



FACULTY OF ECONOMICS AND BUSINESS ADMINISTRATION
DEPARTMENT OF ACCOUNTANCY AND CORPORATE FINANCE

INTERNATIONAL VENTURE CAPITAL INVESTORS AND THEIR PORTFOLIO COMPANIES IN EUROPE

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By David Devigne, 2013

Supervisor: Prof. dr. ir. Sophie Manigart

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Guidance committee

Prof. dr. M. Colombo (Politecnico di Milano)

Prof. dr. S. Manigart (Ghent University and Vlerick Business School, Supervisor)

Prof. dr. M. Meuleman (Ghent University and Vlerick Business School)

Doctoral Jury

Prof. dr. M. De Clercq (Ghent University, Dean-President)

Prof. dr. M. Knockaert (Ghent University and Oslo University)

Prof. dr. S. Manigart (Ghent University and Vlerick Business School, Supervisor)

Prof. dr. M. Meuleman (Ghent University and Vlerick Business School)

Prof. dr. T. Tykvová (University of Hohenheim and ZEW)

Prof. dr. B. van Pottelsberghe de la Potterie (Solvay Brussels School of Economics and Management)

Prof. dr. P. Van Kenhove (Ghent University, Academic Secretary)

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The road to success is not often a straight line. Unfortunately, no one is born with the precise knowledge how to have a comfortable ride to success. While some of us might be lucky and are successful as from their first trial, most learn it the hard way through a loop of multiple trials and errors. For most of us - including me - the pathway to success is hence a bumpy one, with several failures along the ride. No matter how painful and disappointing some professional failures may be, the most important objective is to keep learning from these pitfalls. Because, as long as you learn not to make the same errors again, failure is not equal to failing. Instead, it puts you back on track and one step closer to success. While I'm nowhere near the end of my journey, this PhD dissertation is the ultimate result of intense doctoral studies and represents the conclusion of a very challenging and enriching phase in my life but also the start of a hopefully as fulfilling new phase. Honestly, I wouldn't have made it this far without the encouragement of people around me, who guided and supported me throughout the process. I would therefore, like to express my gratitude to my family, friends and colleagues who have helped and inspired me along the journey.

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Publications

Part of this dissertation has led to a publication in an international peer-reviewed academic journal:

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This doctoral dissertation consists of several studies that discuss different aspects of the internationalization of the venture capital industry. I start this dissertation with an introductory chapter that introduces the research topic and provides an overview of the academic literature on international venture capital. Next, the VICO sample, which is used in the three empirical studies that are the core of the dissertation, is discussed in detail in chapter 2. Chapter 3, 4 and 5 present the three studies. The final chapter discusses the main findings and contributions of the dissertation.

Chapter 1

General introduction

The first ‘true’ venture capital (VC) firm, American Research and Development (ARD), was established in the U.S. in 1946. In the following decades, VC became an important financing source for small, young, high risk unquoted companies (Gompers and Lerner, 2001). Without VC funding, many companies such as Apple, Google, Skype, Microsoft, Ablynx, Spotify and Thrombogenics may not have existed, or may not have developed to the same level and size they have (Bruton et al., 2005). The importance of VC is not limited to the U.S. economy (Wright et al., 2002). Even though the internationalization of investments is an important development within the VC industry, this phenomenon has only recently been receiving attention in academic literature (Wright et al., 2005). The goal of this dissertation is to increase our understanding of international VC investments. We define international or foreign VC investments as investments made in other countries than the VC firm’s head office country. VC firms wishing to expand internationally may do so directly or through establishing a local subsidiary abroad. In this dissertation, cross-border VC investors are defined as investors that manage the investment from another country than the one in which the portfolio company (PC) started its operations (Mäkelä and Maula, 2005), while branch VC firms are defined as local subsidiaries of VC firms which are located in - and manage the investment from - the same country as the one in which the PC started its operations. The focus of this dissertation lies on the differences between cross-border, branch and domestic VC firms in three main aspects of the VC investment cycle: the initial matching with investment targets, the post-investment development of PCs and the exit from PCs. In this introductory chapter, I will start with a description of the VC market, focusing on the development of international VC. A significant weight will be given to international VC investments as an interesting research setting and the state of the current literature in terms of its contributions and gaps. This is followed by a description of the research setting. Finally, a summary of the three studies included in this dissertation concludes this introduction.

1.1. Setting the scene: VC investing

Jointly with buyouts, VC is a subset of the overarching private equity industry (Gompers and Lerner, 2001; Wright and Robbie, 1998). While the strategy in VC is to finance young, entrepreneurial, high risk and high growth potential companies, buyouts aim to acquire and restructure established companies in close cooperation with their management (Wright and Robbie, 1998). This dissertation focuses on the VC subset of private equity and will hence not elaborate the buyouts subset.

In the typical VC investment model, independent VC firms act as intermediaries between their own shareholders (limited partners) and the companies they invest in. VC firms are hence financial market intermediaries,

specializing in the management of information asymmetries¹ and high levels of uncertainty (Carpenter and Petersen, 2002; Gompers and Lerner, 2001). This enables them to provide capital to companies that might otherwise have severe difficulties to attract financing (Gompers and Lerner, 2001; Wright and Robbie, 1998). The companies VC firms target are thereby typically small and young, possess low levels of collateral, often have negative cash flows and operate in new or volatile markets (Stuart et al. 1999). Despite the aforementioned issues, VC firms invest in these high-risk companies by purchasing equity or equity-linked minority stakes, aiming for significant capital gains (Gompers and Lerner, 2001). Over time, the VC industry has introduced several mechanisms to overcome the problems that emerge at each step of the investment process.

In a first step, VC firms carefully select potential investment targets based upon the future prospects (Casamatta and Harichabalet, 2007; Gompers and Lerner, 2001). Their extensive due diligence process, together with their detailed contracts, helps to reduce information asymmetries and ensuing agency problems. Second, VC firms typically do not only provide financial resources but also engage in time consuming post-investment monitoring and value adding activities in order to (i) decrease moral hazard problems caused by information asymmetries (ii) create value in the PC (Macmillan et al., 1989; Sapienza; 1992, Sapienza et al., 1996). Finally, in contrast to other investors, VC firms are not interested in taking permanent equity positions in their PCs. Instead, they exit their investments after a five to seven year holding period (Gompers and Lerner, 2001; Wright and Robbie, 1998). Moreover, VC investors typically do not receive intermediary cash flows from their PCs and investment success hence relies solely on the exit performance (Cumming, 2008). The goal of VC firm's investment model is hence to select the most promising targets, develop them to a level that is sufficiently profitable to attract permanent capital and ultimately to exit the PC at a significant capital gain (Ruhnka and Young, 1987). To summarize, VC investments are in essence long-term, illiquid, high-risk, hands-on, privately held, minority equity investments in high-growth-potential companies initiated and managed by professional investors (Wright and Robbie, 1998).

Tables 1.1., 1.2. and 1.3. underline the importance of the VC industry in the contemporary economy (data from Thomson One, 2013). While Table 1.1. shows the annual evolution in the number of investments over the different regions, Table 1.2. details the evolution in the amounts of equity invested. Finally, Table 1.3. exhibits the relative importance of VC as percentage of GDP by PC region in the year 2010. The total investment volume of VC transactions worldwide between 2000 and 2010 is estimated at €622 billion which was invested in more than 51,000 companies over 130,000 investment rounds by almost 9,000 VC firms. Of all world regions, America has the largest VC industry in investment volume (€423 billion; 68% of global volume), which corresponds to 52% of all investment rounds and approximately half (56%) of the total number of VC backed PCs between 2000 and 2010. The European VC industry was the second largest, with a total equity amount of €79 billion (13% of the worldwide amount) invested in approximately 30,000 investment rounds (23% of all investment rounds) in 18,000 companies (35% of the global number) (Thomson One, 2013). Interestingly, this

¹ Information asymmetry emerges when one party has more or higher quality information than another party. In VC investments, this is often the case as entrepreneurs have more private information about the company than the (potential) VC investors. Information asymmetry may be damaging as the informed party can take advantage of his superior information as opposed to the other party.

implies that the amount invested in a European PC is, on average, lower compared to that invested in a U.S. PC. In terms of relative importance of VC as a percentage of GDP, both America (0.20%) and Asia (0.10%) precede Europe (0.05%) in 2010.

Table 1.1. Number of VC investments

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
America												
Domestic investments	9,877	6,268	4,507	4,388	4,492	4,641	5,171	5,718	5,881	4,445	5,129	60,517
Foreign investments	1,590	992	511	452	403	465	609	758	679	508	616	7,583
<i>Region total</i>	<i>11,467</i>	<i>7,260</i>	<i>5,018</i>	<i>4,840</i>	<i>4,895</i>	<i>5,106</i>	<i>5,780</i>	<i>6,476</i>	<i>6,560</i>	<i>4,953</i>	<i>5,745</i>	68,100
% international investments in target region	13.9%	13.7%	10.2%	9.3%	8.2%	9.1%	10.5%	11.7%	10.4%	10.3%	10.7%	11.1%
% of total international investments	50.2%	47.3%	41.5%	37.1%	29.9%	36.8%	41.7%	43.9%	40.0%	44.1%	45.3%	42.8%
Europe												
Domestic investments	2,721	2,318	1,352	2,788	2,977	2,616	2,719	1,651	1,664	1,261	1,724	23,791
Foreign investments	921	662	409	496	605	507	531	566	603	405	455	6,160
<i>Region total</i>	<i>3,642</i>	<i>2,980</i>	<i>1,761</i>	<i>3,284</i>	<i>3,582</i>	<i>3,123</i>	<i>3,250</i>	<i>2,217</i>	<i>2,267</i>	<i>1,666</i>	<i>2,179</i>	29,951
% international investments in target region	25.3%	22.2%	23.2%	15.1%	16.9%	16.2%	16.3%	25.5%	26.6%	24.3%	20.9%	20.6%
% of total international investments	29.1%	31.5%	33.2%	40.7%	44.9%	40.1%	36.3%	32.8%	35.5%	35.2%	33.5%	34.7%
Asia												
Domestic investments	1,803	759	548	504	552	697	872	1,181	1,055	821	1,079	9,871
Foreign investments	577	375	261	221	294	243	256	309	321	161	197	3,215
<i>Region total</i>	<i>2,380</i>	<i>1,134</i>	<i>809</i>	<i>725</i>	<i>846</i>	<i>940</i>	<i>1,128</i>	<i>1,490</i>	<i>1,376</i>	<i>982</i>	<i>1,276</i>	13,086
% international investments in target region	24.2%	33.1%	32.3%	30.5%	34.8%	25.9%	22.7%	20.7%	23.3%	16.4%	15.4%	24.6%
% of total international investments	18.2%	17.9%	21.2%	18.1%	21.8%	19.2%	17.5%	17.9%	18.9%	14.0%	14.5%	18.1%
Pacific												
Domestic investments	236	283	214	153	171	166	129	123	88	65	70	1,698
Foreign investments	59	57	36	40	40	42	51	64	68	48	52	557
<i>Region total</i>	<i>295</i>	<i>340</i>	<i>250</i>	<i>193</i>	<i>211</i>	<i>208</i>	<i>180</i>	<i>187</i>	<i>156</i>	<i>113</i>	<i>122</i>	2,255
% international investments in target region	20.0%	16.8%	14.4%	20.7%	19.0%	20.2%	28.3%	34.2%	43.6%	42.5%	42.6%	24.7%
% of total international investments	1.9%	2.7%	2.9%	3.3%	3.0%	3.3%	3.5%	3.7%	4.0%	4.2%	3.8%	3.1%
Africa												
Domestic investments	16	17	15	40	66	32	11	21	31	7	13	269
Foreign investments	22	13	15	10	6	6	15	30	26	30	40	213
<i>Region total</i>	<i>38</i>	<i>30</i>	<i>30</i>	<i>50</i>	<i>72</i>	<i>38</i>	<i>26</i>	<i>51</i>	<i>57</i>	<i>37</i>	<i>53</i>	482
% international investments in target region	57.9%	43.3%	50.0%	20.0%	8.3%	15.8%	57.7%	58.8%	45.6%	81.1%	75.5%	44.2%
% of total international investments	0.7%	0.6%	1.2%	0.8%	0.4%	0.5%	1.0%	1.7%	1.5%	2.6%	2.9%	1.2%
Missing												
	3,214	2,104	1,458	1,228	1,059	1,035	1,244	1,136	1,194	981	1,226	15,879
Total domestic investments	14,653	9,645	6,636	7,873	8,258	8,152	8,902	8,694	8,719	6,599	8,015	96,146
Total foreign investments	3,169	2,099	1,232	1,219	1,348	1,263	1,462	1,727	1,697	1,152	1,360	17,728
% international investments*	17.8%	17.9%	15.7%	13.4%	14.0%	13.4%	14.1%	16.6%	16.3%	14.9%	14.5%	15.6%
Total	21,036	13,848	9,326	10,320	10,665	10,450	11,608	11,557	11,610	8,732	10,601	129,753

* Excluding missing

Table 1.2. VC invested worldwide

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
America												
Domestic investments	110,550	47,348	25,824	20,607	21,076	21,551	26,375	28,166	24,576	15,651	26,825	368,549
Foreign investments	13,044	7,175	3,087	2,547	2,545	3,971	4,920	5,914	4,039	2,920	4,457	54,619
<i>Region total</i>	<i>123,594</i>	<i>54,524</i>	<i>28,911</i>	<i>23,153</i>	<i>23,621</i>	<i>25,522</i>	<i>31,295</i>	<i>34,081</i>	<i>28,615</i>	<i>18,571</i>	<i>31,282</i>	423,168
% international investments in target region	10.6%	13.2%	10.7%	11.0%	10.8%	15.6%	15.7%	17.4%	14.1%	15.7%	14.2%	12.9%
% of total international investments	62.7%	62.6%	55.0%	56.8%	50.7%	60.1%	58.7%	61.9%	56.3%	41.9%	63.7%	58.2%
Europe												
Domestic investments	9,875	6,831	4,128	3,591	3,647	4,014	6,372	4,797	4,681	4,070	4,908	56,915
Foreign investments	4,916	2,435	1,400	1,321	1,582	1,366	1,953	1,870	1,974	1,411	1,569	21,799
<i>Region total</i>	<i>14,792</i>	<i>9,266</i>	<i>5,529</i>	<i>4,912</i>	<i>5,229</i>	<i>5,380</i>	<i>8,325</i>	<i>6,668</i>	<i>6,656</i>	<i>5,481</i>	<i>6,477</i>	78,714
% international investments in target region	33.2%	26.3%	25.3%	26.9%	30.3%	25.4%	23.5%	28.1%	29.7%	25.7%	24.2%	27.7%
% of total international investments	23.7%	21.2%	24.9%	29.5%	31.5%	20.7%	23.3%	19.6%	27.5%	20.2%	22.4%	23.2%
Asia												
Domestic investments	6,081	2,675	1,571	1,544	3,123	2,366	4,424	7,107	6,929	4,071	6,748	46,637
Foreign investments	2,691	1,789	1,077	582	834	696	1,058	1,562	1,003	1,600	902	13,793
<i>Region total</i>	<i>8,772</i>	<i>4,464</i>	<i>2,648</i>	<i>2,126</i>	<i>3,957</i>	<i>3,062</i>	<i>5,482</i>	<i>8,669</i>	<i>7,932</i>	<i>5,670</i>	<i>7,650</i>	60,430
% international investments in target region	30.7%	40.1%	40.7%	27.4%	21.1%	22.7%	19.3%	18.0%	12.6%	28.2%	11.8%	22.8%
% of total international investments	12.9%	15.6%	19.2%	13.0%	16.6%	10.5%	12.6%	16.4%	14.0%	22.9%	12.9%	14.7%
Pacific												
Domestic investments	519	709	330	195	212	317	265	228	177	67	96	3,113
Foreign investments	137	64	49	31	60	578	452	202	155	1,040	71	2,839
<i>Region total</i>	<i>655</i>	<i>773</i>	<i>379</i>	<i>226</i>	<i>272</i>	<i>895</i>	<i>716</i>	<i>430</i>	<i>332</i>	<i>1,107</i>	<i>167</i>	5,952
% international investments in target region	20.8%	8.3%	12.9%	13.8%	22.1%	64.6%	63.1%	47.0%	46.8%	94.0%	42.5%	47.7%
% of total international investments	0.7%	0.6%	0.9%	0.7%	1.2%	8.7%	5.4%	2.1%	2.2%	14.9%	1.0%	3.0%
Africa												
Domestic investments	10	15	2	46	93	27	7	126	14	15	219	573
Foreign investments	56	165	22	45	39	7	49	99	108	51	80	722
<i>Region total</i>	<i>66</i>	<i>180</i>	<i>24</i>	<i>91</i>	<i>132</i>	<i>34</i>	<i>56</i>	<i>226</i>	<i>122</i>	<i>65</i>	<i>299</i>	1,295
% international investments in target region	84.8%	91.9%	91.2%	49.8%	29.8%	20.6%	87.7%	44.0%	88.5%	77.7%	26.8%	55.7%
% of total international investments	0.3%	1.4%	0.4%	1.0%	0.8%	0.1%	0.6%	1.0%	1.5%	0.7%	1.1%	0.8%
Missing												
	15,520	7,239	4,061	2,204	1,835	2,200	4,476	6,241	3,502	2,531	2,641	52,449
Total domestic investments	127,036	57,577	31,855	25,981	28,151	28,275	37,443	40,425	36,377	23,873	38,796	475,787
Total foreign investments	20,787	11,464	5,613	4,481	5,021	6,611	8,383	9,549	7,171	6,970	6,999	93,772
% international investments*	14.1%	16.6%	15.0%	14.7%	15.1%	19.0%	18.3%	19.1%	16.5%	22.6%	15.3%	16.5%
Total	163,399	76,445	41,551	32,712	35,046	37,093	50,351	56,314	47,158	33,425	48,516	622,009

* Excluding missing; All amounts are expressed in million €

Table 1.3. Relative importance of VC as percentage of GDP by PC region in the year 2010*

	VC	GDP	%
America	31,282	15,952,561	0.20
Europe	6,477	14,187,152	0.05
Asia	7,650	7,980,002	0.10
Pacific	167	805,084	0.02
Africa	299	1,203,483	0.02
Missing	2,641	NA	NA
Total	48,516	40,128,281	0.12

* All amounts are expressed in million €

1.2. Internationalization of the VC industry

Due to the need to reduce information asymmetries and manage agency risks, VC investing has long been a local industry (Cumming and Dai, 2010; Wright and Robbie, 1998). The geographical proximity to investment targets was deemed necessary to locate and evaluate these targets (Sorenson and Stuart, 2001) and to efficiently provide post-investment monitoring and value adding services (Mäkelä and Maula, 2006). Investing in non-domestic countries brings liabilities of foreignness (LOF) for VC investors (Wright et al., 2005), which are “all additional costs a firm operating in a market overseas incurs that a local firm would not incur” (Zaheer, 1995: 343). Compared to domestic VC investments, international VC investments present additional risks and challenges, as geographical, cultural and institutional distance between PCs and VC investors are increased. As a result, international VC firms have access to lower amounts of high quality information, which is predominantly only locally available, and are less prone to take a board seat in the PC (Lerner, 1995; Sorenson and Stuart, 2001). This creates larger information asymmetries between PCs and VC investors, making selection and monitoring more important but also more difficult (Bell et al., 2012; Sorenson and Stuart, 2001). The increased distance also hinders efficient value adding by VC investors, as cultural and institutional barriers may make entrepreneurs less receptive to advice from foreign investors (Guiso et al., 2008; Sapienza et al., 1996).

