intl exp						0.960*	
						(0.582)	
EFT exit							0.963
							(0.684)
Venture capital				1.953**	1.897**	1.846**	1.936**
				(0.892)	(0.899)	(0.900)	(0.891)
Ln funding			0.450**	0.043	0.056	0.089	0.092
			(0.214)	(0.281)	(0.291)	(0.294)	(0.289)
Congenital learning		0.024	−0.182	−0.039	−0.001	0.083	0.058
		(0.505)	(0.531)	(0.551)	(0.558)	(0.566)	(0.564)
Team	−0.602	−0.601	−1.076	−0.709	−0.959	−1.169	−1.037
	(0.964)	(0.965)	(1.022)	(1.048)	(1.066)	(1.092)	(1.082)
Trade promotion	1.557***	1.558***	1.189**	1.062*	1.127*	1.302**	1.315**
	(0.540)	(0.540)	(0.570)	(0.594)	(0.607)	(0.632)	(0.630)
Ln revenues	0.206***	0.206***	0.175***	0.176***	0.165***	0.171***	0.178***
	(0.056)	(0.056)	(0.058)	(0.061)	(0.061)	(0.060)	(0.061)
Constant	−1.854*	−1.862*	−6.420***	−2.242	−2.285	−2.719	−2.836
	(1.102)	(1.118)	(2.488)	(3.103)	(3.193)	(3.229)	(3.200)
Observations	99	99	99	99	99	99	99
Log Likelihood	−54.011	−54.010	−51.637	−48.927	−47.846	−47.511	−47.914
Akaike Inf. Crit.	116.021	118.019	115.274	111.853	111.691	111.022	111.827

Note: *p<0.1; **p<0.05; ***p<0.01. Standard error in parentheses.

port Hypothesis 3a, which asserts that EFT addition at an early development stage is positively linked with the likelihood of strategy innovations in form of venture internationalization. However, Hypothesis 3b is confirmed, stating the positive effect of the entry of internationally experienced managers on the internationalization propensity of ventures. Recruiting a new team member that brings along international experiences increases the odds of denoting activities outside of the home market by a factor of 2.6 ($\exp(0.960)=2.612, p < .1$).

According to Model 7, team member exit is not statistically significant associated with firms' international engagement. Based on the positive sign of the coefficient we may conjecture that team exits are not highly detrimental to firm internationalization. Given the non-significant nature of the coefficient, this explanation is however merely speculative. Theory provides so far inconclusive evidence for the relationship between founder exit and firm development. Consequently, no directional hypothesis has been formulated. Given the convincing theoretical base for a relationship between founder succession and internationalization, we urge for more research regarding the actual presence of such link.

In addition, the decision to internationalize does not appear to be related to initial EFT size. The coefficient of *Team* is negative but not statistically significant. In our sample, firms founded by a team instead of a single entrepreneur[8], i.e. firms that possess a larger amount of collective knowledge resources at foundation, do not have a higher likelihood to expose their firms to international markets. The direction of the coefficient is in line with Amason, Shrader, and Tompson (2006).

In accordance to our expectations, firms that create higher revenues are more inclined to engage in foreign market activities. Indirectly, this also hints towards the claim that especially in countries with small market economies like Belgium the domestic market quickly exceeds its competitive capacities for high-technology firms and firms start looking abroad for new business opportunities (Debrulle &

[8]We also test the robustness of the dichotomous team variable by replacing it with the exact number of team members in each EFT. Results remain similar.

Maes, 2015; Stucki, 2016).

Summing up, the results presented in Table 5.5.1 align with international new venture theory by conveying that new ventures advance their internationalization by making use of external knowledge acquisition in form of the involvement of venture capitalists. The findings also indicate that grafting of task-specific skilled personnel is an important mechanism for new ventures to attain internationalization knowledge. However, the results contradict earlier propositions concerning the imprinting effect of the prior knowledge and experiences of the entrepreneur on venture internationalization. Our intuition is that currently general international experience through short-term study or work stays abroad, especially in the case of academic spin-offs, is widely available. Thus, only more context-specific international know-how may be perceived as facilitating the decision to internationalize. The findings relate to practical evidence from the VC finance industry. VC investors frequently regard the addition of (experienced) new managers as crucial step towards the professionalization of the EFT and an important prerequisite for their prospective involvement in the target firm (Hellmann & Puri, 2002).

Internationalization intensity

Similar to the previous scenario (firms' internationalization propensity), no statistically significant association between EFTs' accumulated prior international experience and their internationalization revenue ratio Table 5.5.3 and international scope Table 5.5.2 can be established for the young firms in our sample. The involvement of a VC investor, in turn, increases international diversification in both scenarios, internationalization scope (Table 5.5.2) and scale (Table 5.5.3). Consequently, Hypothesis 2b and 2c are confirmed. Again, the size of funding does not show any statistically significant association with internationalization intensity and scope.

For the scope of startups' international activities in form of the number of sales

representations they set up, we find a positive and statistically significant association with both general and specific human capital additions (Table 5.5.2 Models 5 and 6). Hypothesis 3c, suggesting that manager entry is positively associated to internationalization scope and that international experience moderates this effect positively is consequently corrobated.

The results in Table 5.5.3 suggest that the targeted recruitment of a manager with a professional international background is facilitating international revenue creation (Model 6). Adding an internationally experienced manager inflates the ratio of international revenues to total revenues. No statistically significant relation is however found between general human capital accrual and internationalization intensity. Consequently, Hypothesis 3d is not confirmed. Contrary to prior studies (Ganotakis & Love, 2012), a lasting beneficial impact of the international experience of new members is found on firms' internationalization scale. Our intuition is that if team members with international experience are recruited shortly before the firm expands internationally, the prior international experience of the manager may be more target specific. It constitutes a better human capital fit and therefore behaves performance enhancing also in case of internationalization intensity.