Due to the benefits of local presence, cross-border VC investments were a negligible fraction in the total VC investment activity prior to the early 1990s (Manigart et al., 2010). The enhanced domestic competition in maturing VC industries have increasingly driven VC firms to search for investment opportunities abroad (Aizenman and Kendall, 2012; Alhorr et al., 2008; Meuleman and Wright, 2011; Tykvová and Schertler, 2010). Hence, the number of international transactions has become non-negligible (see Tables 1.1 and 1.2). Table 1.1. shows that international VC transactions represent between 13.4% and 17.9% of all VC transactions. Although America has the highest number of VC investments, the vast majority (89%) are domestic investments. While Europe has a lower absolute number of VC investments, the proportion of international investments is much higher in Europe (21%) and represents 35% of the worldwide number of international investments. Table 1.2. further shows that the total international VC investment volume has increased from about 14% in 2000 to more than 20% of the worldwide VC investment value. This indicates that the amounts invested in international VC deals are on average higher than in domestic VC deals. The relative percentage of international investments in Europe is higher in terms of value amount (28%) than in terms of number of deals (21%). This underlines the importance of international investments in the European VC market.

The disadvantages of VC firms investing internationally raises the interesting question of *how* international VC firms manage the additional difficulties of investing internationally and *what their impact is* on PCs. Consequently, researchers have started to investigate this phenomenon more closely. Whereas this research question was ignored ten years ago, the number of publications on this topic has increased substantially since then. Early research on VC in an international context has focused on comparing domestic VC behaviour between different countries (Manigart et al., 2000, 2002). While this research stream enables to comprehend the differences between VC markets in different countries, it does not provide insights in the challenges faced by

foreign VC firms when entering and managing investments in international markets. The literature on cross-country comparisons is hence not further discussed in this dissertation.

1.3. Review of the academic literature on international VC

Before digging into the specificities of the three empirical studies in this dissertation, a review of the literature is presented, focusing on three major research streams on international VC investments. The first research stream takes a meso-economic approach, assessing the determinants of international VC investments and favoured target countries. A second stream of research takes a VC firm level approach and focuses on strategies international VC investors follow in order to mitigate liabilities of foreignness. The final research stream examines the outcomes of international VC investments. A comprehensive review of each of these research streams is given below, focusing on contributions and gaps.

By considering the questions of which VC firms invest across borders, what countries they target, how they compensate for non-domestic investing, what is the outcome of their investments and what are the drivers of this outcome, an overview of the literature on the relation between international VC firms and their PCs is provided and areas for further research are identified.

1.3.1. Determinants of international VC investments

Two broad categories of determinants of flows of international VC investments are identified: country level determinants and VC firm level determinants.

1.3.1.1. Country level determinants²

Extant literature has distinguished several country level determinants that impact the attractiveness of a country for foreign VC investors. In essence, these studies investigate which target firm country's and VC firm country's features influence VC firm's foreign market entry decisions (Aizenman and Kendall, 2012; Balcarcel et al., 2010; Guler and Guillén, 2010a; Schertler and Tykvová, 2011; Schertler and Tykvová, 2012). More specifically these papers answer the question: Why do some countries attract more international VC than other countries?

A first determinant driving international flows of VC is the institutional development of the target country. International VC investors preferably target institutionally developed countries as this creates a more investor-friendly climate with more transparency and less information asymmetries between VC owners and their PCs (Aizenman and Kendall, 2012; Balcarcel et al., 2010; Guler and Guillén, 2010a). VC firms hence invest in host countries characterized by technological, legal, financial, and political institutions that create innovative opportunities, protect investors' rights, facilitate exit, and guarantee regulatory stability. Further, the local presence of qualified human capital is an important factor to attract international VC (Aizenman and Kendall, 2012).

² An overview of the papers discussed, is provided in Table 1.4.

Next to institutional and local human capital determinants, the number of deals financed by foreign investors increases when the expected GDP growth and the size of the stock market of the target countries increase (Aizenman and Kendall, 2012; Schertler and Tykvová, 2011). Similarly, a larger stock market in the VC firm's home country leads to more domestic but also more international deals. The VC firm's home country's expected growth, however, strongly increases the number of its domestic deals, while it slightly discourages the number of its foreign deals. These findings suggest that the expected growth in the PC's country is not the only driver for international VC activity. Rather, VC firms with more promising investment opportunities in their home country prefer to invest more intensively at home and less intensively abroad. In a subsequent study, Schertler and Tykvová (2012), show that the drivers of target countries' gross and net inflows of international VC are broadly similar. For instance, higher expected economic growth of the target country leads to higher gross as well as net international VC inflows. However, while more developed capital markets and a more favourable VC environment result in higher gross inflows, these factors result in lower net inflows due to the gross outflows that outsize the gross inflows. These results suggest that international VC inflows may partly compensate for potential limits in domestic VC supply. The findings may also reflect that VC firms' locational decisions depend on the viability of capital markets.

Several studies investigate the impact of the *differences* between target and investor country characteristics on international VC flows. The expected growth differences between the PC's and VC firm's country are positively related to the number of international deals between the two countries (Schertler and Tykvová, 2011). Smaller distance, common language, colonial ties (Aizenman and Kendall, 2012) and between-country trust (Bottazzi et al., 2012) are significant determinants in directing the international VC flows. VC investors which overcome these hurdles tend to do well (Bottazzi et al., 2012). Moreover, when countries' economies become more integrated, as in the European Union, an increase in the amount of international VC investment is likely to follow (Alhorr et al., 2008). Institutional environments hence play an important role on international VC markets.

Finally, the presence of strong industry networks between the VC firm's home country and its target country enhance international VC flows (Hochberg et al., 2010; Madhavan and Iriyama, 2009). Target countries with more densely networked VC markets – i.e. markets where network ties among incumbents are strong - experience less foreign VC entry (Hochberg et al., 2010). These authors argue that domestic VC firms benefit from reduced foreign VC entry as this improves their bargaining power and results in lower investment prices of their investments. Foreign VC investors with established ties to the domestic VC firms are, however, able to overcome this barrier to entry, but other domestic VC firms may react strategically to increased threats of entry by freezing out domestic firms who facilitate entry. Further, “transnational technical communities” (TTCs), which are groups of immigrants active in both home- and host-country technical networks, positively affect international VC flows (Madhavan and Iriyama, 2009). More specifically, higher professional and technical cumulative immigration levels from a given target nation to the U.S. predicts higher VC outflows from the U.S. to the target nation (Madhavan and Iriyama, 2009).

Table 1.4. Country level determinants of international VC investments

Year - Authors - Journal	Title	Data source	Sample	Theoretical framework	Research question	Findings	Implications/contribution
2008 - Alhorr, Moore, & Payne - Entrepreneurship Theory and Practice	The impact of economic integration on cross-border venture capital investments: Evidence from the European Union	Securities Data Corporation (SDC) Platinum (Thompson Financial Corporation)	24 countries (from the European Union) for the period between 1985 and 2002	Institutional theory	Does economic integration impact international VC investments?	When countries' economies become more integrated (i.e. adoption of a common market and a common currency), an increase in the amount of international VC investment made into other member countries is likely to follow.	(1) Institutional environments play an important role on international VC markets. (2) National leaders, particularly of smaller, less developed nation-states, should note the potential benefit of economic integration policies, especially the adoption of common currencies, on VC investment flows.
2009 - Madhavan & Iriyama - Journal of International Business Studies	Understanding global flows of venture capital: Human networks as the "carrier wave" of globalization	Thomson VentureXpert database, IMF, Statistical Yearbook of the Immigration and Naturalization Service of the U.S. Department of Justice	VC flows from 1982 to 2002 for all nations that have hosted VC flow from the U.S. as of 2002	Network theory, Social embeddedness perspective	What forces of globalization reshape industries with strong reputations for local boundedness, such as VC?	The formation of "transnational technical communities" (TTCs), groups of immigrants active in both the home- and host-country technical networks, significantly affects international VC flows. Professional and technical cumulative immigration levels from a given nation to the U.S. predicts VC outflows from the U.S. to that nation.	Implicitly accept the critical role of interfirm syndication (Sorenson and Stuart 2001), the authors asked, "Where do such ties as interfirm syndications come from?" The tentative answer is that such syndication ties come from prior human networks.
2010 - Balcarcel, Hertzl & Lindsey - SSRN working paper	Contracting frictions and cross-border capital flows: Evidence from venture capital	Thomson VentureXpert database	Cross-border investments made between 1995-2004 by 806 U.S. VC firms in 2052 companies located in 57 countries in total	Institutional theory	What is the effect of a country's legal environment on the extent and nature of investing abroad, with implications for aggregate cross-border investment?	Frictions related to weak contract enforcements are a limiting factor in VC flows. The inability to enforce complex contracting in the target country hinders optimal venture investing abroad, with implications for aggregate cross-border VC flows.	While there is evidence that private contracting mechanisms can mitigate shortcomings in a country's initial legal endowment, reliability of enforcement remains a limiting factor.
2010 - Hochberg, Ljungqvist & Lu - Journal of Finance	Networking as a barrier to entry and the competitive supply of venture capital	International investments made between 1995-2004 by 806 U.S. VC firms in 2052 companies located in 57 countries in total	All investments in U.S. companies made by U.S. based VC funds between 1975 and 2003	Network theory	Do strong networks among incumbent VC firms in local markets help restrict entry by outside VC firms, thus improving the incumbents' bargaining power over entrepreneurs?	(1) Countries with more densely networked VC markets – i.e. markets where network ties among incumbents are strong – experience less foreign VC entry. (2) Foreign VC investors with established ties to the domestic VC firms are able to overcome this barrier to entry, but the other domestic VC firms react strategically to increased threats of entry by freezing out domestic firms who facilitate entry. One possible inducement an entrant can offer in return for cooperation in the target market is access to its home market. Reciprocity benefits the cooperating incumbent but must be balanced against any negative reaction likely to arise from the other incumbents. The resulting Nash equilibrium is a function of the expected severity of punishment. (3) The domestic VC firms benefit from reduced foreign VC entry as this improves their bargaining power and results in lower investment prices of their investments.	(1) Networking can have the effect of reducing entry in the VC market. This result may generalize to other heavily networked industries, such as investment banking. (2) Results help explain prior evidence that better-networked VC firms enjoy better performance. Part of the explanation for this may be due to the lower prices VC firms pay for investments in more densely networked markets. (3) Provide insights on the process of entry in the VC industry. Successful entry appears to involve "joining the club" by offering the incumbents syndication opportunities in one's home market.

Table 1.4. (Continued)

Year - Authors - Journal	Title	Data source	Sample	Theoretical framework	Research question	Findings	Implications/contribution
2010a - Guler & Guillén - Journal of International Business Studies	Institutions and the internationalization of U.S. venture capital firms	Thomson VentureXpert database	216 U.S. VC firms potentially investing in 95 countries during the 1990-2002 period	Institutional theory	What features of the institutional environment influence VC firm's foreign market entry decisions? Why do VC firms decide to invest in some foreign countries but not in others?	(1) VC firms invest in host countries characterized by technological, legal, financial, and political institutions that create innovative opportunities, protect investors' rights, facilitate exit, and guarantee regulatory stability, respectively. (2) As VC firms gain more international experience, they are more likely to overcome constraints related to these institutions.	(2) International VC investors preferably target more institutionally developed countries as this creates a more investor-friendly climate with more transparency and less information asymmetries between VC owners and their PCs. (2) The best way for a government to encourage foreign entry in general, and VC investment from abroad in particular, is to introduce "horizontal" improvements in the scientific, financial, and political institutional infrastructures, that is, reforms that benefit all firms and entrepreneurs as opposed to just a chosen few.
2011 - Schertler & Tykiová - International Business Review	Venture capital and internationalization	Zephyr database	World wide sample of 58,377 VC-PC links	Institutional theory, Info asymmetry, Macro economics	How do country-specific, venture capitalist-specific and deal-specific factors affect international activity?	(1) In the country-pair perspective, expected growth differences between the PC's and VC firm's country are strongly positively related to the number of international deals between the two countries. (2) In the perspective of the VC firm, expected growth in his home country strongly increases the number of its domestic deals, while it slightly discourages the number of its international deals. (3) A higher market capitalization in the VC firm's home countries leads to more domestic as well as foreign deals. (4) In the perspective of the PC, the number of deals financed by foreign investors increases when the expected growth and the market capitalization of the PCs' countries increase.	(1) Not only the expected growth in the PCs' countries is responsible for foreign VC activity. VC firms with more promising investment opportunities in their home country prefer to invest more at home and less abroad. VC firms are hence constrained in raising additional funds when investment opportunities improve. (2) Market capitalization does not only capture investment opportunities, but it also captures VC firms' fundraising conditions. (3) VC firms and PCs should take macroeconomic factors into account when considering internationalization, i.e., when VC firms decide whether to invest in a domestic or a foreign PC, or when the companies choose between a local and a foreign VC. (3) Formulate and test hypotheses on how macroeconomic factors in the PC as well as VC countries affect international investments worldwide.
2012 - Aizenman & Kendall - Journal of Economic Studies	The internationalization of venture capital	Thomson VentureXpert database	Data on VC investments in over 100 countries covering three decades	/	What are the factors in directing the international VC flows?	Distance, common language, and colonial ties are significant determinants in directing the international VC and VC flows. Moreover, local high end human capital, better business environments, higher levels of military expenditure, and larger financial markets are important factors that attract international VC.	
2012 - Schertler & Tykiová - Journal of International Money and Finance	What lures cross-border venture capital inflows?	Zephyr database	Domestic and international VC investments in 15 European countries, the U.S, and Canada from 2000 to 2008	Two country demand – supply framework	Do economic factors drive gross and net international VC inflows differently?	Most economic factors shape gross and net inflows in a similar way. Two target country economic factors drive gross and net international VC inflow differently. Higher expected economic growth leads to higher gross as well as net international VC inflows, while more developed capital markets and more favourable VC environment results in higher gross inflows, but lower net inflows.	First paper that investigates net flows taking into account that countries originate and receive foreign VC finance at the same time. The findings may suggest that international VC inflows partly compensate for potential limits in domestic VC supply. However, the findings may also reflect that VC firms' locational decisions depend on the viability of capital markets. The paper offers valuable insights for policy makers who aim to establish viable VC industries.

Table 1.4. (Continued)

Year - Authors - Journal	Title	Data source	Sample	Theoretical framework	Research question	Findings	Implications/contribution
2012 - Bottazzi, Da Rin & Hellmann - NBER working paper	The importance of trust for investment: evidence from venture capital	Hand collected data, survey of 685 VC firms in 15 European countries	108 responses on survey	Social capital theory, Discrete choice framework	What is the impact of trust among nations on investment by foreign VC firms? (1) Impact on probability to invest? (2) Impact on contracting?	(1) Trust has a significant effect on the investment decisions of VC firms and on how they structure the financial contracts. (2) Trust among nations significantly affects investment decisions. (3) The authors conclude that lack of trust is a hurdle to making VC investments, but that investors who overcome this hurdle tend to do well.	(1) First paper to examine the effect of generalized trust in a corporate finance setting. (2) Identify an effect of trust on investments in a micro-economic environment where alternative explanations can be controlled, most notably with powerful combination of investor and company fixed effects. (3) New insights into how the effect of trust varies across different types of investors. (4) Evidence suggests that lack of trust imposes a hurdle for investments. Importantly, it is a hurdle but not a barrier, so that some key comparative statics on when investors are more or less able to overcome these trust hurdles can be derived. (5) Generalized trust is a force that cannot be ignored in the analysis of VC investment. (6) Policy implications: Governments across the globe are seeking to attract VC firms to invest in their countries. Results suggest that investments will be more forthcoming from countries where there is higher generalized trust. This provides some guidance as to what countries might be the most promising targets for government that want to attract foreign VC investments.

1.3.1.2. VC firm level determinants³

Besides country determinants, several VC firm level determinants impact a single VC firm's probability to invest in foreign countries. Structural and strategic features of VC firms – such as their investment focus, type of VC investor and reputation – impact their probability to invest internationally (Cumming and Dai, 2010; Fritsch and Schilder, 2008; Gupta and Sapienza, 1992). VC firms specializing in early stage, in technology industries, using more staging and investing as lead prefer narrower geographic scope. Corporate VC firms, VC firms where investment managers can spend more time on a single PC, and more reputable VC firms – i.e. older, larger, more experienced and with stronger IPO track record – exhibit a broader geographic scope (Cumming and Dai, 2010; Fritsch and Schilder, 2008; Gupta and Sapienza, 1992). VC firms are hence not homogeneous in their portfolio's product-market scope. Moreover, more reputable and corporate VC firms seem better able to reduce information asymmetries associated with distance.

Next to the VC firms' structural and strategic features, a VC firms' network has a major impact on its probability to make foreign investments (Cumming and Dai, 2010; Iriyama et al., 2010; Sorenson and Stuart, 2001). Social networks in the VC industry - built up through syndication – diffuse information about potential investment opportunities across boundaries expanding the spatial investment radius of VC investors (Sorenson and Stuart, 2001). Better networked VC firms hence exhibit less local bias (Cumming and Dai, 2010; Sorenson and Stuart, 2001). These results show that despite communication technology advances, inherent boundaries around the flow of timely, reliable, fine grained and high-quality information produce localized patterns of exchange. Better networked VC firms are however able to reduce these information asymmetries associated with distance through interpersonal social relations with local investors.

Finally, the investment experience of both a VC firm and its investment managers impact the VC firm's geographical scope (De Prijcker et al., 2012; Patzelt et al., 2009; Schertler and Tykvová, 2011, 2012). VC firms with more foreign experience invest more intensively abroad (Schertler and Tykvová, 2011, 2012) since they are more familiar with the institutional and legal environment in foreign countries and have a better access to international networks. VC firms with extensive domestic experience, on the other hand, also invest more often internationally since they more easily implement a geographical diversification of their portfolios (Schertler and Tykvová, 2011). VC firms with higher proportions of investment managers having international or entrepreneurial experience, have a broader geographic investment scope (De Prijcker et al., 2012; Patzelt et al., 2009). Inherited knowledge through the prior foreign work experience of its management also has a positive effect on internationalization, but external knowledge through its foreign network partners only has limited impact. Intense international contacts even decrease future international activities (De Prijcker et al., 2012). Together, these results highlight the importance of VC firm's and VC manager's experience and inherited knowledge to overcome information asymmetries inherent in the internationalization of VC firms.

³ An overview of the papers discussed, is provided in Table 1.5.