The association between member exit and a firm's international revenue ratio is positive though statistically insignificant (Table 5.5.3 Model 7). In the case of international sales activities a negative coefficient for the EFT exit variable is denoted, however likewise statistically insignificant (Table 5.5.2 Model 7).

Total revenue-wise larger firms also denote a larger share of international revenues as well as number of sales representations. In addition, we find a pronounced increase in the number of foreign sales representations firms establish, if they were enrolled in the internationalization mentoring program of the accelerator. Given the main objective of the trade promotion program was the provision of coaching to help firms in setting up foreign sales offices, this can be recorded as success. Though no statistical significant association has been found between international revenue creation and the trade promotion program in the full models in Table 5.5.3

Models 3-7. However, this might indicate that it takes some time for firms after setting up a sales representation to also create revenues.

Overall, we urge caution in interpreting the findings regarding the relationship between a firm's international knowledge stock acquired through congenital learning, VC involvement or grafting and international revenue creation. The period of observation of firms' international activities has been relatively short. Especially in case of revenue creation in foreign markets, it might take longer for young firms to deploy foreign sales activities and report results.

5.6 Conclusion

In this paper, we investigated the effect of different international knowledge acquisition processes on the likelihood, scope and intensity of early firm internationalization. We conceptualized knowledge acquisition in four ways. First, we analyzed the value-adding effect of a firm's inherited international resources through its founders' prior international experiences. Second, we assumed that VC funding may have an impact on the international knowledge base of a startup. Third, we considered situations where firms acquired and grafted on new members with and without prior international experience. Lastly, driven by the observations that many startups experience team member exits in their early development, we examined succession events and the opportunity they offer for growth enhancing resource recombination.

Using data on 99 new ventures in the IT industry that were part of the Belgian incubation program iStart between 2012 and 2016, we find that firms rather "grow" international as that they are "born" international. Inherited international knowledge by the founders is not determining the internationalization behavior of firms. Whereas prior research has argued that past experiences of entrepreneurs imprint the organization and its consequent strategy formulation process, we do not find

Table 5.5.2: Regression results - internationalization scope

	Dependent variable:						
	Sales rep						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
EFT entry					0.655*		
					(0.388)		
EFT entry intl exp						0.894**	
						(0.440)	
EFT exit							−0.396
							(0.544)
Venture capital				1.251**	0.802*	0.842*	0.916**
				(0.555)	(0.473)	(0.459)	(0.461)
Ln funding size			0.023	−0.186			
			(0.128)	(0.155)			
Congenital learning		−0.256	−0.286	−0.100	−0.389	0.033	−0.332
		(0.416)	(0.449)	(0.463)	(0.422)	(0.473)	(0.420)
Team	−1.274	−1.297	−1.322	−1.050	−1.513*	−1.447*	−1.222
	(0.837)	(0.837)	(0.849)	(0.875)	(0.857)	(0.852)	(0.848)
Trade promotion	1.938***	1.926***	1.900***	1.684***	1.544***	1.591***	1.567***
	(0.502)	(0.502)	(0.524)	(0.533)	(0.538)	(0.532)	(0.526)
Ln revenues	0.268***	0.275***	0.271***	0.201***	0.200**	0.183**	0.211***
	(0.085)	(0.086)	(0.089)	(0.076)	(0.082)	(0.077)	(0.081)
Constant	−3.890***	−3.862***	−4.068**	−1.432	−3.192***	−3.238***	−3.394***
	(1.181)	(1.192)	(1.652)	(1.966)	(1.148)	(1.101)	(1.132)
Observations	99	99	99	99	99	99	99
Log Likelihood	−55.540	−55.344	−55.328	−52.758	−52.066	−51.451	−53.178
Akaike Inf. Crit.	119.079	120.688	122.656	119.516	118.132	116.903	120.357

Note: *p<0.1; **p<0.05; ***p<0.01. Standard errors in parentheses.

Table 5.5.3: OLS regression results - internationalization scale

	Dependent variable:						
	International revenues						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
EFT entry					0.092		
					(0.057)		
EFT entry intl exp						0.082*	
						(0.049)	
EFT exit							0.083
							(0.057)
Venture capital				0.154*	0.140*	0.135*	0.151*
				(0.078)	(0.078)	(0.078)	(0.078)
Ln funding size			0.049**	0.018	0.019	0.020	0.018
			(0.020)	(0.025)	(0.025)	(0.025)	(0.025)
Congenital learning		−0.018	−0.042	−0.030	−0.029	−0.020	−0.022
		(0.052)	(0.052)	(0.051)	(0.051)	(0.051)	(0.051)
Team	−0.114	−0.116	−0.167	−0.135	−0.160	−0.173	−0.158
	(0.110)	(0.111)	(0.110)	(0.109)	(0.109)	(0.110)	(0.110)
Trade promotion	0.133**	0.133**	0.080	0.063	0.063	0.075	0.080
	(0.052)	(0.052)	(0.055)	(0.055)	(0.054)	(0.055)	(0.055)
Ln revenues	0.021***	0.021***	0.017***	0.016***	0.015***	0.016***	0.016***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Constant	0.059	0.065	−0.426*	−0.100	−0.102	−0.120	−0.107
	(0.117)	(0.118)	(0.228)	(0.279)	(0.277)	(0.277)	(0.278)
Observations	99	99	99	99	99	99	99
R^2	0.246	0.247	0.294	0.322	0.341	0.343	0.338
Adjusted R^2	0.222	0.215	0.256	0.278	0.291	0.292	0.287
Residual Std. Error	0.235 (df = 95)	0.236 (df = 94)	0.229 (df = 93)	0.226 (df = 92)	0.224 (df = 91)	0.224 (df = 91)	0.225 (df = 91)
F Statistic	10.328***	7.703***	7.747***	7.299***	6.738***	6.784***	6.628***
df	(df = 3; 95)	(df = 4; 94)	(df = 5; 93)	(df = 6; 92)	(df = 7; 91)	(df = 7; 91)	(df = 7; 91)