Table 1.5. VC firm level determinants of international VC investments

Year - Authors - Journal	Title	Data source	Sample	Theoretical framework	Research question	Findings	Implications/contribution
1992 - Gupta & Sapienza - Journal of Business Venturing	Determinants of venture capital firms preferences regarding the industry diversity and geographic scope of their investments	Pratt's guide to venture capital sources	Random sample of 169 domestic VC firms from California, Massachusetts, and Texas which represented 27% of all U.S.- based VC firms in 1987	Risk diversification and needs	What are the determinants of VC firms' preferences regarding industry diversity and geographic scope of their investments?	(1) VC firms specializing in early stage financing and who provide small business investment companies (SBIC) financing prefer narrower geographic scope. (2) Corporate VC firms and larger VC firms prefer broader geographic scope.	U.S. VC firms are not homogeneous in their portfolio's intended product-market scope. This has implications, not only for VC firms, but also for their suppliers (limited partners), buyers (entrepreneurs), and policy-makers. VC firms can not rely on random investment schemes: they need to attract investor managers considering the benefits offered by their portfolio strategy, and to attract superior investments by offering value added services and know-how.
2001 - Sorenson & Stuart - American Journal of Sociology	Syndication networks and the spatial distribution of venture capital investments	Thomson VentureXpert database	Create the potential but unrealized dyad between all PCs and VC firms that did not pair. This matched sample includes 80,406 cases involving 1,025 VC firms and 7,590 target companies. Realized U.S. VC industry pairs formed between 1986-1998	Opportunity-based theory of market exchange	How do interfirm networks in the U.S. VC market affect spatial patterns of exchange?	Social networks in the VC industry - built up through syndication – diffuse information about potential investment opportunities across boundaries expanding the spatial investment radius of VC investors.	(1) Despite communication advances, inherent boundaries around the flow of timely, reliable, and high-quality information produce localized patterns of exchange. These boundaries exist because interpersonal social relations concentrate within industries and regions more often than they bridge industrial and regional boundaries. This observation reflects the simple fact that people converge in space and time more frequently when they live near one another and have occasion to meet in the course of work and play. (2) Albeit only U.S. data is included in this study, it is interesting, because it provides the cross-border VC field with interesting insights from economic sociology.
2008 - Fritsch & Schilder - Environment and Planning A	Does venture capital investment really require spatial proximity? An empirical investigation	German PE and VC association, business angel network Germany, association of German banks, interview survey carried out between 2004 -2005	75 VC firms in diverse regions of Germany	Selection, Transaction costs	Does VC investment really require spatial proximity?	The probability to make distant investments increases with the time that investment managers can spend on a single investment.	Absence of VC firms in a region is not likely to be a hindrance to innovative entrepreneurs in Germany. From the perspective of the VC managers, the main hindrance is the low numbers of promising investment opportunities. The authors can, however, not completely preclude the existence of informational bottlenecks which prevent a match between entrepreneurs and VC suppliers.
2009 - Patzelt, zu Knyphausen-Aufseß & Fischer - Journal of Business Venturing	Upper echelons and portfolio strategies of venture capital firms	EVCA yearbook of year 2005	TMTs and portfolio strategies of 136 European VC firms	Upper echelon theory	How does the composition of the top management team influence the portfolio strategy choice in VC firms?	VC firms with higher proportions of TMT members with international or entrepreneurial experience have a broader geographic investment scope.	(1) TMTs in VC firms can better understand how their education and experiences impact their collective decision policies with respect to preference of geographic scope which may help them to draw more accurate and better decisions. (2) Entrepreneurs will find different types of expertise in VC firms depending on the portfolio strategy of the firm suggesting that they should consider this strategy when seeking VC funding.

Table 1.5. (Continued)

Year - Authors - Journal	Title	Data source	Sample	Theoretical framework	Research question	Findings	Implications/contribution
2010 - Iriyama, Li & Madhavan - Strategic Entrepreneurship Journal	Spiky globalization of venture capital investments: The influence of prior human networks	Thomson VentureXpert database	50,490 region-nation-year pairs (i.e. 51 U.S. states, 90 foreign nations and 11 years from 1995 to 2006)	Network theory	Is the globalization of VC investments spiky; and what is the mechanism that underlies such spiky globalization?	The spread of U.S. international VC investments has a spiky geographical pattern as - driven by the spiky international pattern of human networks - the linkages between certain regions in the U.S. and some foreign countries is exceptionally intense.	Contributes to international entrepreneurship: (1) Introduce the spiky globalization perspective, offering a better understanding of the geographic pattern of international VC and international entrepreneurship. The bilateral intensity index empirically demonstrates the spiky globalization pattern. (2) A theoretical argument, drawn from economic sociology, is offered to explain the spiky globalization of VC investments: cross-border human networks tend to follow a spiky globalization pattern which, in turn, drives the spiky globalization pattern of VC.
2010 - Cumming & Dai - Journal of Empirical Finance	Local bias in venture capital investments	Thomson VentureXpert database	Sample of U.S. VC investments: 122,248 VC company round observations, representing 20,875 companies invested by 1,908 VC firms from 1980 -2009	Info asymmetry	How does local bias depend on VC firms' characteristics and how does local bias impact performance?	(1) More reputable VC firms (older, larger, more experienced, and with stronger IPO track record) and VC firms with broader networks prefer a broader geographic scope. (2) VC firm specializing in technology industries and using more staging prefer a narrower geographic scope. (3) VC firms prefer a narrower geographic scope when they are the lead VC and when investing alone.	(1) More reputable VC firms are better in reducing information asymmetry associated with distance. (2) Regional development policies implications: to stimulate the development of the new ventures the presence of local VC firms should be stimulated given the existence of local bias in VC investments. This can be achieved either by direct investment in the local new ventures or by forming syndicates with VC firms in other areas.
2011 - Schertler & Tykvvová - International Business Review	Venture capital and internationalization	Zephyr database	World wide sample of 58,377 VC-PC links	Institutional theory, Info asymmetry, Macro economics	How do country-specific, VC-specific and deal-specific factors affect international activity?	(1) VC firms with more foreign and domestic experience invest more intensely abroad since they are more familiar with the institutional and legal environment in foreign countries and have a better access to international networks. (2) VC firms with extensive domestic experience invest internationally more often since they more easily implement a geographical diversification of their portfolios.	(1) Examine whether the benefits and costs of international investing vary with VC firms' foreign and domestic experience. (2) Investigate whether larger deals are responsible for VC firms' internationalization. They posit that foreign VC firms are more likely to participate in large deals either because the degree of information asymmetries is lower and management support is less needed or because large deals have a higher diversification necessity.
2012 - Schertler & Tykvvová - Journal of International Money and Finance	What lures cross-border venture capital inflows?	Zephyr database	Domestic and international VC investments in 15 European countries, the U.S., and Canada from 2000 to 2008	Two country demand – supply framework	Do economic factors drive gross and net international VC inflows differently?	VC firms with more domestic and foreign experience invest more intensely abroad.	First paper that investigates net flows taking into account that countries originate and receive international VC finance at the same time. The findings may suggest that international VC inflows partly compensate for potential limits in domestic VC supply. However, the findings may also reflect that VC firms' locational decisions depend on the viability of capital markets. The paper offers valuable insights for policy makers who aim to establish viable VC industries.

Table 1.5. (Continued)

Year - Authors - Journal	Title	Data source	Sample	Theoretical framework	Research question	Findings	Implications/contribution
2012 - De Prijcker, Manigart, Wright & De Maeseeneire - International Business Review	The influence of experiential, inherited and external knowledge on the internationalization of venture capital firms	Hand-collected data, questionnaires, archival data, national and European VC associations, Zephyr database	110 VC firms from 5 European countries	Info asymmetry, Agency risk, Network theory	Which types of international knowledge accumulation impacts the internationalization of VC firms?	(1) International human capital of VC firms increases the likelihood to operate internationally. (2) VC manager's experience and inherited knowledge have a positive effect on internationalization, but external knowledge has limited impact. (3) Intense international contacts even decrease international activities. (4) Together, these results highlight the importance of VC manager's experience and inherited knowledge to overcome information asymmetries inherent in the internationalization of professional service firms, and of VC firms in particular.	(1) Different types of foreign knowledge accumulation differentially compensate for international investing problems. (2) Highlight the complementarities between early internationalization theorists (focus on internal knowledge development) and the findings from "new venture internationalization" studies (stress the impact of inherited knowledge). Show that, under conditions of severe information asymmetries, both sources of knowledge accumulation are important. (3) Stress the multidimensionality of network relationships through the different effects of foreign network range and foreign network intensity. (4) Explain the effect of resources on the investment strategy through a focus on international investment activities. Add to the knowledge on international VC transactions by focusing on the determinants of the international investment strategy. (5) Professional service firms with international aspirations should focus on several sources of foreign knowledge accumulation as each of these sources may influence international development. (6) Professional service firms should pro-actively develop a human resource management that specializes in the search and retention of international management talent. (7) VC firms with international aspirations have to reflect on their cooperation with non-domestic syndication partners, as it may prove a suboptimal strategy. Knowledge-intensive firms should, in contrast, actively build a broad social network fostering international development.

1.3.2. Strategies to compensate for liabilities of foreignness⁴

In line with the understanding that local knowledge and networks are key in a VC setting, multiple papers show that domestic and non-domestic PCs differ in the way they are sourced, funded, syndicated, monitored and receive value adding (Mäkelä and Maula, 2006). The increased geographical, cultural and institutional distance foreign VC firms face severely limits the use of domestically used investment strategies to mitigate information asymmetries. In a local context, VC firms manage uncertainty by sourcing favourable investment targets through their entrusted local networks and intensive screening involving face to face meetings (Sorenson and Stuart, 2001). Moreover, VC firms provide their PCs more than blunt capital. Instead they provide value adding services (Hsu, 2004). These value adding are however also hindered for cross-border VC investors, as they often require proximity. Additionally, telecommunication cannot be regarded as a means of overcoming the problems of geographical distance, telecommunication is hence no full substitute for face-to-face contact (Fritsch and Schilder, 2008). As a result, when VC firms invest internationally, they will have to adapt their investment strategy rather than to merely implement the “recipes” from their domestic markets. For instance, foreign VC firms in India place significantly greater emphasis on product market factors and accountants’ reports than domestic VC firms when selecting investment targets in India (Wright et al., 2002). In contrast they put less emphasis on financial contributions of the PC’s management, their own due diligence and information from entrepreneurs in assessing risk than they do in their respective domestic markets. Moreover, foreign VC firms investing in India prefer strategic monitoring and advice than monitoring of the operational activities, as the former is easier to provide across distance (Pruthi et al., 2003).

A first strategy which cross-border VC investors may employ to compensate for the increased information asymmetries, is the use of legal contracts (Balcarcel et al., 2010; Bengtsson and Ravid, 2009; Bottazzi et al., 2009). Using a sample of European VC deals, Bottazzi and colleagues (2009) find that better legal systems in a VC firm’s home country are associated with more VC involvement and the VC investor’s legal system is more important than the PC’s in determining investor behaviour even when investing abroad. More specifically, the adoption of certain contracting practices, for instance downside protection, is affected by the VC firm’s domestic legal system. As a result, VC firms from common law countries are more prone to use such contracts, not only in their domestic investments but also when investing across borders. Balcarel et al. (2010) further demonstrate that cross-border VC investors invest larger amounts in PCs in countries with worse legal protection. This suggests cross-border VC firms mitigate contracting problems in countries with weak legal environments by taking larger equity stakes, which enables to enforce control rights which courts may not be able to adequately enforce with smaller stakes. Finally, contracts give more high powered incentives to the entrepreneurs, such as cash flow contingencies, when the geographical distance between a VC firm and its PC increases (Bengtsson and Ravid, 2009). This supports the view that geographical distance makes monitoring more difficult and that VC investors try to mitigate these drawback through contracting.

⁴ An overview of the papers discussed, is provided in Table 1.6.

Deal flow generation also experiences liabilities of foreignness, as foreign VC firms originate fewer unsolicited deals from their networks compared to domestic VC firms (Lu and Hwang, 2010). In response, international VC firms mainly draw upon their home country advantages by originating more solicited deals from their networks. Moreover, some VC firms' domestic network advantages, such as their social status advantages, are transferable from the VC firms' home country to the target company's country (Guler and Guillén, 2010b).

Geographical distance reduces the efficiency of information transmission (Sorenson and Stuart, 2001). Cross-border VC firms entering less institutionally developed countries alleviate higher levels of information asymmetries through syndication with local VC investors (Chemmanur et al., 2012; Dai et al., 2012; Guler and Guillén, 2010b; Meuleman and Wright 2011; Sorenson and Stuart, 2001). Based upon cases of nine Finnish VC backed PCs, Mäkelä and Maula (2008) show how local VC firms actively help their PCs in attracting cross-border VC investors. Local syndication mitigates information and value adding problems as it allows to outsource the monitoring and value adding functions to local co-investors (Mäkelä and Maula, 2008; Chemmanur et al., 2012), which are not hindered by geographical, cultural or institutional distance. Additionally, by co-investing with local partners, international VC firms may generate additional value through the combination of skill sets, experience and networks of a diversity of VC firms (Schertler and Tykvová, 2012). VC firms can, however, reduce institutional environment barriers and the negative effects of information asymmetries through organizational learning (Meuleman and Wright, 2011). Both a VC firm's focal country-level experience and its multinational experience reduce its need to rely on local partners through cross-border syndication. Further, VC firms with more investment executives per PC learn faster and hence have a lower probability to engage in cross-border syndication (Meuleman and Wright, 2011).

A different strategy used by cross-border VC firms to overcome liabilities of foreignness is to select PCs with lower ex-ante information asymmetries which decreases information costs and thereby compensates their deficiencies related to the lack of knowledge of local markets and higher monitoring costs. Foreign VC firms are more likely to invest in more information-transparent PCs (i.e. in a later stage or a later round) and in larger deals (Chemmanur et al., 2012; Dai et al., 2012; Schertler and Tykvová, 2011).

Finally, the internationalization literature suggests yet another strategy to compensate for non-domestic investing, which is to set up a local branch office. This ensures proximity to entrepreneurs and thereby reduces asymmetric information problems (Pruthi et al., 2009). When employing local investment professionals in the branches, cultural and institutional differences disappear, thereby further facilitating transfer of knowledge and advice to the PC (De Prijcker et al., 2012; Pruthi et al., 2009). The foreign head office will typically be represented in the branches' investment committee that typically decides on investments. This allows the foreign head office to manage challenges that otherwise would require deployment of expatriates (Pruthi et al., 2009). VC firms' decision to open a branch in a foreign region is strongly driven by the success rate of VC investments in that region (Chen et al., 2010).

Table 1.6. Strategies to compensate for liabilities of foreignness

Year - Authors - Journal	Title	Data source	Sample	Theoretical framework	Research question	Findings	Implications/contribution
2001 - Sorenson & Stuart - American Journal of Sociology	Syndication networks and the spatial distribution of venture capital investments	Thomson VentureXpert database	Create the potential but unrealized dyad between all PCs and VC firms that did not pair. This matched sample includes 80,406 cases involving 1,025 VC firms and 7,590 target companies. Realized U.S. VC industry pairs formed between 1986-1998	Opportunity-based theory of market exchange	How do interfirm networks in the U.S. VC market affect spatial patterns of exchange?	Syndication enables the distribution of information across geographical boundaries and VC firms in central network positions have better access to information from distant sources and thus a larger investment radius. They further argue that geographical distance reduces the efficiency of information transmission.	(1) Despite communication advances, inherent boundaries around the flow of timely, reliable, and high-quality information produce localized patterns of exchange. These boundaries exist because interpersonal social relations concentrate within industries and regions more often than they bridge industrial and regional boundaries. This observation reflects the simple fact that people converge in space and time more frequently when they live near one another and have occasion to meet in the course of work and play. (2) Albeit only U.S. data is included in this study, it is interesting, because it provides the cross-border VC field with interesting insights from economic sociology.
2002 - Wright, Lockett & Pruthi - Small Business Economics	Internationalization of western venture capitalists into emerging markets: Risk assessment and information in India	Interviews with VC executives	31 VC firms investing in India	Institutional theory, Info asymmetry	Do managers in foreign VC firms adapt to local market conditions and do they use the same approaches to assess the risk and sourcing information as in domestic markets?	(1) Foreign (mainly U.S.) VC firms in India place significantly greater emphasis on product market factors and accountants' reports than domestic firms in India. (2) They place significantly less emphasis on financial contributions of the PC's management in assessing risk and own due diligence and information from entrepreneurs than do U.S. firms in their domestic market. (3) High levels of employment of Indian nationals affords access to local information networks but foreign firms were also more likely to seek other independent info.	Implications both for the development of internationalization strategies by VC firms and for the development of emerging VC markets. Evidence that VC firms adapt to local market conditions rather than implementing the "recipes" from their domestic markets.
2003 - Pruthi, Wright & Lockett - Asia Pacific Journal of Management	Do foreign and domestic venture capital firms differ in their monitoring of investees?	Asia Pacific Private Equity Bulletin (VC directory), questionnaire, face-to-face interviews	31 interviews (84% of active VC firms in India in year 2000)	Info asymmetry, Agency theory	Do foreign and domestic VC firms differ in their PC monitoring?	(1) Cross-border VC firms are more involved on the strategic level and domestic ones on the operational level of steering PCs. (2) Cross-border VC firms prefer strategic monitoring and advice which is easier to guarantee across distance than monitoring of the operational activities.	(1) First detailed analysis of the monitoring activity of VC firms in India. (2) Foreign VC firms have significantly less operational and informal level involvement in some areas than domestic firms. This finding is interesting as foreign VC firms employ a high level of local nationals as investment executives. This might be expected to contribute to overcoming local cultural differences. (3) Foreign VC firm parents tend to set policy after discussion with the local subsidiary. Therefore, the foreign parent firms may attempt to institutionalize local executives into their way of conducting business. (4) Different approaches to involvement and monitoring mechanisms may be appropriate in the different markets in which VC firms seek to operate. (5) Further evidence on differences between VC markets and highlight the dangers of over-generalization both from one market to another and within markets. These differences apply not just to comparisons between developed and undeveloped economies, but also within broader geographical areas.