Note: *p<0.1; **p<0.05; ***p<0.01. Standard errors in parentheses.

evidence for this claim with respect to the international experience of founders and venture internationalization. Only if international knowledge has been acquired after incorporation through the recruitment of new managers, it appears to be value adding for firm internationalization. Especially the involvement of a VC investor is persistently benefiting international expansion throughout all specifications. The rapid professionalization of the human capital base of a startup seems to increase the odds for an early entry into foreign markets. Consequently, we argue that organizations benefit from bringing in outsiders to the EFT. In contrast, with respect to internationalizing intensity, knowledge acquired by grafting only exerts a weak effect.

The findings have important implications for the entrepreneurial community. Venture capital investors often base their funding decisions on the screening and assessment of founding team compositions. We show that at least in the case of early firm internationalization, EFT's inherited international expertise plays an insignificant role. Furthermore, the professionalization of an EFT through new member accrual is often based on process heuristics. In this study, we provide empirical evidence for the performance enhancing effect of new member entry with respect to firm's international expansion.

Though not our initial research objective, our results revealed a large positive effect of trade promotion programs on the establishment of foreign sales representations. This suggests the importance of trade support initiatives for new ventures. Policy-makers should be aware of the impact and attractiveness of these initiatives for starting entrepreneurs. Export promotion agencies offering context-specific assistance to young firms that strive for rapid internationalization appear to be an effective option for public policy agents to foster the growth and global competitiveness of young high tech firms. However, the role of trade promotion programs for venture internationalization has only been marginally treated in our analysis, though the results are noteworthy. We therefore strongly encourage further enquiry on the optimal set up of similar initiatives e.g. which knowledge and resource

constraints have to be addressed to effectively and sustainably foster new venture internationalization?

Limitations and Future Avenues for Research

Though our results reveal evidence that startups which early on expand their human capital base through targeted recruitment have been more likely to engage in international activities shortly after, findings have to be interpreted cautiously. Our data does not allow for making any inference about the causality between the decision to internationalize and the expansion of the EFT. We cannot tell if it is the new team member that triggers strategic changes towards internationalization or if a new manager entry is a response to the changing needs of the expanding organization. Our findings nevertheless draw a link between knowledge acquisition through VC funding and grafting and new venture internationalization.

While our sample of firms is carefully chosen and contains highly granulated data, it is still limited to Belgian firms participating in a single business acceleration program. It consequently has to be tested if the results are generalizable in other contexts. The internationalization timing and speed may vary between new ventures participating in an business accelerator program and those that are not (self-selection bias). In addition, expanding the sample to include firms not part of the accelerator will lead to an increase in sample size, further adding to the generalizability of results.

Another extension of our work and avenue for future research would be to look into new venture team dynamics beyond binary member entry and founder exit e.g. by employing a temporal focus. The time dispersion of EFT changes (frequency and timing) and its subsequent effect on internationalization performance has not yet extensively been studied in international entrepreneurship research. Besides, introducing more specific knowledge variables on EFT members may offer important clues if it is e.g. prior work or rather study experience, that matters for subse-

quent internationalization as well as information as to any threshold level of such experiences.

Though, our results did not reveal any immediate association between EFT's prior international experiences and firm internationalization, future research could analyze though if there exists any interaction between the prior international experience of founders and their capability to attract VC funding and especially international VC investors. In other words, there may exist a so far undetected indirect link between congenital learning and firm internationalization. Related, it would also be interesting to see if, similar to the effect of internationally experienced manager entry, also internationally experienced VC funds positively moderate the association between VC and foreign market activities. In the current sample, so far however only four firms attained funding from international VC investors, hence a too small number to perform any robust statistical testing.

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6

Conclusion

This chapter presents and discusses the main outcomes of this research. First, the findings per study are summarized. Thereafter, I detail the theoretical and practical contributions the findings provide for. Next, some limitations and suggestions for further research are elaborated. I conclude this dissertation by pointing out some general critical remarks on VC affairs that provide a starting point for future discussions and actions.

6.1 Summary of the Findings

VC is a crucial source of financing for young and innovative companies. Over the past decades the industry has been evolving from activities mainly concentrated in the US to new markets emerging around the globe. These new market dynamics of VC and especially the emergence of cross-border transactions deserve notice. In this dissertation, I attempted to expand the scarce literature on cross-border VC activity and new venture internationalization. More specifically, I tried to reduce the knowledge gaps on the alleged globalization of the VC industry by providing empirical results concerning:

(1) The patterns and determinants of long-distance VC transactions.

(2) The performance implications of cross-border VC investments.

(3) The drivers of the early internationalization of young firms.

Overall, in this work, I have turned away from the neoclassical view of the 'homo oeconomicus' and the idea that financial transactions follow a rational, frictionless path towards where they can reap the highest benefits. I show that concepts like "space" and "location" matter for capital flows as well as do social configurations.

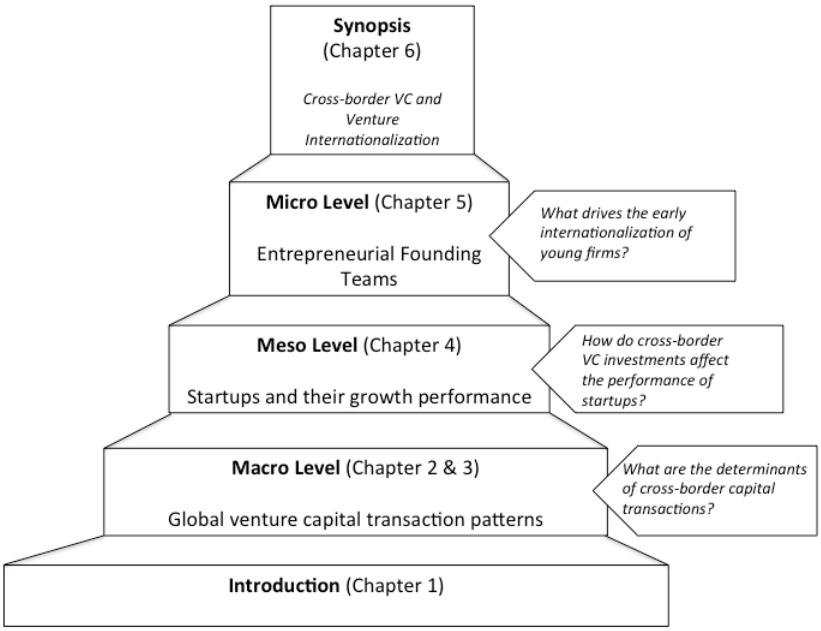

Figure 6.1.1: Structure of dissertation

Chapter 2 - Patterns of cross-border VC transactions

This chapter explores how globalized financial markets are focusing on VC. The key research questions that are addressed in this study are: "How global is the VC industry?" and "What are the determinants of cross-border capital transactions?" Despite the high global potential of VC backed companies into global market places, a distinguishing feature of venture capital has for long been its local bias. This contradicts notions of an increasing globalization of financial markets and popular 'death of distance' claims. It however closely reflects the 'home bias puzzle' found in the international trade literature. In this study, I examined the extent to which international venture capital transactions still depend on physical distance.

The empirical results suggest that distance is not 'dead' in case of international financial flows, rather it has a constant negative effect on trade volume. Globally, a

10 per cent increase in average physical separation between trading partners leads to a decrease of about 6 per cent in capital flows. In Europe, the trade friction effect of distance is even more pronounced. A 10 per cent increase in average distance decreases the number of cross-border VC transactions by roughly 9 per cent.

Chapter 3 - Determinants of cross-border VC transactions

Given the active involvement of venture capitalists in their investments, the friction effect of distance has been detailed in this Chapter by assessing the role of opportunity costs associated with manager mobility as a barrier to trade. The empirical results suggest that transport accessibility plays an important role for regions to attract international venture capital. Especially regional access to primary international air connections positively affects the volume of overseas VC inflows. An hour increase in intermodal travel time is associated with a decrease in the amount of cross-border transactions of about 36 per cent. Caution has however to be exercised in interpreting the association between transport accessibility and economic growth at the regional level. Improving transport accessibility does not necessarily lead to the attraction of foreign VC investments and regional economic development. Regions deprived of global hub connections might also lack skilled labor, agglomeration economies and other growth relevant dynamics. Improvements in transport accessibility leading to travel time reduction are therefore rather complementing regional development than being a conditio sine qua non. We have partially taken account of these issues by solely analyzing the impact of transport accessibility for regions that denote a minimum level of local VC activity.

The analyses in Chapter 2 and 3 combined demonstrate that geography and spatial transaction costs continue to matter for supposedly 'weightless' international equity transactions. It is concluded that international capital mobility is far from frictionless and that the international VC market remains geographically segmented.

Chapter 4 – Social Ties and Firm Performance

Firm financing literature has been dominated by a relatively 'undersocialized' and 'aspatial' view. This gap has been approached in Chapter 4 by applying a social capital and economic geography informed lens to financial transactions. It is explored if and how the early growth performance of VC backed organizations varies with the structural and physical location of their investors in syndication networks. The overarching research question that has been approached in this study was: "How do cross-border VC investments affect the performance of startups?" Drawing on longitudinal data of Belgian firms and their venture capital investors, it is demonstrated that inter-firm relational ties and, especially cross-border linkages expand organizational outcome. In that, I showed that not only social relations shape financial activity, but that also spatial patterns of co-investment networks deserve notice.

Chapter 5 – New Venture Internationalization and Knowledge Resources

In this Chapter, our understanding on the international development of new ventures has been extended by examining the role of pre-foundation international experiences, VC funding and ex post foundation international knowledge acquisition. To answer the research question "What drives the early internationalization of young firms?" I have traced the growth path of 99 high technology IT ventures.

Results show that congenital international knowledge transfer, i.e. a founder's prior work and study experience abroad, does not imprint consecutive firm internationalization. Rather, the early professionalization of the initial founding team by means of VC investor involvement and the recruitment of internationally trained managers is associated with a more rapid international expansion. The findings suggest that firms are not "born" global, but rather "grow" global through target oriented knowledge acquisition during their early development phase.

6.2 Theoretical Contributions

Each core chapter of this dissertation reviews international VC from a different perspective and at a different level of analysis (macro, meso, micro). In this section, I discuss the scientific contributions of the findings to the international entrepreneurship and firm financing literature.