Table 1.6. (Continued)

Year - Authors - Journal	Title	Data source	Sample	Theoretical framework	Research question	Findings	Implications/contribution
2008 - Fritsch & Schilder - Environment and Planning A	Does venture capital investment really require spatial proximity? An empirical investigation	German PE and VC association, business angel network Germany, association of German banks, interview survey carried out between 2004 -2005	75 VC firms in diverse regions of Germany	Selection, Transaction costs	Does VC investment really require spatial proximity?	Telecommunication cannot be regarded as a means of overcoming the problems of geographical distance, telecommunication is hence no valid substitute for face-to-face contact.	(1) Absence of VC firms in a region is not likely to be a hindrance to innovative entrepreneurs in Germany. (2) From the perspective of the VC managers, the main hindrance is the low numbers of promising investment opportunities. The authors can, however, not completely exclude the existence of informational bottlenecks which prevent a match between entrepreneurs and VC suppliers.
2008 - Mäkelä & Maula - Entrepreneurship and Regional Development	Attracting cross-border venture capital: the role of a local investor	58 semi-structured interviews, observations and several secondary sources (Thomson VentureXpert database, company websites, press releases, newspapers,...)	9 PCs from Finland who have their primary market in foreign nations and were invested by at least one cross-border VC	Grounded theory approach & case study, Institutional theory	What is the role of local VC investors in attracting cross-border VC investors?	Cross-border VC investors preferably invest in companies to which local VC firms have provided operational management advice, introduced local contacts and local market knowledge. The importance of this preparation by local VC firms is mitigated when the entrepreneurs are highly experienced or when the home market is not important for the PC. The domestic VC firms hence have an important signalling value which facilitates cross-border investment and syndication.	Overall, the model developed in the paper contributes to a better understanding of cross-border VC and in particular to the division of labour between domestic and foreign VC firms in international VC syndicates. The paper also contributes to the emerging literature on international social capital.
2009 - Bottazzi, Da Rin & Hellmann - Journal of Financial Intermediation	What is the role of legal systems in financial intermediation? Theory and evidence.	Survey send to 750 VC firms, Amadeus, Worldscoop and Thomson VentureXpert database	1,431 investments from 124 VC firms in 17 European countries for the period 1998–2001	Double moral hazard, Institutional theory	How do optimal contracts and investor actions depend on the quality of the legal system?	The VC firm's home country legal system plays a critical role in their behaviour when investing abroad. Better legal systems are associated with more VC involvement and the VC investor's legal system is more important than the PC's in determining investor behaviour even when investing abroad. More specifically, the adoption of certain contracting practices, for instance downside protection, is affected by the VC's domestic legal system. As a result, VC firms from common law countries are more prone to use such contracts not only in domestic investments but also when investing across borders.	The main theoretical contribution is to introduce legal systems issue into a double moral hazard model.

Table 1.6. (Continued)

Year - Authors - Journal	Title	Data source	Sample	Theoretical framework	Research question	Findings	Implications/contribution
2009 - Pruthi, Wright & Meyer - International Journal of Human Resource Management	Staffing venture capital firms' international operations	Questionnaire survey with qualitative interviews	37 International VC firms; 31 non-international VC firms all investing in the UK	Knowledge-based view (exploratory approach)	RQ1: What is the composition of VC firms' international staffing pool? RQ2: Why do VC firms deploy expatriates? RQ3: How do VC firms co-ordinate international decision-making?	(1) When foreign VC firms establish a local branch, the recruitment of local executives is more important than the deployment of expatriates. (2) From all suggested motives in literature, the most important reason for expatriation is to transfer knowledge. (3) Investment committees play a key role in the international decision-making process, it allows international VC firms to manage challenges faced by local branches that otherwise would require deployment of expatriates.	(1) Even though VC firms can transfer their general human capital across markets, they need to acquire context-specific knowledge and experience in the local markets they enter. VC firms manage the integration of global and local knowledge primarily through decision-making in investment committees that bring together key executives from the home country with local executives. In this way, they overcome the conventional 'parent-subsidiary' hierarchy typical of manufacturing firms. (2) The article adds to understanding of the heterogeneity of service industries and their implications for international staffing. (3) This paper fills a gap in the international human resource management literature by focusing on an industry that is very knowledge-intensive and thus allows the application of the knowledge based view (KBV) of the firm, a relatively under-explored framework for understanding internationalization strategies.
2009 - Bengtsson & Ravid - SSRN working paper	The geography of venture capital contracts	VCExperts	1,800 investment rounds in 1,500 early stage U.S. high tech PCs	Contract theory, Institutional theory	Do geographical elements and regional culture impact contract design?	When the geographical distance between a VC and a PC increases, contracts give more high powered incentives to the entrepreneurs such as cash flow contingencies. This supports the view that geographical distance makes monitoring more difficult and that VC investors try to mitigate these drawbacks.	(1) Unlike studies of international differences in VC contracts and VC investment decisions, this paper is the first to study the role of geography within a country. The results can hence not be explained by differences in the legal system, rule-of-law, accounting transparency, bankruptcy procedures, taxation, etc. Interviews with lawyers and legal scholars have confirmed that there are no institutional reasons why U.S. VC contracts should vary by company or VC location. (2) Because geographical factors have real-world relevance for how VC contracts are designed, they should be included as controls in any empirical analysis of cash flow and control rights.
2010 - Balcarcel, Hertzal & Lindsey - SSRN working paper	Contracting frictions and cross-border capital flows: Evidence from venture capital	Thomson VentureXpert database	Cross-border investments made between 1995-2004 by 806 U.S. VC firms in 2,052 companies located in 57 countries in total	Institutional theory	What is the effect of a country's legal environment on the extent and nature of cross-border investment?	U.S. VC firms make larger investments (in fewer rounds) in companies located in countries with worse legal protection. In particular, both average round sizes and the fraction of financing raised in the first round are larger for companies in countries with poorer legal enforcement. This result is in line with the third-best contracting hypothesis: VC firms take a larger stakes because courts may not be able to adequately enforce control rights with smaller ownership stakes.	While there is evidence that private contracting mechanisms can mitigate shortcomings in a country's initial legal endowment, reliability of enforcement remains a limiting factor.
2010 - Lu & Hwang - Asia Pacific Journal of Management	The impact of liability of foreignness on international venture capital firms in Singapore	EDB (Economic Development Board), AVCJ (Asia Venture Capital Journal), Survey in 1999	34 VC firms investing in Singapore responded to survey of which 17 are international VC firms	Liabilities of foreignness, Info asymmetry	What is the impact of liabilities of foreignness on the deal sourcing of international VC firms in Singapore?	Due to liabilities of foreignness, foreign VC firms investing in Singapore originate fewer unsolicited deals from their networks compared to domestic VC firms. In response to this drawback, international VC firms mainly draw upon their home country advantages by attempting to originate more solicited deals from networks.	(1) Contribute to VC investment decision process literature by taking a knowledge perspective which links VC deal origination and VC evaluation to VC knowledge differences. (2) While prior research found VC investment behavioural differences across markets in various development stages, this study found such differences exist in one market. (3) Contribute to the less explored field of the investment decision process of international VC firms in overseas markets. (4) International VC firms need help to accumulate their local knowledge and build networks. Policy makers could formulate relevant policies to help them. For example, incentives for domestic VC firms, particularly government-linked VC firms, to co-invest with international VC firms.

Table 1.6. (Continued)

Year - Authors - Journal	Title	Data source	Sample	Theoretical framework	Research question	Findings	Implications/contribution
2010b - Guler & Guillén - Academy of Management Journal	Home country networks and foreign expansion: Evidence from the venture capital industry	Thomson VentureXpert database, World Bank's (2004) World Development Indicators database, Henisz's (2000) Index of Political Constraints, CEPII geographic distance database	All actual and potential investments of 1,010 U.S. based VC firms active between 1990-2002 in 95 countries	Social network theory, Foreign networks expansion theory	Do home country advantage VC firm's foreign expansion?	Home-country network advantages of U.S. VC firms such as social status advantages are transferable from the home country to the target country.	(1) Add to transferability of network-based advantages literature by examining the impact of home-country network advantages on firms' propensity to expand abroad and on the choice of foreign markets to enter. (2) Examine how focal firms with various levels of social status and brokerage advantages react to the entry of home country partners into foreign markets, thus providing a dynamic perspective that takes into account how networks and the advantages associated with them change over time. (3) Integrate theories of international business with those from the field of social network analysis. (3) Extend prior work on foreign market entry by emphasizing firm-specific advantages that originate from network structure as opposed to advantages that firms develop within their boundaries. (4) Contributes to the research on interfirm networks by examining the portability of advantages originating from a given network outside the boundaries of the network. (5) Complement prior research by highlighting how the impact of network advantages on foreign market entry changes as a network evolves.
2011 - Schertler & Tykvová - International Business Review	Venture capital and internationalization	Zephyr database	World wide sample of 58,377 VC-PC links	Institutional theory, Info asymmetry, Macro economics	How do country-specific, venture capitalist-specific and deal-specific factors affect international activity?	As costs of investing abroad vary with deal size, large deals have a higher probability that foreign VC firm participates and this effect is more pronounced when a large deal takes place in a small country, indicating that international VC investment is partly due to limitations in the availability of local VC firms.	Deal size influences the participation of a foreign VC which is consistent with the view that the costs and/or benefits of investing in non-domestic countries depend on the degree of information asymmetries between the VC and the portfolio company and the VC's diversification needs.
2011 - Meuleman & Wright - Journal of Business Venturing	Cross-border private equity syndication: Institutional context and learning	Centre for Management Buy-out Research (CMBOR), British Venture Capital Association (BVCA), European Venture Capital Association (EVCA), questionnaire with telephone follow-up, Bankscope	685 buy-out investments by 69 different UK PE investors between 1990-2006 in continental Europe. Questionnaire response rate of 82%	Institutional theory, Organizational theory	Why do foreign PE firms rely on local partners through cross-border syndicates when investing abroad?	(1) Institutional differences induce PE firms to rely on local partners through cross-border syndication. The likelihood that a cross-border deal will be syndicated with local partners decreases when the number of investment banks in the host country is higher. Moreover, there is an inverted U-shape relationship between the likelihood that a cross-border deal will be syndicated with local partners and the number of local investors. (2) PE firms reduce institutional environment barriers through learning. Country-level experience and multinational experience reduce the need to rely on local partners through cross-border syndication. (3) The more investment executives that are available at the PE firm to manage the investments, the faster PE firms learn and hence the lower the probability to use cross-border syndication. (4) Presence of a local office is not significantly related to the reduced likelihood of syndicating with local partners.	(1) PE literature has mainly focused on the early stage VC market. Informational asymmetries may however be less problematical in the later stage market, which has implications for the need to syndicate. (2) PE firms are different from other service firms as they invest in a foreign venture with the aim of making a financial return when they divest. At the same time, PE firms assume an active role by monitoring and adding value to their PC. (3) Examine whether cross-border syndication decisions are shaped by the PE firm's capacities as an adaptive learning organization. Extend the notion of experience by incorporating the concepts of direct experiential knowledge from doing deals either in the host country or multinationally and the intensity of that experience, and the indirect experience from having a local office which may not involve deal doing but which may add to knowledge of the local institutional context. (4) Provide insights to practitioners into the complementarities involved in syndication and recruitment strategies when PE firms internationalize. PE firms that internationalize may explicitly pursue an initial strategy of syndicating with local partners since expertise gained in the domestic market may not easily transfer to a foreign context. Once they have built experience, they may gradually rely more on investing on their own.

Table 1.6. (Continued)

Year - Authors - Journal	Title	Data source	Sample	Theoretical frame work	Research question	Findings	Implications/contribution
2012 - Chemmanur, Hull & Krishnan - SSRN working paper	Do local and international venture capitalists play well together? A study of international venture capital investments	Thomson VentureXpert database	30,071 VC backed companies invested from 1989-2008 and located in 45 countries world wide	Institutional theory, Syndication	Do international VC firms add value to entrepreneurial companies, and how do they interact with domestic VC firms?	(1) More distant international VC firms are more (marginally) likely to syndicate with local VC firms and stage their investments over more rounds, and are less likely to invest in early stage entrepreneurial firms, potentially to mitigate their deficiencies related to the lack of knowledge of local markets and higher monitoring costs. (2) Results are stronger for VC investments in emerging nations than for those in developed nations, which is consistent with the notion that the difficulties in monitoring and the deficiencies in local knowledge faced by international VC firms are more important in emerging markets.	(1) Both expertise in VC and knowledge of local firms and markets are important in enabling VC to add value to the entrepreneurial firm they invest in. (2) Syndicates consisting of different kinds of VC firms allow an exchange of information across VC firms and also enable the syndicate to overcome deficiencies of individual VC firms. (3) Greater distance between VC and PC increases monitoring costs. (4) Staging is a way to mitigate the effects of the larger monitoring costs faced by international VC firms. (5) Younger and early stage entrepreneurial firms require a locally available VC industry, since farther away VC firms are less likely to invest in such firms. (6) The fact that results are stronger for emerging markets indicates that the deficiencies of international VC firms may be overcome by the better infrastructure of, and the VC's greater investment experience in, developed markets.
2012 - Dai, Jo & Kassiech - Journal of Business Venturing	Cross-border venture capital investments in Asia: Selection and exit performance	Thomson VentureXpert database, SDC Platinum M&As, Global New Issues Database	2,860 PCs receiving 4,254 rounds of VC financing by 468 VC firms in Asia from 1996-2006	Info asymmetry	How do frictions associated with geographical and cultural distance impact the investment behaviour (selection) and the exit performance of foreign VC firms investing in Asia?	In the Asian VC markets, when investing alone, foreign VC firms are more likely to invest in more information-transparent (later stage, later round) PCs. Partnership with domestic VC firms helps alleviate information asymmetry and monitoring problem and has positive implication for the exit performance of local entrepreneurial firms.	Sheds additional light on the investment selection behaviour of foreign VC firms when they invest in Asia. The evidences suggests that the geographical and cultural distances faced when investing in Asia has a negative impact on the formation of partnership between foreign and local VC firms. The study extends the syndication literature by showing that partnerships when investing in Asia produces synergy in cross-border VC investments by reducing frictions associated with both geographical and cultural distance. The study also has implications for practitioners interested in investing in the Asian VC market.

1.3.3. Outcomes of international VC investments

Ultimately, what matters for both the entrepreneurs and the VC investors is the outcome of the PC. The exit from PCs is the last and perhaps most important step in the VC cycle (Gompers and Lerner, 2001; Wright and Robbie, 1998), as several stakeholders have a particular interest in the exit outcome. First, the exit route determines the VC firms' returns (Ruhnka and Young, 1987). Second, entrepreneurs are highly involved as the exit route not only impacts their financial return but also their future role within the company. When analysing the exit from PCs it is thus important to note that this phenomenon can be viewed from these different perspectives. A successful outcome for the VC firm is not by definition a successful outcome for the entrepreneur. I will hence discuss the outcomes of international VC investments from both perspectives.

1.3.3.1. Investment outcome from the perspective of the PC⁵

International VC investors impact their PCs' development differently compared to domestic VC investors. Mäkelä and Maula (2006) develop a theoretical model which proposes that changes in a PC's prospects influence the cross-border VC firm's commitment more strongly compared to domestic VC investors. This relationship is magnified with greater geographical distance but mitigated by the relative investment size and the investor's embeddedness in local syndication networks. Next, foreign VC investors may help their PCs to implement an internationalization strategy. Specifically, foreign VC firms located in a PC's target market of internationalization can be valuable for the PC by legitimizing the unknown new company in that market (Mäkelä and Maula, 2005; Mäkelä and Maula, 2006) or can even help to relocate the company into that market (Cumming et al., 2009). However, the remoteness of a cross-border VC investor and its more limited local experience could potentially be harmful as well (Mäkelä and Maula, 2005; Mäkelä and Maula, 2006). Further, cross-border investors tend to drive their PCs towards their home markets, and the benefits may turn into disadvantages if the target market differs from the home markets of the cross-border VC investors (Mäkelä and Maula, 2005).

⁵ An overview of the papers discussed, is provided in Table 1.7.

Table 1.7. Investment outcome of international VC investments from the PC's perspective

Year - Authors - Journal	Title	Data source	Sample	Theoretical framework	Research question	Findings	Implications/contribution
2005 - Mäkelä & Maula - Venture Capital: An International Journal of Entrepreneurial Finance	Cross-border venture capital and new venture internationalization: An isomorphism perspective	58 semi-structured interviews, observations and several secondary sources (Thomson VentureXpert database, company websites, press releases, newspapers,...)	9 PCs from Finland primary market in foreign nations and were invested by at least one cross-border VC firm	Grounded theory approach, Case studies, Institutional theory	What is the role of cross-border VC firms in the internationalization of their PCs?	Foreign VC firms located in a PC's target market of internationalization can be valuable for the venture by legitimizing the unknown new PC in that market. However, foreign investors tend to drive PC towards their home markets, and the benefits may turn into disadvantages if the target market differs from the home markets of the foreign investors.	(1) Prior to agreeing on cross-border investment rounds, entrepreneurial teams and local investors should carefully examine the internationalization objectives of the company, especially in terms of the target locations of internationalization and whether their new candidates for investors are both willing and able to help them there. In addition to financial capital, new investors should be able to provide endorsement, international social capital, and knowledge. (2) Investors, for their part, should search for PCs whose business objectives can be reconciled to be reasonable by both the investor and the investee.
2006 - Mäkelä & Maula - Entrepreneurship Theory and Practice	Interorganizational commitment in syndicated cross-border venture capital investments	58 semi-structured interviews, observations and several secondary sources (Thomson VentureXpert database, company websites, press releases, newspapers,...)	8 PCs from Finland who were invested by at least one domestic and one cross-border VC firm	Grounded theory approach, Case studies, Commitment theory	What are the antecedents of VC firms' commitment in cross-border syndication networks?	Changes in a PC's prospects influence the VC firm's commitment. This relationship magnified by the VC firm's geographical distance and mitigated by the relative investment size and the investor's embeddedness in local syndication networks.	(1) Once an international interorganizational network has been assembled, commitment is needed to hold it together. (2) Results may be generalizable to areas such as the management of international joint ventures and alliances and decision making concerning subsidiaries in multinational corporations. (3) Distant actors that are not well embedded in social action in the vicinity of the focal actor are more likely to relinquish commitment as a response to decreased expectations. To take a reverse angle, proximate actors with a high degree of network embeddedness may exhibit a higher escalation of commitment, i.e., a non-rational degree of continuing commitment.
2009 - Cumming, Fleming & Schwenbacher - Entrepreneurship Theory and Practice	Corporate relocation in venture capital finance	Hand collected dataset from VC firms operating in the Asia-Pacific region using Asian Venture Capital Journal's Annual Guides; Asian Venture Capital Journal, Australian Venture Capital Journal, and Thomson VentureXpert database	53 VC funds involving 468 PCs in 12 countries in Asia-Pacific region from 1989-2001	Institutional theory	Why and when do VC firms relocate PCs?	(1) Relocations to the U.S. are motivated by economic conditions as well as an improvement in the laws of the country in which the entrepreneurial company is based. (2) Relocations to the U.S. yield much greater returns to Asia-Pacific VC firms than investing in companies already based in the U.S. at the time of VC investment. (3) More experienced Asia-Pacific VC firms have greater success with their PC relocations to the U.S., and these relocations yield higher returns relative to staying in their country of origin.	(1) Legal conditions are important for VC-backed companies and to the growth of a VC market. With the help of VC firms, entrepreneurs are more likely to move promising companies to markets with a stronger legal environment in order to facilitate the successful exit of investors. (2) International relocations facilitate locational advantages for PCs in terms of being closer to consumers. (3) PCs backed by more experienced VC firms are more likely to experience greater success with their international relocations. Entrepreneurs in emerging countries therefore have a pronounced incentive to be backed by an experienced VC. (4) PC characteristics are important for driving the need for and success of the relocation. Early stage and high-tech PCs are more feasibly relocated and more likely to benefit from international relocation. (5) Relocation may generate costs as it requires greater flexibility from entrepreneurs and working in foreign jurisdictions that may be substantially different from their home country. (6) Entrepreneurs may favour investors who can facilitate a transnational approach, but this is sometimes at the expense of other investors that may bring other benefits. More specifically, these investors may be needed in specific stages of development, making otherwise cross-border relocation more difficult in follow-up stages.