The first paper – On the Internationalization of Venture Capital: Is the 'Death of Distance' near? (Chapter 2) - contributes to the literature on bilateral equity flows. It is one of the first attempts to define the patterns of global VC flows in a comprehensive way. It provides evidence that even in a world that is super-interconnected through technology, a "flat" world, physical proximity still matters.

The second article - Time is Money! Effects of Air Transport Accessibility on International Venture Capital Flows (Chapter 3) - decomposes geographic distance and considers the opportunity costs of investor mobility by incorporating detailed transport accessibility measures. In that, it adds to the theoretical debate around changes in asset trade modeling. Portes and Rey (2005) suggest integrating transaction costs and information asymmetries, often applied in goods trade models, also into models on "weightless" financial assets. We provide empirical evidence for the applicability of this claim in the case of VC.

The third article - Venture Capital: The Effect of Local and Global Social Ties on Firm Performance (Chapter 4) – adds to the 'relational turn' in economic geography (Bathelt & Glückler, 2003). While the firm financing literature has largely shied away from sociological and geographical concepts, I approach this theoretical gap by applying social capital theory (Granovetter, 1985; Podolny, 2001; Uzzi, 1996) and an economic geography informed perspective to VC transactions.

The fourth study - Born or grown global? New Venture Internationalization and the Role of International Knowledge Resources (Chapter 5) – complements the international entrepreneurship literature and, in particular, international new ven-

ture theory (Oviatt & McDougall, 1994) by discussing the role of entrepreneurial founding team dynamics for venture internationalization.

6.3 Policy Implications and Recommendations

The research for this dissertation started under the umbrella of the Policy Research Center on Entrepreneurship and Regional Economics (stORE – Steunpunt Ondernemen en Regionale Economie). A recurring question, I encountered among policy makers was 'how to foster innovative entrepreneurship?" Often the asker had thereby in mind the local creation of a highly successful, globally leading innovative cluster of entrepreneurs like Silicon Valley. VC had been widely anticipated as playing a key role in this process. The rationales for government intervention on VC consequently become clear: Policy-makers frequently regard VC as panacea to innovative entrepreneurship, which in turn is fruitful for local, regional and national economic growth.

The previous chapters have shown that there exists by now an extensive academic body of studies thoroughly examining the value addition of VC for the performance of young innovative firms. Contributing to this literature, in this dissertation, I have shown that VC and especially internationally networked VC investors are instrumental in accelerating the growth of their target firms. In addition, by addressing the drivers of young venture internationalization in Chapter 5, it has been forwarded that VC funding also facilitates firms' early expansion beyond the home market. The academic literature on the spatial patterns and regional economic implications of, especially, international VC flows is still limited. Chapter 2 and 3 in this dissertation have been aimed at approaching this gap.

Nevertheless, single academic studies can only tentatively be translated in definite policy actions. Overall, the findings forwarded in this thesis, e.g. concerning the barriers and drivers of cross-border VC as well as venture internationalization,

though based on robust empirical modeling, should in the first place be regarded as guidance for policy-makers, instead of guidelines carved in stone. Although this dissertation offers a holistic perspective on cross-border VC and venture internationalization, additional research to work out and fine-tune relevant policy measures is encouraged.

Policy-making is a complex process involving many layers and different policies, leading towards a large degree of ambiguity. Thus, effective policy actions need thorough, multifaceted and multilayered research. For example, in the design of policy initiatives intended to stimulate VC markets, two countervailing forces have to be taken into consideration: On the one hand, the formation of VC funds at the investor level may lead to the acceleration of VC funding aimed for. On the other hand, government intervention may cause the "crowding-out" of investment funds that have previously targeted other market segments, however that subsequently adapt their portfolio to be able to benefit from the governmental support (this trend has been observed e.g. in the Netherlands and to a lesser extend in the UK with respect to seed stage financing). Launching public VC initiatives, it will generally remain challenging to find a balance between instruments directly or indirectly increasing the VC supply and avoiding the crowding-out of private investments.

There are many examples of the involvement of the public sector into VC markets, whereby some initiatives have been more successful than others. Generally, the common rational behind government initiatives addressing VC financing is the tackling of market failures concerning the funding of young and innovative high growth businesses. Overall, the adopted measures address asymmetries in the respective VC markets in two ways: either the government provides VC directly and acts as venture capitalist itself or indirect subsidies are adopted that intend to increase the supply of VC by encouraging investments of other (private) financial intermediaries. In the following paragraphs, I provide a brief overview of prominent policy actions on VC across countries.

At the outset, the **US** VC market has been heavily subsidized by the government and until the 1980s only few private investors had entered. The US VC industry experienced its first boost when the Employment Retirement Income Stabilization Act was adopted by the government in 1975, allowing pension funds to invest in private equity and VC firms (Bottazzi & Da Rin, 2002). Often cited as cornerstone for the development of the US VC market is however the foundation of the American Research and Development Corporation (ARDC) in Boston in 1946 as the first venture capital firm.

Another crucial initiative to boost the VC market has been the adoption of the Small Business Investment Act by the US government in the 1950s. The Act allowed the setting up of Small Business Investment Companies (SBICs), private VC firms that sourced part of their funds from public sources, and that were intended to provide funding to small and medium sized businesses. The program is managed by the Small Business Administration [SBA], which does not directly provide capital to portfolio firms, but instead invests capital in private-owned funds [SBICs] in form of government guaranteed debt. The provision of guaranteed loans is intended to stimulate the interest of private owned funds in early growth businesses. For every dollar invested by a private fund, the government provides two additional dollars, up to a maximum of $150m. The SBICs, in turn, invest in small businesses in form of providing long-term loans (debt financing) or equity financing in form of VC. The annual commitment of the US government for SBIC adds up to $4bn. In 2014, 287 SBICs were in operation. Apple, Amgen, AOL and FedEx are among the most prominent firms having benefited from SBIC (SBA, 2014). With some adaptation, the program is still in use today.

A second governmental initiative that directly as well as indirectly enhanced the provision of VC to high growth firms in their early development phase is the "Small Business Innovation Research Program" [SBIR]. The program has been established in 1982 under the Small Business Innovation Development Act and has been extended several times so far and will continue to be in operation at least until 2017.

The program requires federal agencies spending more than $100m annually on research to reserve 2.8 per cent (2014) for awards granted to small businesses. Eleven federal agencies take part in the program. Lerner (1996) finds in his evaluation study of SBIR that small businesses having received a SBIR grant show higher employment and sales growth rates and are consequently more likely to receive follow-up VC funding. The latter is ascribed to the positive signaling effect that emanates from qualifying for an SBIR grant (SBIR, 2014).

In **Belgium**, governmental VC initiatives are mainly initiated at the regional level. The Flemish and Walloon regional governments have launched several support schemes stimulating innovative entrepreneurship. To accelerate the VC market in Flanders, the Flemish government has set up an independent investment company, the "ParticipatieMaatschappij Vlaanderen" (Flemish Holding Company - [PMV]). PMV administers different programs aiming at increasing the availability of VC in Flanders. One of the largest initiatives in this respect is the ARKimedes program, which was launched in 2005 and has until 2012 raised €220m VC spread over two funds, ARKimedes I and II (PMV, 2014). Since 2015, the fund is also allowed to reinvest any incomes from realized investments (it changed from a closed end structure to an open end one). In 2016, the government invested an additional €50m. Between 2005 and 2013 the ARKimedes program has financially supported 164 young firms in Belgium and, on average, annually invested VC amounting to about 0.005 per cent of Flemish GDP (Manigart, Knockaert, Vanacker, Standaert, & Lauwers, 2014).

The capital raised via ARKimedes is allocated to a number of so-called ARKIVs. ARKIVs are private accredited VC funds that were selected by ARKimedes Management nv to execute investment deals. ARKimedes Management nv acts as minority shareholder of the ARKIVs and contributes a maximum of 50 per cent of the capital via its funds. In that the ARKimedes program acts as multiplier, for every euro invested by one of the accredited private partners, the ARKimedes funds contribute an additional euro. The average size of the ARKIV funds ranges from €17 to

€20m. The maximum investment via ARKimedes had been limited to €1.5m per dossier before 2016 (PMV, 2012). Murray, Cowling, and Liu (2010) stress that VC funds investing in early growth stage businesses and that have a smaller capital commitment volume than $50m often incur problems related to operational ineffectiveness. Clarysse, Knockaert, and Wright (2009) forward that VC deals small in volume (< £2m) enhance the risk of failure for innovative firms. Picking up on previous research, it seems likely that the fragmentation of funding initiatives managed by PMV leads to sub-optimal funding outcomes. With a capital commitment between €17 and €20m, the size of the ARKIV funds is below the cited threshold level. Also maximum funding amounts per deal provided by the ARKIVs remain relatively low and below the critical volume of £2m. The strict investment caps preclude public programs from supporting entrepreneurs past the initial seed stage. Also Manigart et al. (2014) argue for an increase in public funding amounts. They regard this step as crucial in order to maintain the international competitiveness of high-growth enterprises in Flanders. A first step to increase funding amounts has been undertaken by the Flemish government in 2016 by increasing the fund size by €50m. In addition, the government has adapted the funding limits and ARKIVs are able to invest now up to a maximum of €20m.

Despite potential problems associated with the relatively low funding ceilings of ARKimedes and other government support schemes, the ARKimedes program constituted an important buffer during the economic crisis. Without ARKimedes, the Flemish VC market would have even declined more severely during that time. Particularly with respect to the early growth segment, ARKimedes investments made up for the drop out of many private investors (Manigart et al., 2014).

The **UK** government has launched a number of programs that provide loans and mentorship to starting entrepreneurs like the Growth Accelerator program (£200m) and the Startup Loan Company, both initiated in 2012. Start-up Loan, with a fund volume of about €80m, is managed by the British Business Bank and offers loans to businesses not existing longer than 12 months that do not yet fulfill banks' lend-

ing requirements. As of January 2014, 12.700 starting entrepreneurs have taken part in the funding scheme. For high-growth businesses, the average loan facilities of about £4.500 are however relative low, and the program is regarded as being primarily targeted towards promoting smaller scale self-employment endeavors.

Clarysse et al. (2009) stress that public VC investments in the UK have been too fragmented in the past leading to relatively small investment amounts per deal. In addition, UK government initiatives have failed to trigger a higher share of private investment in the market. The government initiatives in place primarily strengthen seed and early stage VC, consequently, the authors fear that there occurs a lack of follow-on funding opportunities.

The majority of national VC programs in **Germany** is managed by the quasi-public development bank, the Kreditanstalt für Wiederaufbau [KfW]. In addition, many states have created regional development agencies (Mittelständische Beteiligungsgesellschaften) that have launched VC programs with a regional focus. Often these programs are co-financed by private and public actors (e.g. public banks). Examples of regional VC funds include the VC Fund Baden-Württemberg with a capital commitment of potentially €20m and investments between €300k and €1.25m per high-tech SME, the NRW.BANK Venture Fund that targets seed and early growth businesses in the high-tech industry and provides capital between €500k and €5m per SME, and the VC Fund Technologie Berlin with €52m capital committed by Investmentbank Berlin and the Federal Land Berlin. The latter also targets seed and early growth high tech firms and offers capital per SME of up to €3m, but not more than €1.5m at the first financing round.