1.3.3.2. Investment outcome from the perspective of the VC firm⁶

Compared to cross-border VC firms, local VC firms are more likely to have successful exits controlling for PC quality and VC firm reputation (Cumming and Dai, 2010; Humphrey-Jenner and Shard 2013). Surprisingly, Knill (2009) shows that compared to industry, stage diversification and domestic geographical diversification, international geographical diversification is the only diversification strategy which has no negative effect on the PC exit performance. As such, it is possible that VC firms can use this form of diversification to reduce risk and potentially grow their firm without impacting the PC exit performance.

Recent studies stress the benefits of local syndication and greater staging for exit success of cross-border VC investments, particularly for early stage investments and for investments in emerging countries (Chemmanur et al., 2012; Cumming and Dai, 2010; Dai et al. 2012; Hazarika et al., 2013; Humphery-Jenner and Suchard, 2013; Wang and Wang, 2012). Specifically, PCs with both cross-border and local VC partnership are about 5% more likely to successfully exit (Dai et al., 2012). Further, greater distance between the country of the VC firm and that of the PC is associated with a lower probability of a successful exit (Chemmanur et al., 2012). The probability of foreign VC firms enabling successful exits is higher when they invest in later stage companies and when they are diversified across industries (Humphery-Jenner and Suchard, 2013).

The effect of foreign VC firms' human capital on the exit success of their PCs is not well understood yet. Hursti and Maula (2007) find that the international experience of the management team and pre-IPO ownership by cross-border VC investors are positively related to foreign IPOs in developed markets. In contrast, Wang and Wang (2011) show that there is little correlation between a foreign VC firms' human capital, such as its experience, networks and reputation, and PCs' exit performance in emerging markets. Instead, the domestic entrepreneurs' experience is crucial to exit performance (Wang and Wang, 2011).

Next to local syndication and experience, the target country and PC characteristics impact the international VC firm's exit performance. In more economically free countries, foreign VC-backed PCs are more likely to successfully exit through an IPO or an M&A, and investment durations are shorter (Wang and Wang, 2012). The legal protection rights of VC firms' country of origin within the VC syndicate of an IPO firm negatively impacts the underpricing of IPOs, and this negative association is stronger for IPOs involving foreign VC firms (Chahine and Saade, 2011). This expands prior research on VC syndication by showing that in addition to VC monitoring, the shareholders' protection rights of the country of origin of foreign VC syndicate members signals the quality of PCs at IPO. There is also evidence of a positive but marginally significant effect of the legal protection rights of VC firms' country of origin on the long-term performance of their PCs. Superior legal rights (and enforcement) and better-developed stock markets significantly enhance PC long term performance (Hazarika et al., 2013). Remarkably, cultural distance between countries of the PC and its lead investor positively affects VC success: it creates incentives for rigorous ex-ante screening, improving VC performance, particularly in emerging economies. Moreover, Bottazzi and colleagues (2012) find a negative relationship between trust in a country and exit performance, especially for IPOs. They further show that more sophisticated

⁶ An overview of the papers discussed, is provided in Table 1.8.

investors are more likely to make low trust investments, and doing so they achieve superior performance. Lack of trust in a country is hence a hurdle to making VC investments, but cross-border investors who overcome this hurdle tend to do well. To the best of my knowledge, no studies have examined the effect of investing from a local branch on PC exit.

Table 1.8. Investment outcome of international VC investments from the VC firm's perspective

Year - Authors - Journal	Title	Data source	Sample	Theoretical framework	Research question	Findings	Implications/contribution
2007 - Hursti & Maula - Journal of Business Venturing	Acquiring financial resources from foreign equity capital markets: An examination of factors influencing foreign initial public offerings	SDC Platinum New Issues Database, IPO prospectuses (from Pioneer database of perfect information Ltd.), Datastream	2,862 IPOs made by EU VC firms between 1991 - 2001 (of which 163 are foreign IPOs)	Institutional theory	What are the determinants of a foreign IPO?	Pre-IPO ownership by cross-border VC investors is positively related to foreign IPOs. While cross-border VC investors may help their investments to implement an internationalization strategy, the remoteness of an international investor and his limited local experience could potentially be harmful.	(1) Examine the role of PC's characteristics; high-tech focus; size in increasing the need for foreign IPOs; international entry capability related to effects of international management experience; international operations; and foreign pre-IPO ownership in facilitating foreign IPOs. (2) Companies can circumvent some limitations of their domestic stock markets by an IPO abroad. Foreign VC ownership can support this strategy. (3) The demise of both EASDAQ and Neuer Markt show that investors' interest in single European economies is insufficient to support market liquidity in volatile, high-risk industries. European PCs must be willing and able to find capital abroad. Public policy must support this activity but without favouring large blue chip companies or endangering local exchanges. (4) VC, needs a well-functioning local exchange. (5) For entrepreneurs and VC firms, the results show that European exit markets have developed in a positive way and cross-border exit markets are available in different European countries. (6) Foreign VC investors and corporate investors may help lower the boundary for going public abroad, further enhancing the globalization strategy. (7) However, entrepreneurs planning to reside in their home country need to consider the costs and benefits of foreign ownership from the outset.
2009 - Knill - Financial Management	Should venture capitalists put all their eggs in one basket? Diversification versus pure-play strategies in venture capital	Galante's Venture Capital and Private Equity Directory and Thomson Financial's SDC Platinum	Investment preferences of the 500 largest U.S. VC and PE firms + information on PC from Thomson Financial's SDC Platinum	Portfolio theory	Should VC firms diversify or use pure-play strategies?	Compared to industry, stage and domestic geographical diversification, international geographical diversification is the only diversification strategy which has no negative impact on the PC's exit performance. As such, it is possible that VC firms can use this form of diversification to reduce risk and potentially grow their VC firm without impacting the PC exit performance.	To the extent that PCs are able to shop around for VC funding, and that their ultimate goal is to obtain access to public markets quickly, they may want to seek out a VC who is either a pure-play or is diversified across geographic locations only. VC firms that diversify across industry or stage should be avoided if delay of exit is of prime importance.
2010 - Cumming & Dai - Journal of Empirical Finance	Local bias in venture capital investments	Thomson VentureXpert database	Sample of U.S. VC investments: 122,248 VC company round observations, representing 20,875 companies invested by 1,908 VC firms from 1980 -2009	Info asymmetry	How does local bias depend on VC firms' characteristics and how does local bias impact performance?	Compared to more distant VC firms, local VC firms are more likely to have successful exits controlling for PC quality and VC reputation.	(1) More reputable VC firms are better in reducing information asymmetry associated with distance. (2) Policy implications: to stimulate the development of the new companies the presence of local VC firms should be stimulated given the existence of local bias in VC investments. This can be achieved either by direct investment in the local new ventures or by forming syndicates with VC firms in other areas.

Table 1.8. (Continued)

Year - Authors - Journal	Title	Data source	Sample	Theoretical frame work	Research question	Findings	Implications/contribution
2011 - Chahine & Saade - Corporate Governance: An International Review	Shareholders' rights and the effect of the origin of venture capital firms on the underpricing of U.S. IPOs	Securities Data Company (SDC) database	410 randomly selected U.S. VC backed IPOs from 1997-2007 (represents 30.5% of all VC backed IPOs)	Institutional theory, Agency theory	Is PC performance at IPO affected by the VC firm's country of origin's shareholders' protection rights ?	(1) U.S. IPOs' underpricing is negatively related to the weighted average legal protection rights' index of VC firms' country of origin within the VC syndicate of an IPO firm. This negative association is stronger for IPOs involving foreign VC firms. (2) Legal protection rights of foreign VC firms and board independence of IPO firms play a complementary role in reducing underpricing. This suggests that foreign VC firms from countries with a higher legal protection rights are likely to invest in PCs with better governance, and this reduces underpricing. (3) Results are robust when controlling for selection bias of IPO firms by foreign VC firms, and using the effect of the protection rights of the country of origin of the lead, largest, board member, or oldest, i.e., most experienced, VC firm. (4) Evidence of a positive effect of the legal protection rights of VC firms on the long-term performance of their PCs.	(1) Institutional framework and national legal differences matter in considering the effect of VC firms on IPO performance. (2) Expand prior research on VC syndication by showing that in addition to VC monitoring, the shareholders' protection rights of the country of origin of foreign VC syndicate members signals the quality of PCs at IPO. (3) Complementary role between the legal protection rights of the country of origin of foreign VC firms and board independence indicates that PC performance is the outcome of complex mechanisms involving both PC and country-level settings. (4) Policy-makers and practitioners should view legal protection of shareholders' rights as a global issue. (5) Results contribute to the understanding of cross-border partnering and the quality of partners within the VC industry.
2011 - Wang & Wang - Pacific-Basin Finance Journal	Cross-border venture capital performance: Evidence from China	Zero2IPO, Thomson VentureXpert database	495 VC investments between 1999 and 2006 by 84 foreign VC firms in 243 Chinese domestic companies	Institutional theory	What is the impact of foreign VC firms' human capital and domestic entrepreneurs' experience on cross-border VC performance in the Chinese VC market?	(1) Foreign VC firms' human capital (experience, networks and reputation) is not correlated with VC performance. (2) Domestic entrepreneurs' experience is crucial to VC performance. In particular, if an entrepreneur has more general experience in terms of the number of companies previously worked for or more specific experience in terms of the number of companies previously served as a CEO or top manager, successful exit (IPO or M&A) and shorter investment duration in the PC are more likely.	(1) Analysis helps clarify the factors underlying cross-border VC performance in emerging markets (China). (2) The roles of both VC firms and entrepreneurs on VC performance are studied. The literature on VC performance generally focuses on the role of VC firms but pays little attention to the role of entrepreneurs.

Table 1.8. (Continued)

Year - Authors - Journal	Title	Data source	Sample	Theoretical framework	Research question	Findings	Implications/contribution
2012 - Chemmanur, Hull & Krishnan - SSRN working paper	Do local and international venture capitalists play well together? A study of international venture capital investments	Thomson VentureXpert database	30,071 VC backed companies invested from 1989-2008 and located in 45 countries world wide	Institutional theory, Syndication	Do international VC firms add value to entrepreneurial companies, and how do they interact with domestic VC firms?	(1) VC investments by syndicates composed of international and local VC firms are more successful (more IPO exits) than VC investments by syndicates composed of purely international or purely local VC firms. (2) Greater distance between the country of the VC and that of the entrepreneurial firm is associated with a lower probability of success. (3) Syndication with local VC firms and greater staging by international VC firms mitigates the negative association between the distance from the international VC to the entrepreneurial firm and the successful outcome of the VC investment. (4) Investment in early stage entrepreneurial firms exacerbates this negative association. (5) Results are stronger for VC investments in emerging nations than for those in developed nations, which is consistent with the notion that the difficulties in monitoring and the deficiencies in local knowledge faced by international VC firms are more important in emerging markets.	(1) Greater expertise of international VC firms and the superior local knowledge and lower monitoring costs of local VC firms are both important in obtaining successful outcomes and backing by syndicates consisting of the two kinds of VC firms enable entrepreneurial firms to benefit from their strengths. (2) Syndicates consisting of different kinds of VC firms allow an exchange of information across VC firms and also enable the syndicate to overcome deficiencies of individual VC firms. (3) The fact that results are stronger for emerging markets indicates that the deficiencies of international VC firms may be overcome by the better infrastructure of, and the VC's greater investment experience in, developed markets.
2012 - Wang & Wang - Journal of Empirical Finance	Economic freedom and cross-border venture capital performance	Thomson VentureXpert database	10,205 cross-border VC investments by 1,906 foreign VC firms in 6,535 PCs from 35 countries between 1995-2005	Economic theory, Institutional theory	What is the impact of economic freedom on cross-border VC performance?	(1) PC country's economic freedom plays a crucial role in determining cross-border VC performance. In more economically free countries, foreign VC-backed PCs are more likely to be successfully exited (IPO or an M&A), and investment durations are shorter. (2) Cross-border VC performance is also strongly associated to other PC country characteristics. The GDP per capita is negatively correlated to the probability and hazard of a successful exit, legality is positively related to cross-border VC performance and the PC country's entrepreneurial activity is positively related to the probability of a successful exit. (3) PC quality and local VC firms' participation have a positive impact, while early stage investments and VC firms' portfolio size have a negative impact, on the likelihood of a successful exit.	(1) Investigate the impact of an important country-level factor, namely a domestic country's economic freedom, on cross-border VC performance. (2) Enrich the literature by exploring the determinants of cross-border VC performance. (3) Contribute to the literature on the influence of many other factors of domestic countries, PCs, VC firms and the global VC market on cross-border VC performance.

Table 1.8. (Continued)

Year - Authors - Journal	Title	Data source	Sample	Theoretical framework	Research question	Findings	Implications/contribution
2012 - Bottazzi, Da Rin & Hellmann - NBER working paper	The importance of trust for investment: Evidence from venture capital	Hand collected data, survey of 685 VC firms in 15 European countries	108 responses on survey	Social capital theory, Discrete choice framework	What is the impact of trust among nations on investment by foreign VC firms? (1) Impact on probability to invest? (2) Impact on contracting?	(1) Negative relationship between trust and exit performance, especially for IPOs. (2) More sophisticated investors are more likely to make low trust investments, and doing so they achieve superior performance. (3) Lack of trust is a hurdle to making VC investments, but that investors who overcome this hurdle tend to do well.	(1) First paper to examine the effect of generalized trust in a corporate finance setting. (2) Identify an effect of trust on investments in a micro-economic environment where alternative explanations can be controlled, most notably with powerful combination of investor and company fixed effects. (3) New insights into how the effect of trust varies across different types of investors. (4) Evidence suggests that lack of trust imposes a hurdle for investments. Importantly, it is a hurdle but not a barrier, so that some key comparative statics on when investors are more or less able to overcome these trust hurdles can be derived. (5) Generalized trust is a force that cannot be ignored in the analysis of VC investment. (6) Policy implications: Governments across the globe are seeking to attract VC firms to invest in their countries. Results suggest that investments will be more forthcoming from countries where there is higher generalized trust. This provides some guidance as to what countries might be the most promising targets for government that want to attract foreign VC investments.
2012 - Dai, Jo & Kassiech - Journal of Business Venturing	Cross-border venture capital investments in Asia: Selection and exit performance	Thomson VentureXpert database, SDC Platinum M&As, Global New Issues Database	2,860 PCs receiving 4,254 rounds of VC financing by 468 VC firms in Asia from 1996-2006	Info asymmetry	How do frictions associated with geographical and cultural distance impact the investment behaviour (selection) and the exit performance of foreign VC firms investing in Asia?	Partnership with domestic VC firms has positive implication for the exit performance of local PCs. Specifically, PCs with both foreign and local VC partnership are about 5% more likely to successfully exit.	(1) Sheds additional light on the exit performance of foreign VC firms when they invest in Asia. (2) Evidences suggest that the geographical and cultural distances faced when investing in Asia has a negative impact on the exit performance of PCs. (3) Study extends the syndication literature by showing that partnerships when investing in Asia produces synergy in cross-border VC investments by reducing frictions associated with both geographical and cultural distance. (4) The study also has implications for practitioners interested in investing in the Asian VC market.
2013 - Humphrey-Jenner & Suchard - Journal of Corporate Finance	Foreign VC firms and venture success: Evidence from China	ChinaVenture	4,753 Chinese / Hong Kong portfolio companies that received capital between 1988-2011	Networking theory, Info asymmetry, Portfolio theory	Do foreign VC firms increase the likelihood of a successful exit in emerging markets?	(1) In emerging markets, the presence of a foreign VC firm by itself does not per se significantly increase the probability of a successful exit. (2) Syndication with local VC firms increases the probability of a successful exit for foreign VC firms. (3) If a foreign VC successfully exits an investment, then, compared with a domestic-VC, it prefers to exit via a M&A or a secondary-buyout as opposed to through an IPO. This reflects the significant lock-up periods associated with VC-backed IPOs in China, the difficulty of achieving a foreign listing, and the difficulty listing a start-up on Chinese stock markets. (4) The impact of foreign VC firms on performance depends both on the characteristics of the investment as of the VC firm, it is higher when investing in later stage PCs and when the VC is diversified across industries.	Foreign investment does not per se increase the likelihood of investment success, although this depends on the nature of the VC firm. Moreover, the exit-preferences of foreign investors reflects changing market conditions and regulations. The results are consistent with the idea that foreign VC firms' main contributions come from providing capital and expertise to relatively large companies than from nurturing start-ups. Collaborating with domestic VC firms may enable foreign VC to build local knowledge and networks.

Table 1.8. (Continued)

Year - Authors - Journal	Title	Data source	Sample	Theoretical framework	Research question	Findings	Implications/contribution
2013 - Hazarika, Rajrishi & Kishore - Journal of Financial and Quantitative Analysis	Success in global venture capital investing: Do institutional and cultural differences matter?	Thomson VentureXpert database, SDC Platinum M&As, Global New Issues Database	9,153 PCs from 32 countries (North America is excluded) invested between 1996 and 2002	Info asymmetry	What is the impact of institutional and cultural differences on success in global VC investing.	(1) Superior legal rights (and enforcement) and better-developed stock markets significantly enhance VC performance. (2) Remarkably, cultural distance between countries of the PC and its lead investor positively affects VC success. (3) Further analysis reveals that cultural differences create incentives for rigorous ex-ante screening, improving VC performance, particularly in emerging economies. (4) Local VC participation enhances success and mitigates foreign VC firms' — liability of foreignness, albeit only in developed economies.	(1) Country's institutional framework – legal system and capital markets – is important in contributing to success of VC investments. The presence of better developed legal institutions and capital markets hence represents a source of comparative advantage for countries trying to promote entrepreneurship and the venture capital industry. (2) Cultural differences and local investor participation have an influence on VC success. This emphasises the importance of both VC screening (due-diligence) and monitoring for VC success. (3) Separate analysis of the sub-samples of developed and emerging economies provides evidence regarding the determinants of VC success in both types of markets.

1.3.4. Suggested avenues for further research

Taken together, while the academic literature has provided interesting insights in challenges, drivers, strategies and outcomes of international VC investments, significant research gaps remain. Given the increasing importance of the foreign investments in the VC industry, more in depth academic attention is called for.

1.3.4.1. In general

Multiple studies call for additional research on VC firms' modes of internationalization, which has been largely neglected in the academic literature so far. The drivers and impact of the internationalization mode (i.e. setting up a local branch versus investing from headquarters) should hence be thoroughly examined (Guler and Guillén, 2010a; Pruthi et al., 2003; Wright et al., 2002). An interesting research question is whether there is a life-cycle to these different entry modes (Wright et al., 2002). The relatively high presence of local executives in VC firms' staffing pool, for example, suggests an underlying multi-domestic strategy (Pruthi et al., 2009). The role of the investment committee in international investment decision-making, the implications of investment committee's structure and composition for international staffing are still not fully understood (Pruthi et al., 2009). It would also be relevant to develop a longitudinal approach in order to examine in more detail the process of international staffing, especially from the perspective of local offices (Pruthi et al., 2009).