Interest in VC at the political level in Germany remains high and the issue has been addressed in the actual and previous coalition agreements. However, besides a capital increase for the High Tech Starter Fund, few improvements of the German VC environment are so far apparent (Roehl, 2014). Roehl (2014) stresses that the establishment of leading regional high-tech clusters in Germany, i.e. in the Biotech industry, is hampered by the large degree of fragmentation of public initiatives tar-

geting innovative entrepreneurship financing. Public VC funds launched by the different Federal Lands (Bundesländer) are overall relatively small in size, which prevents them from providing follow-up financing for later stage ventures.

In contrast to the widely adopted practice of governments across Europe aiming to improve the financing environment for innovative young firms by setting up public or semi-public VC funds themselves, the Dutch government does not act as VC investor itself. Public VC schemes in **the Netherlands** are based on the provision of subordinated loans not to the portfolio firms directly, but rather to selected investment firms. In 2004, the Dutch government launched the "Actieprogramma TechnoPartner" for the period 2005 until 2010. The program aimed at the stimulation of high tech entrepreneurship in the Netherlands by specifically addressing two bottlenecks: the supply of entrepreneurial financing and the lack of entrepreneurial spirit. To ease the financial distress of starting high tech businesses, in particular the Seed Capital Regulation pillar of the program strengthens the provision of seed and early stage VC. The investment risk for private investors investing in early-stage high-tech partners gets reduced by granting private investment firms subordinated loans partly safeguarding their investment in startups. Given the positive evaluation of the program, the Dutch government launched the "Innovation fund SME+" (Innovatiefonds MKB+) initiative in 2012 to continue furthering entrepreneurship in new technology sectors in the period 2012-2015. With respect to entrepreneurial financing, the "Innovation fund SME+" initiative, closely follows the strategies implemented by its antecessor, the "Actieprogramma TechnoPartner".

Summing up, government programs have played an important role in the evolution of the VC markets in all countries under investigation. Generally, they stimulate VC investment in segments of the market where information asymmetries coupled with a high risk-profile of firms prevent private investors from acting. In addition, in some countries, they partly absorbed the setback of the market in the aftermaths of the financial crisis. However, a high degree of fragmentation of public VC initia-

tives, especially in Europe, is apparent. Public VC programs often solely provide funding at a small scale. VC amounts invested in the US market are, for example, much higher than in Europe. Addressing the undercapitalization of VC funding programs, it is therefore suggested to investigate whether the concentration of governmental VC schemes leads to an improvement of the VC funding environment for businesses and an enhancement of their international competitiveness. Another pitfalls of existing policy programs relates to their potential to "crow-out" private investors.

Existing policy initiatives primarily focus on the development of a vivid domestic VC environment. They are reluctant to provide incentives for non-domestic involvement or the promotion of a pan-European VC market as envisaged by the European Commission. Instead fragmentation is common, even on the national level, with regions providing their own VC initiatives targeted at locally domiciled innovative startups. On basis of the empirical studies compiled in this thesis, potential approaches for policy action specifically aimed at advancing cross-border VC flows and venture internationalization are presented in the following paragraphs.

Chapter 2 suggests that trade frictions are still much more prevailing in Europe compared to a global sample. Continuing fragmentation of VC investments along national borders and unequal domestic patterns of VC activity may impact the longer-term innovative development and competitiveness of regions and countries. Cross-border investments could address some of the funding challenges declared by young and innovative founders in peripheral and less mature VC markets. In addition, fundraising across borders could increase the fund size of European VC funds enabling them to finance firms longer and make up for the prevailing gap in exit values between Europe and the US market. With respect to the acceleration of cross-border VC flows some potential policy suggestions include the creation of a clear and trade facilitating regulatory and fiscal environment. Results in this study have shown that trade barrier reducing frameworks such as the Euro

or Schengen Area increase bilateral capital exchange. The European Commission has undertaken first policy initiatives in this direction. These include the setting up of the European Investment Fund, the launch of the Capital Markets Union action plan, and the Regulation on European Venture Capital Funds that came into force in 2013. There is a need to continue this policy progress in the future.

From Chapter 4 the take away for policy makers is that both the deepening of entrepreneurial networks, but especially the spatial diversification of knowledge linkages are important factors fostering the growth of young and innovative firms. Potential policy actions should therefore aim at the strengthening of the attractiveness of domestic VC markets to foreign investors, but also at the engagement of domestic VC investors abroad. Both scenarios are probable to lead to a gain in non-redundant knowledge flows for high growth firms. So far, especially public VC programs are however often subject to strict, geographically limited investment guidelines.

Chapter 5 shows that young firms face a more and more global market environment making it indispensable for their survival and growth to internationalize early. Nevertheless, many young firms struggle with scaling up into foreign markets. Though not the initial research focus of Chapter 5, trade support initiatives have been found to be of utmost importance for young firms. Export promotion agencies offering context-specific assistance to young firms that strive for rapid internationalization appear to be an effective option for public policy agents to foster the growth and global competitiveness of young high tech firms. However, the role of trade promotion programs for venture internationalization has only been marginally treated in our analysis, though the striking results are noteworthy. We therefore strongly encourage further enquiry on the optimal set up of similar initiatives e.g. which knowledge and resource constraints have to be address to effectively and sustainably foster new venture internationalization.

6.4 Practical Implications for the Entrepreneurial Community

For entrepreneurs a practical implication arising from Chapter 3 is that they should pay attention to where they locate and how the place is linked to global financial hubs. Many entrepreneurs consider opening their businesses close to their home (Dahl & Sorenson, 2009). Important to contemplate is then if the necessary transport infrastructure is available in that place. Otherwise innovative startups' risk to be deprived from international VC circuits.