Another field which would benefit from further research is analysing the behavioural differences of the different types of VC firms with the foreign and domestic players within a particular country (Pruthi et al., 2003; Pruthi et al., 2009). Consequently, it would be relevant to distinguish between the internationalization activities of early-stage versus late-stage (i.e. buy-out) investors, which require different types of expertise and thus, presumably, different needs to transfer executives from one context to another (Pruthi et al., 2009). Moreover, what are the differences among VC firms regarding their capabilities to exploit network advantages in their investment decisions (Guler and Guillén, 2010b)?

Finally, as multiple studies find important differences between developed and emerging markets (e.g. Chemmanur et al., 2012; Dai et al., 2012), a further analysis of the differences between developing and developed markets provides an interesting area of future research (Pruthi et al., 2003).

1.3.4.2. Determinants of international VC investments

Extant research provides some areas of future research on country level determinants of international VC flows. Some of the unresolved questions are: Are there temporal variations in the internationalization of the VC industry? E.g., the VC industry is cyclical, and prone to periodic booms and busts. Could there be differences in global outflow patterns depending on these cyclic stages (Madhavan and Iriyama, 2009)? Do international VC firms find foreign countries more attractive based on the characteristics of the available co-investors to syndicate or on the presence of other home-country VC firms (Guler and Guillén, 2010a)? What is the impact of technical immigration as opposed to overall professional immigration on international VC flows? Such refinements would allow the analyst to get closer to the drivers of international entrepreneurship in high-technology domains (Iriyama et al. 2010).

Next to country determinants, the literature also provides some areas of future research on VC firm determinants. Does the VC firm type impact geographical scope and performance (Cumming and Dai, 2010)? Moreover, what are the implications of VC organization's actual investment behaviour? Do different VC firms demonstrate different levels of tolerance for taking on the risks of a global investment strategy? What are the determinants of such differences, as well as their consequences (Madhavan and Iriyama, 2009)? How do contextual factors moderate the relationship between the composition of top management teams and portfolio strategy choice in VC organizations (Patzelt et al., 2009)?

1.3.4.3. Strategies to compensate for liabilities of foreignness

Although several studies have started to investigate how international VC investors cope with liabilities of foreignness, there remain unanswered research questions. First, analysing companies that have tried but failed to raise foreign VC would help to analyse more accurately the role of local investors in raising foreign VC (Mäkelä and Maula, 2008). Further, an important question is whether there are differences between emerging VC markets compared to developed markets in structuring and monitoring investments (Wright et al., 2002)? Next, are there differences between domestic and international VC firms in screening and valuing potential PCs? More specifically, to what extent do foreign VC firms adapt their approaches to local market conditions? If so, how do they adapt their approaches to deal with different asymmetric information problems (Pruthi et al., 2003)? Do VC firms, for instance, replicate the network connections present in their home countries in the new markets they enter (Guler and Guillén, 2010b)? Foreign VC firms may also gain external knowledge through domestic syndication partners that have relevant international investment experience or through other network partners, for example international shareholders or service providers such as lawyers or consultants. To what extent are these other partners substitutes for foreign syndication partners, or do they complement them in different ways (De Prijcker et al., 2012)? Do the technology level of potential investments, the background and experience levels of the VC firm's general partners, and the market for IPOs or other forms of exit available to VC firms impact the investment preferences of VC firms (Gupta and Sapienza, 1992)?

How can mechanisms, such as expatriating staff and hiring local talents effectively overcome hurdles related to information friction and cultural differences in international VC investments (Dai et al., 2012)? Do local executives effectively substitute for local co-investors for internationalizing firms seeking to invest in foreign markets (Pruthi et al., 2009)? Is it possible to make the expertise of key people in the home country available through investment committees (Pruthi et al., 2009)? How can VC firms use a mix of strategies – attracting local partners, working with local VC firms or setting up local branches – in order to deal with the peculiarities of the local environment (Meuleman and Wright, 2011)?

1.3.4.4. Outcomes of international investments

Important questions on the outcome of international VC investments are: What is the relation between distance and probability of non-rational continuation of commitment to a PC that does not meet the initial prospects (i.e. escalation of commitment) (Mäkelä and Maula, 2006)? Is international VC firm's commitment influenced by

country-specific factors other than distance (Mäkelä and Maula, 2006)? Foreign VC firms may help professionalize the local entrepreneurial firms given their experience of advising and nurturing PCs in their home countries. Do these local entrepreneurial companies have spill over effects on their fellow companies which are currently not financed by foreign VC firms (Dai et al., 2012)? In the same vein, how does the presence of foreign VC firms and their partnership with local VC firms help professionalize the local VC firms (Dai et al., 2012)?

Additional outcomes such as the number of countries in which the VC firm has international investments or its mode of entry in international markets should be considered (De Prijcker et al., 2012). Can foreign VC firms provide other value-added benefits, such as increased internationalization, even if they are not per se associated with PC success (Humphery-Jenner and Suchard, 2013)? What is the role played by foreign VC firms in PCs after the IPO? Foreign VC firms might provide a better contact with international investors; facilitate the presence of PCs in foreign markets; and they might also provide valuable help in PCs' internationalization process (Chahine and Saade, 2011). Finally, there may be unobserved determinants associated with relocation of PCs such as tax strategies, the size of VC markets, branch offices in different countries (Cumming et al., 2009).

1.4. Empirical setting: The European VC market

This dissertation focuses on international VC transactions in Europe, more particularly in seven Western European countries. Europe is the second largest VC market worldwide, after the U.S., and follows the development of the U.S. VC market closely with an increasing number of large and experienced investors and a mature fund raising market (Alhorr et al., 2008; Manigart et al., 2010; Schertler and Tykvová, 2011). The European VC market is a particularly interesting research scene to study international VC transactions due to the availability of detailed data and its international focus (Schertler and Tykvová, 2011). Moreover, the Europe union represents a unique group of countries in terms of size and proximity to each other (Alhorr et al., 2008), which are economically strongly integrated.

Throughout the 1990's, the European Union has taken an active role in removing barriers to investment in growth firms within the European region through various political actions (Hursti and Maula, 2007). Two examples of such actions are "The Investment Services Directive" and the obligation for consistent accounting principles. These regulatory adjustments contributed to the formation of European stock market alternatives to NASDAQ. Moreover, enabling free capital flows across borders, a common currency, and consistent regulations could potentially alleviate the constraints of available equity capital across Europe (Hursti and Maula, 2007). These developments are important for the international development of the European VC industry. They may not only increase the amount of foreign capital mature European companies can attract, but also reduce the inconsistencies across Europe in the availability of VC and other forms of financing for small firms.

Bottazzi and colleagues (2004) indeed show that the integration of the European VC industry is stronger than previously believed: 27% of all VC firms have a branch office in a foreign country; 25% have investment partners that come from another country; 24% of all investments are made in foreign countries. Nevertheless,

country barriers still matter (Hursti and Maula, 2007). Bottazzi et al. (2004) additionally demonstrate that the European VC industry has important links to the U.S., and is progressively applying U.S. investment practices. Nonetheless, the importance of banks and corporations as VC investors, next to independent VC firms, remains a specific characteristic.

In conclusion, the European context is a particularly interesting research context as it has a developed VC market and the removal of multiple barriers makes it a relatively homogeneous setting. Therefore, in contrast to heterogeneous and/or emerging research settings, any result which shows differences between international and domestic VC firms in Europe carries greater importance as the occurrence of it is less likely.

Although data on European VC investments and private companies is much more abundant in Europe as opposed to the U.S., one of the main issues VC researchers face is the access to relevant information on large enough sample sizes. Thanks to the joint effort of all participants in the European FP7 VICO research project entitled “Financing entrepreneurial ventures in Europe”, a consistent, large and detailed cross-European database of VC backed companies was built. This database is used in the three empirical studies in this dissertation, and will be further described in Chapter 2.

1.5. A summary of the three dissertation studies

This section presents a brief summary of the three empirical papers based upon the VICO database that are presented in this doctoral dissertation. All studies have been prepared to meet the requirements of the specific publications and conferences for which they were intended. Moreover, all three empirical essays relate to the field of international VC and study the relation between VC investors and PCs. The three studies of this essay aim to crack some of the various understudied aspects of international VC investing. These papers are organized around three core questions discussed above: “How do the VC investor’s origin and the PC’s characteristics impact their mutual matching process?”; “What is the role of domestic and cross-border VC investors in the growth of European PCs?” and “How do cross-border, branch and domestic VC firms behave when PCs do not meet initial expectations?”.

1.5.1. Study 1: Matching of supply and demand: The impact of VC investor’s origin and portfolio company’s characteristics

1.5.1.1. Research question

How do the VC investor’s origin and the PC’s characteristics impact their mutual matching process?

1.5.1.2. Unit of analysis

Each unique VC-PC pair at the time of the focal VC’s first investment in the PC.

1.5.1.3. Method

We use data from 7 European countries (U.K., Belgium, Finland, France, Germany, Spain and Italy). The dataset covers 1770 first investments of 840 VC firms in 679 companies of which 1241 are made by domestic

VC firms, 356 by cross-border VC firms and 126 by branch VC firms. The proprietary dataset includes companies that eventually fail and hence results are not subject to survivorship bias.

The first investments of VC firms in the sample companies take place between 1994 and 2011. The PCs are a maximum 10 years old at the time of initial investment and are active in medium and high-tech industries.

The differences in the probability of a match between companies and respectively cross-border, branch and domestic VC firms are tested with multinomial logistic models, an extension of the binary logistic model, as our dependent variable can take more than two discrete outcomes (see e.g. Cooper et al., 1994). Next to the estimated coefficients, the average marginal effects are reported as it is useful to highlight economic significance alongside statistical significance - i.e. how much a change in a variable changes the probability of the focal outcome (Hoetker, 2007).

1.5.1.4. Principal topic

A VC investment in a company is a mutual decision, requiring the consent of both the investor and the company. Investors (i.e. the supply side) have preferences over investments in portfolios of companies, and entrepreneurs (i.e. the demand side) have preferences over matches with specific investors (Fried and Hisrich, 1994; Sorenson, 2007). While the VC industry used to be spatially constrained, VC investors increasingly invest across borders (Alhorr et al., 2008; Meuleman and Wright, 2011) which may impact the matching process both from the supply side as from the demand side. The goal of this study is hence to investigate the differences in the drivers of the mutual matching process between companies and respectively domestic, cross-border and branch VC firms.

From a demand perspective, we draw upon the resource-based view of the firm to build a life cycle model on the association between PC's resource needs and the VC investor's geographic origin. Obtaining cross-border VC has both advantages and disadvantages compared to domestic VC (Mäkelä and Maula, 2005). For instance, cross-border VC investors legitimate companies and provide access to international networks of customers, suppliers, financiers or potential acquirers (Mäkelä and Maula, 2005), leading to higher growth (Devigne et al., 2013). However, higher transaction costs lead to less time devoted to PCs (Sapienza et al. 1996) and lower commitment (Mäkelä and Maula, 2005). There is hence heterogeneity in the demand for such association because entrepreneurs have both different endowments of resources and reputation (Hsu, 2004), as well as access to different resource bases of partner organizations. More specifically, we expect later stage PCs' international focus will increase their probability to engage with cross-border and branch VC firms. In contrast, early stage PCs' need for hands-on guidance is expected to increase their probability to ally with domestic and branch VC firms. Finally, the advantages linked to a broad resource base are expected to increase the probability of PCs backed only by domestic VC firms to engage with cross-border and branch VC firms.

From a supply perspective, the spatial and cultural distance cross-border investors face brings liabilities foreignness (LOF) (Wright et al., 2005). LOF are "all additional costs a firm operating in a market overseas incurs that a local firm would not incur" (Zaheer, 1995: 343). We argue that cross-border VC investors use

several strategies to alleviate these LOF (Bell et al., 2012). A first structural strategy is to set up a local branch office, thereby mitigating the frictions associated with geographic and cultural distance (Pruthi et al., 2009). Second, cross-border VC investors may focus on projects with lower ex-ante information asymmetries or PCs that need less advice which both will decrease information costs (Dai et al., 2012). A third strategy to mitigate information and value adding problems is to leverage syndicate partners (Meuleman et al., 2010). Syndicating with local partners lowers information asymmetries between entrepreneurs and cross-border investors due to the increased information production by the local investor. Prior studies indeed show that while the probability of a successful exit is lower when VC investors invest across borders, it increases when cross-border VC investors syndicate with domestic VC firms (Chemmanur et al., 2012; Cumming and Dai, 2010; Moser, 2010; Dai et al., 2012). Next, LOF may be reduced through certification. A final strategy we will hence consider is cross-border VC targeting PCs backed by more and more experienced co-investors as these will alleviate issues related to institutional and cultural distance.

1.5.1.5. Findings

From a supply perspective, we confirm that cross-border VC firms preferably match with lower information asymmetry companies. This effect disappears when controlling for co-investor characteristics. Cross-border VC firms have a higher probability to invest with local investors, with larger investment syndicates and with more experienced investors. We further demonstrate that investing through a local branch as opposed to form a foreign head office allows foreign VC firms to exhibit the same investment behaviour as domestic VC firms. We thereby exhibit that local and more resourceful co-investors or establishing a local presence mitigate LOF and enable cross-border investors to invest in the same companies as domestic VC firms. From the demand perspective, we show that less developed companies have a higher probability to match with domestic VC firms as opposed to cross-border VC firms. Moreover, seed stage companies in which only cross-border VC firms co-invest have a higher probability to attract a local VC firm as opposed to other cross-border VC firms. Our results hence display that entrepreneurs dynamically assess their companies' resource gaps and consequently target VC investors with specific geographic origins based upon the required resources.

1.5.2. Study 2: The role of domestic and cross-border VC investors in the growth of PCs

1.5.2.1. Research question

What is the role of domestic and cross-border VC investors in the growth of European PCs?⁷

1.5.2.2. Unit of analysis

First VC investment round of PC.

⁷ Unfortunately at the time this paper was written, we did not have the knowledge on branch VC firms yet. Therefore, branch VC firms were considered as domestic VC firms in this research.

1.5.2.3. Method

We use data from 7 European countries (U.K., Belgium, Finland, France, Germany, Spain and Italy). The dataset covers 761 companies that received initial VC between 1994 and 2004. The PCs are a maximum 10 years old at the time of initial investment and are active in medium and high-tech industries.

The data include, but are not limited to, yearly data on sales, total assets and payroll expenses (our growth measures) of the respective PCs and this for up to 7 years after the initial VC investment.

Random Coefficient Modelling (RCM), also referred to as growth modelling, is used as an appropriate longitudinal technique to study growth within PCs across time. The RCM framework has less restrictive data requirements and much flexibility in the type of models that may be specified compared to traditional methods for analysing longitudinal data. For instance, companies may be measured at different points in time, can have a different number of time points, and can have a different (non-linear) growth trajectory (Fitzmaurice et al., 2004).

1.5.2.4. Principal topic

Cross-border VC, defined as investments made by VC investors in PCs located in countries other than the country in which investments are managed, is an increasingly important phenomenon (Wright et al., 2005). Prior research focused on the macro issues driving the international development of VC markets (Guler and Guillén, 2010a; Maula and Mäkelä, 2003), the advantages and disadvantages for the companies that receive cross-border investments (Hursti and Maula, 2007; Mäkelä and Maula, 2005) and the adjustments in investment behaviour of VC firms when investing abroad (Cumming and Macintosh, 2003; Pruthi et al., 2003; Wright et al., 2002). Yet, the literature falls short in explaining the differential impact of cross-border VC, as compared to domestic VC, on the performance and growth of PCs across time.

Nevertheless, prior research provides both advantages and disadvantages of obtaining cross-border VC. For instance, foreign VC investors legitimate companies in foreign markets (Mäkelä and Maula, 2005). This is expected to benefit the international sales of PCs and may benefit resource accumulation in foreign markets. However, the commitment of cross-border investors is expected to be lower compared to domestic investors, especially when performance falls short of early expectations. (Mäkelä and Maula, 2005). This may reduce the amount of knowledge-based resources provided by cross-border investors to their PCs, which may hamper the development of companies. The goal of this study is to empirically investigate the economic consequences of getting cross-border VC compared to domestic VC.

Contrary to most prior research, we do not treat cross-border VC investors as a homogenous group. Rather, we distinguish between cross-border investors investing in a syndicate with domestic and without domestic VC investors. Syndication of cross-border investors with domestic VC investors may have a distinct impact on PC growth through their differential ability to select the companies with high growth potential pre-investment and contribute to company growth through the provision of value added services post-investment.

1.5.2.5. Findings

Findings demonstrate how companies initially backed by domestic VC investors exhibit higher growth in the short term compared to companies backed by cross-border investors. In the medium term, companies initially backed by cross-border VC investors exhibit higher growth compared to companies backed by domestic investors. Finally, companies that are initially funded by a syndicate comprising both domestic and cross-border VC investors exhibit the highest growth. Overall, this study provides a more fine-grained understanding of the role that domestic and cross-border VC investors can play as their PCs grow and thereby require different resources or capabilities over time.

1.5.3. Study 3: Distressed portfolio company exit and cross-border VC investors

1.5.3.1. Research question

How do cross-border, branch and domestic VC firms behave when PCs do not meet initial expectations?

1.5.3.2. Unit of analysis

Individual VC investment round.

1.5.3.3. Method

We use longitudinal data on 684 PCs in 7 European countries that received initial VC between 1994 and 2004. We track the identity and characteristics of their VC investors over investment rounds and collect detailed information on the PCs including exit type and timing exit outcome of 1060 VC investments. Escalation of commitment is analysed focusing on the hazard rate of successful or unsuccessful exits following an investment round (Guler, 2007).

Event-history analysis is used to dynamically estimate the investment process through the distributions of the hazards of successful and unsuccessful exits (Guler, 2007). The hazards of successful and unsuccessful exits are estimated using the semi-parametric competing risks Cox proportional hazard model, which does not require the distribution of time dependence of the hazard to be specified (Guler, 2007). Coefficients are estimated using partial likelihood estimation.

1.5.3.4. Principal topic

Drawing upon an escalation of commitment framework, this study investigates how differences between domestic, cross-border and branch VC investors in access to information, social and structural factors affect their decision to terminate an unsuccessful investment.

VC investors face a liquidation dilemma when PCs underperform: they may either further finance the PC to keep the option of improvement or terminate it, which entails certain losses (Tversky and Kahneman, 1992). Prior research has shown that VC firms escalate their commitment to a failing course of action (Guler, 2007). We argue that escalation of commitment is more prevalent when domestic VC firms invest, compared to cross-border and branch VC firms. The smaller geographical and cultural distances domestic VC firms face, result in lower transaction costs and higher emotional attachment (Mäkelä and Maula, 2005; Guiso et al., 2008; Bottazzi

et al., 2012). Moreover, lower costs and difficulties to acquire and process reliable soft information on PCs and local market conditions increase the domestic VC firms' probability to escalate commitment as they will focus more on soft information, use less high-powered contracts and apply lower hurdle rates compared to cross-border VC firms (Bengtsson and Ravid, 2009; Chen et al., 2010). The goal of this study is to empirically investigate the probability of escalation of commitment by domestic VC firms as compared to cross-border and branch VC firms.

1.5.3.5. Findings

Results show that domestic investors have a high tendency to escalate their commitment to a failing course of action. In contrast, cross-border investors terminate their investments efficiently, even when investing through a local branch. This is explained by cross-border investors having more limited access to soft information, a lower social involvement with the project and a lower embeddedness in the local economic and social environment, which are all factors that contribute to lower escalation of commitment. Local branches of cross-border investors are further shielded from escalation of commitment through structural safeguards. Domestic investors may hence benefit from mimicking the behaviour of cross-border investors.

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Chapter 2

Sample & data

The VICO data set is the backbone of the datasets used in the three empirical papers. This data set was established thanks to the joint effort of all participants in the VICO project⁸. Within the VICO project I was responsible for the data collection in Belgium. In order to investigate the specific research questions of the studies in this dissertation some additional data were collected.

In the following section an overview is provided on the sampling process, data sources and sample composition of the VICO dataset. This overview is largely based on a paper written by Fabio Bertoni and José Martí Pellón, both member of the VICO project. Next I will provide an overview of the additional data which I collected.

⁸ This data set is part of the EU 7th Framework Programme 'Financing Entrepreneurial Ventures in Europe: Impact on innovation, employment growth, and competitiveness - VICO (Contract 217485). The data collection effort has been conducted thanks to the joint effort of all participants in the project. Project scientific coordinator of the project: Massimo G. Colombo. WP leaders: Bart Clarysse, Anna Gervasoni, Terttu Luukkonen, Sophie Manigart, Tomasz Marek Mickiewicz, José Marti Pellon, Philippe Mustar, Tereza Tykvoová, and Mike Wright. Local data collection teams: Fabio Bertoni, Francesco Bollazzi, Annalisa Croce, Diego D'Adda, Itxaso del Palacio, David Devigne, Giancarlo Giudici, Luca Grilli, Massimiliano Guerini, Matthias Deschryvere, Samuele Murtinu, Tuomo Nikulainen, Anita Quas and Jolien Roelandt.

2.1. VICO dataset⁹

Abstract

The VICO project collected a database on young high-tech entrepreneurial companies operating in seven European countries (Belgium, Finland, France, Germany, Italy, Spain, and the United Kingdom). The objective of the data collection process was to build a data infrastructure to conduct an extensive study about the VC activity in high-tech sectors in Europe. The dataset includes two strata of companies: the first is a sample of VC-backed companies and the second a control group of non-VC backed (but potentially investable) companies (not included in this description)¹⁰. Data were collected by local teams from each country (using a variety of commercial and proprietary sources) and checked for reliability and consistency by a centralized data collection unit. The dataset consists of 8370 companies, 759¹¹ of which VC-backed, and 1125 VC investors. Detailed information was collected for each firm, investor, and investment, including accounting data, patenting data, and investor type and experience.

2.1.1. The VICO project

VICO is a research project, funded by the 7th Framework Programme of the European Commission (theme SSH-2007-1.2.3 – Grant Agreement 217485) aiming to assess the impact of VC investments on the economic performance of entrepreneurial firms in Europe as reflected by their innovation rates, employment creation, growth, investments and efficiency, and the role which VC investors play in helping these firms bridge their resource and competence gaps. The project involved 9 research centers from 7 European countries: Armines – Ecole des Mines de Paris (France), Politecnico di Milano (Italy), Università Carlo Cattaneo (Italy), Research Institute of the Finnish Economy (Finland), Centre for European Economic Research (Germany), Universidad Complutense de Madrid (Spain), University College London (United Kingdom), Vlerick Business School (Belgium) and Ghent University (Belgium).

Data at micro-level included: the characteristic of companies (age, industry, and independence), the typology of investments to be studied in order to fully capture the heterogeneity of the phenomenon (i.e. considering not only “Silicon Valley-style” Independent VC funds), the target number of VC-backed companies per country and time period, the type of accounting information needed for the econometric analyses, the information needed about each round of investment (e.g. amount invested, equity stake, identity of the investor...) and the information needed about each investor (e.g. country, foundation year, typology...). The information collected by public sources has been supplemented by an extensive web based survey addressed to both companies and VC investors. This adds non-publicly available information such as the value added by VC to investee

⁹ This overview is largely based on a paper written by Fabio Bertoni and José Martí Pellón, both member of the VICO project. The description refers to version 2.1 of the VICO dataset released on September 30, 2011. The full version of the paper can be downloaded from SSRN: <http://ssrn.com/abstract=1904297>

¹⁰ As I did not use the control group sample in the empirical papers, this part was left out of this overview.

¹¹ The initial database VICO 1.0 (used in the second empirical study (chapter 4)) contained 761 VC backed companies. Two companies have been dropped because they were found not to be independent at foundation.

companies (according to the perception of both companies and investors). More information about the project can be found at the following link: www.vicoproject.org.

2.1.2. The sampling process

2.1.2.1. Introduction

The purpose of the micro-level data collection effort was to allow econometric analysis on the impact of VC on several dimensions of firm performance. The extent to which the analyses would have been effective in controlling for firm observable and unobservable heterogeneity and survivorship were crucially dependent on the characteristics of the data collection process.

- Data on VC-backed companies were collected in time-series, creating a panel dataset, which allows the use of advanced and effective econometric techniques to control for unobserved heterogeneity.
- In order to control for survivorship the VC-backed sample includes both surviving and non-surviving companies (i.e. companies that ceased operations or were acquired, losing their independence).

2.1.2.2. Data collection process

VICO partners agreed that the use of local sources of information was crucial in the data collection process, and that an in-depth country-specific knowledge was essential for the quality of the outcome. The geographic scope of the dataset was then restricted to companies established in the 7 European countries represented by partners in the project: Belgium, Finland, France, Germany, Italy, Spain and the United Kingdom.

Data were collected by local teams for each country. Information was collected at local level using different sources of information. Data were first checked for reliability and internal consistency by each local team. Then data were regularly sent to a central data collection unit which ensured that information across countries was consistent and comparable and its availability balanced. This two-tier structure allowed the early recognition and solution of problems. For instance, particular importance was given in the early stage of the data collection to the consistency in the definitions of accounting variables across countries. Moreover, in some countries some fine-grained accounting variables turned out to be rarely available (e.g. the distinction between depreciation of tangible assets and depreciation intangible assets) which prompted the collection of second-best variables which were instead more often available (e.g. total depreciation).

2.1.2.3. Scope of the sample

To identify young high-tech enterprises we followed the definition commonly adopted in the literature for new technology-based firms which specifies that they should:

- Be younger than 10 years
- Operate in high-tech sectors
- Be independent from other corporations

The sectors included in the analysis, as well as their NACE code (when available) are reported in Table 2.1.

Table 2.1.: Sectors included in the sample and NACE codes

Sector	NACE rev.1	NACE rev.2
Pharmaceutical	24.4	21
ICT manufacturing	30.02 + 32 + 33	26
Robotics	29.5	28.99.20
Aerospace	35.5	30.30
TLC services	64.2	61
Internet	72.60	63.11.30 & 63.12
Software	72.2	62
Web Publishing	72.2	5.2
Biotechnology	73.1	72.11

Since the interest of the project was in early stage investments, the population of VC-backed companies was restricted to those that received their first round of investment less than 10 years after foundation. Limits were also put on the period in which the first investment had occurred. Due to data limitations in years before the early 1990s, we only considered VC-backed companies invested after 1994. Moreover, since a minimum number of post-investment observations should be present to evaluate the impact of VC on firm performance, we considered only VC-backed firms which received their first round of VC before 2004.

2.1.2.4. Target size of the sample

Based on their research experience, the partners of the project decided that in order to make the econometric analyses meaningful the dataset should include a minimum of 700 VC-backed companies. This would allow a sufficient size of the sample even when analysing sub-groups of companies in some specific sectors, countries or periods, even in presence of a non-negligible amount of missing data.

The overall target of VC-backed companies is then broken down at country level. The number of VC-backed companies per country was set to meet two criteria. First, countries in which the VC industry is larger should be more represented in the sample. Second, a minimum number of VC-backed companies should be present in each country to allow the estimation of country-level studies. Table 2.2. shows the target composition of the sample.

Table 2.2.: Target composition of the sample

Country	Number	Percentage
Belgium	80	11.43
Finland	50	7.14
France	120	17.14
Germany	120	17.14
Italy	100	14.29
Spain	80	11.43
U.K.	150	21.43
Total	700	100.00

2.1.3. Data collected and sources

The first step of the data collection process was the identification of sample companies. Once sample companies were identified, information was gathered using several sources based on a list of variables identified by each

WP to satisfy its research objectives. Data can be broadly classified as firm data, accounting data, investment data and are explained in the remainder of this Section.

2.1.3.1. Identification of sample companies

In order to identify sample companies several sources were combined. Investment and investor level data was first obtained from VentureXpert. VentureXpert data however are known to under-represent investments made by smaller and informal VC investors which are instead allegedly very important for young high-tech entrepreneurial companies. Accordingly additional information was collected using country specific sources, as shown in Table 2.3..

Table 2.3.: Sources used to identify the population of VC-backed companies

Country	Source
Belgium	VentureXpert, Investor annual reports, Investor websites, Press releases, Press clippings, Belgium VC Association yearbooks.
Finland	VentureXpert, Finnish VC Association yearbooks.
France	VentureXpert, Investor websites, Press releases.
Germany	VentureXpert, ZEW Foundation Panel, VC Pro-Database, BVK Directory, Zephyr, Investor websites.
Italy	VentureXpert, RITA directory, Private Equity Monitor, Italian Private Equity and VC Association.
Spain	VentureXpert, José Martí Pellón Database, Spanish VC Association, WebCapitalRiesgo.com.
U.K.	VentureXpert, Library House (now: Venture Source), Investor websites.

Once VC-backed companies were identified combining all sources in Table 2.3., a random sample was drawn in each country to reach the target set in Table 2.2.. Criteria for inclusion were then cross-checked at both local and central level.

2.1.3.2. Firm data

The data collected about each firm in the sample were:

- Company id (Name, VAT Code or equivalent, BvD code)
- Address (Country, NUTS 2 code, City, Street, Zip Code)
- Industry classification (including NACE rev1 and rev2 codes)
- Contacts (Telephone, Fax, Website, Generic email)
- Contact person (Name, Email)
- Listed status (including year of IPO)
- Status (Active, Acquired, Bankrupt, Other inactive; Including year in which exit occurred)

The main source for firm-level data was Amadeus (and its local equivalent) but some further sources of information were used by each team to improve data availability and reliability. More specifically Table 2.4. reports the sources used by each country for this category of data.

Table 2.4.: Data sources for firm-level information

Country	Source
Belgium	Belfirst, Belgian law gazette, Company websites, Press releases, Press clippings.
Finland	Amadeus, Company websites.
France	Amadeus, Company websites, Press releases.
Germany	ZEW Foundation Panel, Zephyr, German Stock Exchange, Firm websites.
Italy	RITA, Company websites, Telemaco, Press releases.
Spain	Amadeus, José Martí Pellón Database, WebCapitalRiesgo.com, Press releases.
U.K.	Amadeus, Library House, Company websites.

2.1.3.3. Accounting data

Several accounting variables were collected for each company of the sample in each available year.

- Income statement figures:
 - Sales
 - Payroll expenses
 - Value added
 - Depreciation of tangible assets
 - Depreciation of intangible assets
 - Total depreciation
 - EBITDA
 - EBIT
 - Net profit
 - Cash flows (Net profit + Depreciation)
- Assets:
 - Tangible assets
 - Intangible assets
 - Cash & cash equivalents
 - Inventory
 - Total assets
- Liabilities:
 - Long term financial debt
 - Short term financial debt
 - Total financial debt

- Equity
- Headcount

The main source of accounting data was Amadeus (and its local equivalent) but some further sources of information were used by each team to improve data availability and reliability. More specifically Table 2.5. reports the sources used by each country for this category of data.

Table 2.5. : Data sources for accounting information

Country	Source
Belgium	Belfirst.
Finland	Amadeus.
France	Amadeus.
Germany	Creditreform.
Italy	RITA, AIDA, Telemaco.
Spain	Amadeus.
U.K.	Amadeus.

2.1.3.4. Investment data

A specific set of additional data was collected for each round of investment by each investor. Data include the following:

- Investor-level information:
 - VC identity (Name of the management company and, if applicable, of the VC fund)
 - Year of foundation of the management company
 - Type of management company (Independent VC, Corporate VC, Bank-affiliated VC, Governmental VC, University seed fund)
- Deal-specific information for each investment round:
 - Date of the investment
 - Amount invested
 - Equity interest acquired
 - Stage of development of the company (EVCA classification)
 - If syndicated deal: who retains leadership
 - Exit (if the investor/fund exited the investment, when and how)
 - Contact person for the investment (Name, Phone, Email, Mail address)

The main source of investment and investor level data was VentureXpert but substantial information was collected using country specific sources. More specifically Table 2.6. reports the sources used by each country for this category of data.

Table 2.6. Data sources of investment data by country

Country	Source
Belgium	VentureXpert, Annual reports, Investor websites, Press releases, Press clippings, IPO Prospectuses, European VC and Private Equity Association yearbooks.
Finland	VentureXpert, Finnish VC Association, European VC and Private Equity Association yearbooks.
France	VentureXpert, Investor websites, Press releases, European VC and Private Equity Association yearbooks.
Germany	ZEW Foundation Panel, VentureXpert, VC Pro-Database, BVK Directory, Zephyr, German Stock Exchange, Investor websites, European VC and Private Equity Association yearbooks.
Italy	VentureXpert, RITA directory, Private Equity Monitor, European VC and Private Equity Association yearbooks.
Spain	José Martí Pellón Database, Local VC Association (ASCRI), WebCapitalRiesgo.com, VentureXpert, European VC and Private Equity Association yearbooks.
U.K.	Library House (now: Venture Source), VentureXpert, Investor websites, European VC and Private Equity Association yearbooks.

2.1.3.5. Patent data

The collection process for patent data required a specific process. Most of the data collection effort was centralized to ensure harmonization in the patenting data and achieve economies of scale in the process. The main source of information was the European Patent Office's Worldwide Patent Statistical Database (PATSTAT), which provides detailed information of patent applications and grants (records over 60 million patent applications and 30 million granted patents) in more than 100 countries worldwide. PATSTAT is a snapshot of the master documentation database DOCDB maintained by the European Patent Office and designed to be used for statistical research. For Europe only EPO patents are taken into account as these are of higher quality and hence have a higher signalling value. First, based on company name and address, we searched for potential matches among patent assignees in PATSTAT. An automated algorithm was used to ensure that firms could be recognized even when some of the characteristics (e.g. the name) was spelled slightly differently (much like the algorithms used by modern internet search engines to recognize misspells in the search).

Potential matches have then been dispatched to local teams for individual cross-checking their correctness. For each of the correct matches information was obtained from PATSTAT about all patent applications including:

- Patent id codes
- Complete history of the application process (Including, when applicable, grant date, oppositions, suspension...)
- List of countries of patent validity
- Patent references to journal articles (including journal type)
- IPC codes

For each company we computed the patent stock at the year of first investment. Moreover, patent stock is computed, as customary, with a 15% decay rate. There are three versions of the patent stock variable: the first is computed including only patents after they have been granted, the second including only patents eventually granted but considering them at application date, the third including all applications at time of application regardless of the outcome of the valuation process.

2.1.4. General descriptive statistics

2.1.4.1. Breakdown by country

Each country extracted an initial number of VC backed companies which oversampled between 10% and 25% the target level, such that, once all inclusion criteria had been controlled for, the final number of companies included in the sample would meet the requirements. As a result of this iterative data collection process, the final number of companies in the sample deviated marginally from the target level. The distribution of the sample is reported in Table 2.7..

Table 2.7.: Distribution of the VICO and EVCA dataset by country

Country	VICO Sample		EVCA Sample ¹²	
	Number	Percentage	Number	Percentage
Belgium	89	11.73	649	0.14
Finland	68	8.96	602	0.11
France	112	14.76	2553	0.04
Germany	134	17.65	3188	0.04
Italy	98	12.91	458	0.21
Spain	82	10.8	486	0.17
U.K.	176	23.19	2685	0.07
Total	759	100.00	10621	0.07

Overall the number of VC-backed companies in the sample is consistent with target levels. Comparing the VICO sample with the EVCA data shows that while a large number of the Belgian, Finnish, Italian and Spanish investments are included in the sample, relatively fewer deals of the larger European countries France, Germany and U. K. are included.

2.1.4.2. Breakdown by industry

Each firm is classified along a standard industry classification which incorporates that presented in Table 2.1.. The distribution by industry is reported in Table 2.8..

¹² Data provided by EVCA. Only high-tech initial VC investments are included.

Table 2.8.: Distribution of the VC-backed sample by industry

Sector	Number	Percentage
Biotech & Pharmaceutical	159	20.95
ICT manufacturing	124	16.34
Internet	134	17.65
Software	256	33.73
TLC services	44	5.80
Other high-tech manufacturing ^a	23	3.03
R&D services	19	2.50
Total	759	100.00

a. Includes: aerospace, robotics, nanotech and cleantech

2.1.4.3. Breakdown by foundation period

Table 2.9.: Distribution of the VC-backed sample by foundation period

Foundation period	Number	Percentage
1984-1989	22	2.90
1990-1994	92	12.12
1995-1999	339	44.66
2000-2004	306	40.32
Total	759	100.00

2.1.4.4. Availability of accounting data

Table 2.10.: Financial statements available for sample firms

Firm-year observation	VC-backed
Mean	8.98
Median	9.00
Total	6819

2.1.4.5. Patent applications

Table 2.11.: Patent applications for sample firms

Patent application	VC-backed
Mean	2.20
Total	1672

2.1.4.6. Investments

Table 2.12.: Descriptive statistics on investments before the update

VC-backed firms	759
Investors	1125
Investors per company (mean)	2.77
Investments per company (mean)	4.58
Total investments	3475

2.2. Additional data collection

A specific set of additional data was hand collected or updated in order to investigate the specific research questions of the studies in this dissertation.

- Investor-level information:
 - Country of origin
- Deal-specific information for each investment round:
 - Date of the investment rounds
 - Identity of the investors in each round
 - Experience of the VC at time of the investment
 - Previous experience: number of deals by sector, geographic area and investment stage
 - Previous exit experience: number of IPOs
 - Exit: which VC firms exited, how and when
 - Geographical distance between each specific investor and their PC
 - Origin of each VC compared to each of their PCs: domestic, cross-border or branch

The main source for the update of the data was VentureXpert and Zephyr but substantial information was also collected using VC or PC websites and press clippings. The sector, geographic and investment stage experience variables are measured by the cumulative number of previous initial investments a VC firm in respectively a certain sector, country and investment stage. In the same vein, exit experience is measured by a VC firm's cumulative number of IPO exits.