A further advice for entrepreneurs is to keep in mind that diversity matters. Homophily, "birds-of-a-feather-flock-together", is a common trait of social interactions. In particular, Chapter 5 entails empirical evidence for the performance enhancing effect of new team member entry with respect to company's international expansion. In turn, these results, in a systematic way, scientifically substantiate the frequent though rather "gut instinctive" practice of investors to improve the performance of their target firms by professionalizing founding teams early on.

The results in Chapter 5 also reveal a large positive effect of trade promotion programs on the establishment of foreign sales representations. To facilitate the scale-up of their businesses, entrepreneurs are advised to look out for and make use of trade support programs.

For investors, especially the findings in Chapter 4 are relevant. It is forwarded that investors who maintain globally diverse investment ties appear to be more beneficial for the early growth of their target firms. For those investors that shy the higher opportunity costs related to long-distance investments, the analysis shows that even the participation in local VC deals in cooperation with overseas investors carries positive externalities.

6.5 Suggestions for Further Research

This research has contributed to the knowledge on a changing VC industry. Naturally, it comes with some limitations. Going back to the beginning of this dissertation, "To explain all nature is too difficult a task for any one [wo]man or even for any one age. 'Tis much better to do a little with certainty and leave the rest for others that come after you", in this section, suggestions for the "rest" i.e. further research avenues are pointed out.

The continuing importance of interpersonal ties during the VC investment process opens up future avenues of research. I suggest a more detailed analysis of human networks and how they steer the emergence of international VC activity. There is need for research that investigates the mechanisms of the formation of international investment ties at the micro-level. A good starting point here is the literature on transnational technical communities (Madhavan & Iriyama, 2009; Saxenian, 2002). It also closely relates to studies on the social structure of the VC industry by Sorenson and Stuart (2001) who find that social ties help overcoming local investment biases in case of domestic investors and Tykvová and Schertler (2011) who attribute tie density among local investors to the size and style of cross-border VC flows. Prior research also points out that syndication with local investors can help to overcome some of the barriers associated with cross-border VC investing. Prospectively, the refinement of models to also take into account the role investors play in a deal (lead versus no-lead) as well as the facilitating role of VC firms' local branch offices, would further advance our understanding of the distance sensitivity of VC investments. Social relations seem to play a much larger role still in newly emerging VC markets (e.g. China). Performance differences based on diverging social ties may therefore appear even more explicit when investigating emerging VC markets.

The fact that the VC industry stays in motion encourages further academic research on the topic. For the European market, the prospective withdrawal of the

UK from EU membership may also have implications for VC activity. Most obvious, British innovative startups will have to forgo public VC spending from the European Investment Fund [EIF], accounting for about a third in fundraising volumes of British VC funds. Though, if market mechanisms and the principle "money goes where it can reap the highest benefits"[1] work and providing the continuity of a striving innovative ecosystem breeding competitive startups, any prospective increase in trade barriers related to invoking Article 50 of the Treaty on European Union should have a less pronounced effect. Outside investors would continue to invest in the UK. Nevertheless that does not deflect the fact that without payments of the EIF, the domestic market is likely to contract. In-depth research is needed to precisely estimate the implications of the "Brexit" for the UK VC market. In addition, given that the UK market up to now has been the most mature and capitalized European domestic VC market, effects on 'continental' European startups, who have largely benefited from incoming UK investment flows in the past, need to be assessed more thoroughly. Britain's departure from the EU may also constitute an interesting 'natural experiment' for entrepreneurial finance scholars to further explore e.g. with respect to the effectiveness of public VC initiatives.

6.6 Some Final Critical Remarks on Venture Capital Affairs

Despite investing in the most innovative and disruptive of today's technologies that have lasting impacts on the (daily) lives of many million people around the globe, the VC industry itself is all but innovative and path-breaking when it comes to its demographics. As much as VC investments have been geographically concentrated, VC firms have remained ethnically segregated (predominantly "white") and male dominated (Brush, Carter, Gatewood, Greene, & Hart, 2004). In 2015, only 11 per cent of investment partners in US VC firms have been female. The number shrinks even more when racial inclusiveness is considered. Compared

[1] Unlikely outcome according to the overall findings in this dissertation. VC flows are not frictionless.

with the financial service industry overall, the VC industry lacks behind in filling partner positions with employees that are non-male and have a non-white background e.g. African-American, Asian or Hispanic (NVCA & Deloitte, 2016). The few women that find their way into the VC industry or the financial sector face an earning gap of about 41 per cent in the US (Kopecki, 2010). For VC firms, a wake-up call for more diversity should be the recent findings by Gompers, Mukharlyamov, and Xuan (2016) stressing that investment syndicates are often characterized by a high coherence in venture capitalists' ethnic, educational, or career backgrounds despite the fact that more heterogeneous co-investment team constellations appear to increase the odds for success.

Besides not being widely represented in the upper echelons of VC firms, also female business founders encounter obstacles in obtaining VC. The current disclosures of pervasive (sexual) harassment practices by venture capitalists against female entrepreneurs seeking VC funding show that the industry has moved away very little from its "bro culture" image.

The prevailing diversity issue in the VC industry is far beyond the scope of the current research project. Nevertheless, it is of utmost relevance to address these issues and call attention to a much-needed cultural shift towards more inclusive innovative entrepreneurial ecosystems. I want to use this last section of my thesis to encourage the importance of applying a diversity study informed lens on VC activity in future research.

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