2.2.1. General descriptive statistics

2.2.1.1. Investments

Table 2.13.: Descriptive statistics on investments after the update

VC-backed firms	759
Investors	1087
Investors per company (mean)	2.94
Investments per company (mean)	8.28
Total investments	6281

2.1.4.2. Breakdown by VC origin

Table 2.14.: Descriptive statistics on VC origin after the update

Domestic VC	4369
Cross-border VC	1020
Branch VC	442
Missing origin	450
Total investments	6281

Chapter 3

Matching of supply & demand: The impact of VC investor's origin & portfolio company's characteristics

David Devigne^a, Sophie Manigart^{a, b}

^a *Competence Centre Accounting & Finance, Vlerick Business School, Belgium*

^b *Department Accountancy & Corporate Finance, Ghent University, Belgium*

Keywords

Venture Capital, Cross-Border Investments, Resource-based View, Liabilities of Foreignness, Two-sided selection, Investment Strategies

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Abstract

Analysing 1770 venture capital (VC) investments in young technology based companies, of which 20% by cross-border VC firms and 7% by local branches, we show that VC firm's geographic heterogeneity impacts the matching with companies both from the supply side (i.e. the VC investors) as from the demand side (i.e. the companies). From a supply perspective, we argue that foreign VC firms use several strategies to mitigate liabilities of foreignness (LOF). We confirm that cross-border VC firms preferably match with lower information asymmetry companies. This effect disappears when controlling for co-investor characteristics. Cross-border VC firms have a higher probability to invest with local investors, with larger investment syndicates and with more experienced co-investors. We further demonstrate that investing through a local branch as opposed to from a foreign head office allows foreign VC firms to exhibit the same investment behaviour as domestic VC firms. We thereby exhibit that local and more resourceful co-investors or establishing a local presence mitigate LOF and enable cross-border investors to invest in the same companies as domestic VC firms. From the demand perspective, we show that less developed companies have a higher probability to match with domestic VC firms as opposed to cross-border VC firms. Moreover, seed stage companies in which only cross-border VC firms co-invest have a higher probability to attract a local VC firm as opposed to other cross-border VC firms. Our results hence display that entrepreneurs adopt a life cycle approach, at each development stage of their companies they assess their companies' resource gaps and consequently target VC investors with specific geographic origins based upon the required resources.

3.1. Introduction

A venture capital (VC) investment in a company is a mutual decision, requiring the consent of both the investor and the company. Investors have preferences over specific investments depending on their investment strategies, and entrepreneurs have preferences over matches with specific investors depending on the investors' resources (Fried and Hisrich, 1994; Sorenson, 2007). From these preferences a mutual sorting process arises to match the requirements of both VC firms (i.e. the supply side) and companies (i.e. the demand side). Sorting implies that a given investor is pushed down in the relative ranking of an entrepreneurial company if its resources do not fully fit the company's needs. In the same vein, VC investors may use different investment strategies to minimize their specific investment risks (Elango et al, 1995). As a result, companies that do not fit the VC investor's investment strategy are in turn pushed down in the relative ranking of the VC.

It is widely accepted that entrepreneurs care about the identity of VC investors: "It is far more important whose money you get [as an entrepreneur] than how much you get or how much you pay for it" (Bygrave and Timmons, 1992: p. 208). Consequently, when faced with multiple offers, entrepreneurs may turn down the investor with the best financial offer in favour of an investor that is expected to add more value in other ways (Hsu, 2004). Since entrepreneurs more willingly accept financing from VC firms that add more value, these investors have more feasible investments to choose from.

Accordingly, we take investor's and company's diversity into account by investigating the role of VC investor's origin and portfolio company's (PC's) characteristics on their mutual investment decision. More specifically, we differentiate between three origins of VC firms: domestic VC firms, cross-border VC firms investing from headquarters (hereafter: cross-border VC firms) and cross-border VC firms investing from a branch located in the same country as the target PC (hereafter: branch VC firms). Heterogeneity in VC firm's geographic origin is expected to impact both the supply and the demand side of the sorting mechanism. Our goal is hence to investigate the differences in the drivers of the mutual matching process between companies and respectively domestic, cross-border and branch VC firms. We hereby address the call to examine how international VC firms use a mix of strategies – for instance by working with local VC firms or setting up local branches – in order to deal with information asymmetry problems linked to foreign investing (Fritsch and Schilder, 2008; Mäkelä and Maula, 2008; Meuleman and Wright, 2011; Pruthi et al., 2003). Moreover, by considering the demand perspective we also address the call by Pruthi and colleagues (2003) to investigate what factors influence the PCs decision to obtain finance from an international rather than from a domestic VC firm.

The liabilities of foreignness (LOF) theory is used to explain different investment strategies used by the different type of suppliers of finance (Wright et al., 2005). LOF are “all additional costs a firm operating in a market overseas incurs that a local firm would not incur” (Zaheer, 1995: 343). LOF are particularly severe when investing in non-domestic entrepreneurial high-tech companies as these are characterized by short operating and financial histories, and are based upon company specific proprietary technological know-how which is especially difficult to assess for distant “outside investors”. LOF may hence force VC investors to employ different investment strategies when investing across borders compared to when investing domestically (Bell et al., 2012; Dai et al., 2012). More specifically, setting up a local branch office enables to mitigate the frictions associated with geographic and cultural distance and hence mitigates LOF (Dai et al., 2012). Next, cross-border VC firms may select PCs with lower ex-ante information asymmetries or PCs that need less advice; both strategies will decrease information costs and asymmetric information problems (Dai et al, 2012; Pruthi et al., 2009). Third, network theory suggests that cross-border VC firms may outsource their deal flow generation, monitoring and value adding functions to branch or domestic co-investors (Mäkelä and Maula, 2008; Chemmanur et al., 2012; Sorenson and Stuart, 2001), thereby allowing to leverage resources of syndicate partners (Meuleman et al., 2010). Finally, cross-border VC firms may target PCs backed by more and more experienced co-investors as these will certify PCs and thereby alleviate issues related to institutional and cultural distance.

From a demand perspective, we draw upon the resource-based view of the firm to build a life cycle model on the association between a PC's changing resource needs and a VC investor's geographic origin. There is heterogeneity in the demand for such association because entrepreneurs have both different endowments of resources and reputation (Hsu, 2004), as well as access to different resource bases of partner organizations. More specifically, we expect later stage PCs' international focus will increase their demand for the skills of cross-border and branch VC firms as opposed to domestic VC firms. In contrast, early stage PCs' need for hands-on guidance will increase their demand for local VC investors. Finally, PCs backed only by domestic VC

firms are expected to have a higher demand for cross-border and branch VC firms in order to broaden and diversify their partners' resource base.

The hypotheses are tested on a sample of 1770 VC investments in young technology-based companies in seven European countries (Belgium, Finland, France, Germany, Italy, Spain and the U.K.), of which 20% by cross-border VC firms and 7% by branch VC firms. Europe offers an interesting environment for our research questions for three reasons. First, European VC investments have more international VC participation than U.S. VC investments (Schertler and Tykvová, 2011). Second, Europe is the second largest VC market worldwide, after the U.S., and follows the development of the U.S. VC market closely with an increasing number of large and experienced investors and a mature fund raising market (Alhorr et al., 2008; Manigart et al., 2010; Schertler and Tykvová, 2011). Third, the Europe union represents a unique group of countries in terms of size and proximity to each other (Alhorr et al., 2008), which are economically strongly integrated. Europe therefore provides a particularly attractive context to examine the drivers of the matching process between companies and their VC investors. Moreover, if significant differences are found between the VC origins, despite the fact that the European economies are more integrated than emerging economies and hence lower LOF are expected, this provides a very strong test of our hypotheses.

Our study suggests that heterogeneity in VC firm's geographic origin impacts both the supply and the demand side of the sorting mechanism. From the supply perspective, VC firms use different strategies to mitigate LOF. First, we confirm earlier findings that cross-border VC firms target companies with lower information asymmetries (Dai et al., 2012; Sorenson and Stuart, 2001), thereby limiting the scope of investment opportunities considered. More specifically, compared to domestic VC firms, cross-border VC firms have a lower probability to match with seed stage and first VC investment round PCs, but a higher probability to match with companies with more patents. However, when also accounting for co-investor presence and characteristics, PC characteristics do not impact the probability of raising money from a cross-border rather than a domestic VC firm. Instead, compared to domestic VC firms, cross-border VC firms have a higher probability to co-invest with a local VC firm (either a domestic or a branch VC firm), with larger investment syndicates and with a VC firm that can bring additional experience beyond that of the focal VC firm. Co-investors thus allow expanding the range of investment opportunities for cross-border VC firms. Interestingly, there are no differences between the investment strategies of domestic and branch VC firms. Branch VC firms invest in the same PCs and with comparable syndicate partners.

From the demand perspective, we first show that less developed PCs have a higher probability to match with domestic VC firms as opposed to cross-border VC firms. Second, seed stage companies in which only cross-border VC firms co-invest have a higher probability to match with a domestic or a branch VC firm. Refining the opportunity and building the early resource base is important in this phase, and local VC investors (either domestic or branch VC firms) are better equipped to provide support in these matters.

Our research contributes to the VC and entrepreneurship literature. The realization of an investment deal is a mutual decision of both VC firms and PCs, and we argue that therefore both the investor's origin and PC's

characteristics impact this outcome through a sorting mechanism. From the demand perspective, we argue that the resource needs of entrepreneurial companies change over time, and show that different types of VC investors may address different resource needs. From the supply perspective, we show that - when investing internationally - VC firms may target companies with specific characteristics to mitigate LOF. Hence, we provide a two-sided perspective on the drivers of the matching process between VC investors from different origins with companies having distinct characteristics. We further contribute by showing that investing through a local branch combines the benefits of both domestic and cross-border VC firms. While from a supply point of view investing through a local branch efficiently lowers LOF, from a demand point of view, branches are able to provide both local resources through their proximity and employment of local investment managers and international resources by leveraging their head office resource base. Setting up a local branch hence allows VC firms to expand internationally while limiting LOF.

The rest of the paper is organized as follows. Given the limited attention given to branch VC firms, we first discuss the benefits of branch VC firms compared to domestic and cross-border VC firms. Thereafter, we develop the hypotheses on the impact which VC investor's origin and PC's characteristics have on investment deal realization. Next, we outline our research method, including the sample, variables and method of analysis. This is followed by a presentation of the main findings, including robustness tests. Finally, a discussion of the results from both a theoretical and a practical perspective concludes this paper.

3.2. Literature review and development of hypotheses

3.2.1. VC internationalization mode

VC firms wishing to expand internationally may do so through direct cross-border investments or through establishing a local branch. The establishment of a local branch is a frequently used internationalization mode to mitigate LOF, thereby sharing characteristics of both domestic and cross-border VC investors.

On the one hand, investing through a local branch rather than through foreign headquarters allows international VC firms to mimic domestic VC firms (Miller and Eden, 2006; Pruthi et al., 2009; Zaheer, 1995). Operating from a local branch ensures proximity to entrepreneurs which makes it easier to add value, to monitor companies closely and to reduce information asymmetries. Proximity also provides legitimacy, as branches are strongly embedded in the local cultural and institutional environment (Pruthi et al., 2009). Next, sunk costs are different when investing from a branch compared to when investing from headquarters. Setting up a local branch necessitates predominantly a large financial investment, while investing across borders from headquarters requires higher temporal investments. Temporal investments have, however, a much smaller mental impact than financial investments, leading to lower sunk cost effects (Soman, 2001). The large sunk cost associated with the establishment of a branch makes it the most far-reaching form of local embeddedness a foreign VC firm can display and signals that the focal country is a part of the VC firm's long term strategy. This, in turn, may result in an increased trust from the local entrepreneurs. Additionally, VC branches typically employ local investment professionals who have a fine-grained understanding of the local institutions. As a

result, cultural and institutional differences disappear, thereby further facilitating transfer of knowledge and advice to the PC (De Prijcker et al., 2012; Pruthi et al., 2009). The quality and number of interactions of branch VC investors with their PCs are therefore expected to be similar to those of domestic VC investors. Branch VC firms thereby exhibit lower LOF and are able to interact and monitor companies more closely compared to cross-border VC firms.

On the other hand, local branches of foreign VC firms differ from domestic VC firms as they share characteristics of cross-border VC firms through their access to head office's resources. Cross-border and branch VC firms can influence and add value to companies in different ways than domestic VC firms as they have access to different international networks and may signal unobserved qualities of the company to different markets. More specifically, they may contribute to the internationalization of their PCs by sharing their knowledge pertaining to internationalization and international markets (Fernhaber and McDougall-Covin, 2009; Lutz and George, 2012) and by legitimizing the unknown company in their home market (Hursti and Maula, 2007; Mäkelä and Maula, 2005). Consequently, as branch VC firms share characteristics of both cross-border and domestic VC firms, it is important to treat them as a separate category of VC firms.

3.2.2. *Supply perspective: liabilities of foreignness in VC markets*

Despite technological advances, financial investors like VC firms are still prone to a "home bias", implying that they prefer to invest close to home compared to what would be optimal from a diversification perspective (French and Poterba, 1991; Fritsch and Schilder, 2008). A VC firm's reluctance to invest across borders is explained by LOF in capital markets, originating from difficulties in information gathering increasing information asymmetries and agency risk, and institutional and cultural distances between the investor's and the target company's country of origin (Bell et al., 2012). Additionally, VC investors differ from "traditional" financial investors in that they provide value-enhancing services to their PCs and monitor the PCs closely after the investment (Sapienza et al., 1996). This creates a supplementary LOF, as geographical and cultural distance hinders the efficient transfer of services (Ambos and Ambos, 2009). We expand on these antecedents of LOF hereafter.

A first antecedent of LOF in capital markets relates to increased *information costs*. As there is greater potential for an unequal distribution of information between national and cross-border investors, information flows are an important determinant of cross-border equity transactions (Portes and Rey, 2005). Unawareness about the customary rules regulating the behaviour and activities of managers in foreign markets, different business practices and standards, national and corporate cultures all increase information (Bell et al., 2012). Compared with domestic and branch VC firms, cross-border VC firms hence face higher barriers to access and interpret information when attempting to evaluate and monitor PCs (De Clercq and Sapienza, 2006). In the VC market, Cumming and Dai (2010) showed that geographic proximity leads to information advantages and reduces monitoring costs, leading to a higher successful exit probability for PCs that are close to their VC investors. Branch VC firms are expected to have access to similar amounts and types of information as domestic VC firms and are thus presumed to rely more on soft information compared to cross-border VC firms investing from head

office (Berger and Udell, 2002). Hence, cross-border VC firms have a strong information disadvantage compared to both domestic and branch VC firms.

A second antecedent of LOF is the *institutional distance*, or the extent to which institutions differ between the country of origin of the cross-border VC firm and that of the PC. Although formal institutional barriers in capital markets have been lowered in recent years, differences that are relevant for financial markets still persist in national institutions (Chan et al., 2005). This increases the risk and uncertainty of investing across borders (Bell et al., 2012). At the macro-economic level, it has been shown that well-developed legal frameworks including investor protection rights and well-developed stock markets increase the flow of cross-border VC (Cumming et al., 2010). In contrast, thanks to the geographic proximity and the employment of local investment managers, branch VC investors are not expected to face institutional LOF. Hence, cross-border VC firms are projected to have a higher institutional disadvantage compared to both domestic and branch VC firms.

Third, *cultural distance* has an effect on VC investor behaviour (Bruton et al., 2005; Dai et al., 2012; Wright et al., 2005). Culture are the shared values, beliefs and attitudes that influence individual perceptions and behaviours (Bell et al., 2012). Cultural distance impacts VC investment practices, which tend to differ across countries (Bruton et al., 2005). As a result, cross-border VC firms behave differently compared to domestic VC firms (Mäkelä and Maula, 2006; Pruthi et al., 2003). These differences hamper cross-border VC firms in achieving legitimacy in the target country, reducing their deal flow and hindering syndication with local VC investors. It also makes it more challenging to adhere to the local way of doing business. This may impact the effectiveness of cross-border VC firms, as the internationalization literature has shown that cross-border firms suffer lower returns until they become accustomed to the local culture and networks (Contractor et al., 2003). Again, branch VC investors are expected to face no cultural LOF thanks to their geographic proximity and the employment of local investment managers which helps them to be fully accustomed to the local culture. Hence, cross-border VC firms are expected to have a larger cultural disadvantage compared to domestic and branch VC firms.

Finally, VC investors differ from “traditional” forms of financial intermediation in that they provide their PCs more than blunt capital. Instead they are *actively involved* after the investment in the governance of the PCs and provide value-enhancing services to the PCs through participation in the board of directors (see e.g. Hsu, 2004; Sapienza et al., 1996). Value adding and monitoring is however more challenging for cross-border VC investors, as both are hampered by distance. This creates an additional LOF for cross-border VC firms, as their ability to monitor and add value to the PC, to coach the management team, and to provide introductions depends upon the ability to interact frequently with the PC. For example, VC firms are less likely to serve on the boards of geographically distant companies (Lerner, 1995). Additionally, telecommunication cannot be regarded as a means of overcoming all problems of geographical distance and is hence no full substitute for face-to-face contact (Fritsch and Schilder, 2008). Efficient value adding by VC investors is also hindered, as cultural and institutional barriers may make entrepreneurs less receptive to advice from foreign investors (Guiso et al., 2008). This creates a supplementary LOF for cross-border VC firms hindering the efficient transfer of services

(Ambos and Ambos, 2009). In contrast to cross-border VC investors, branch VC firm's geographic proximity to PCs and employment of local investment managers enables them to provide similar levels of value adding as domestic VC firms. Therefore, cross-border VC firms are expected to have a larger value adding disadvantage compared to domestic and branch VC firms.

Once a VC investment is made, it is illiquid and its success is highly dependent on a small group of entrepreneurs, making it all the more important that the initial decision to invest be a good one (Fried and Hisrich, 1994). As argued, the selection of PCs is even more important for cross-border VC firms as opposed to both domestic and branch VC firms due to the LOF they face. As a result, when VC firms invest across borders, we expect them to adapt their investment strategy rather than merely implementing the "recipes" from their domestic markets.

3.2.2.1. Impact of PC's development stage on matching: Supply viewpoint

A first strategy which cross-border VC firms may use to overcome LOF is to select PCs with lower ex-ante information asymmetries or PCs that need less advice. Both strategies decrease information costs (Dai et al, 2012). More specifically, the difficulty of opportunity appraisal and the importance of monitoring vary with the target company's development stage (Sorenson and Stuart, 2001). Early stage companies do not only face liabilities of newness and smallness, but they also often operate under unproven business models and in immature markets. Evaluating these early-stage companies proves difficult because they lack performance history for making informed quality assessments. In turn, the lack of a performance history upon which to base quality assessments tremendously increases the importance of trust — which is built through repeated interaction — in the VC investment relation (Sorenson and Stuart, 2001). Both information and trust require social interaction, yet the likelihood of this interaction diminishes with geographic distance. Additionally, less developed PCs produce less and lower quality financial information increasing information asymmetry (Hand, 2005). In contrast, in later stage companies, VC firms can more easily evaluate the quality of the management team in light of its performance on a number of key performance indicators.

VC firms therefore devote more time and interact more frequently with early stage PCs (Gupta and Sapienza, 1992). Consequently, extant research has shown that VC firms specializing in early stage prefer narrower geographic scope (Cumming and Dai, 2010; Fritsch and Schilder, 2008; Gupta and Sapienza, 1992). Next, cross-border VC firms will prefer to invest in a subsequent VC investment round, as information asymmetries decrease after a first VC investment. The initial VC firm will install stronger management control techniques in the PCs (Silvola, 2008), leading to more and higher quality subsequent information production (Beuselinck et al., 2009). Hence, cross-border VC firms will have a lower probability to invest in a first VC investment round. Finally, cross-border VC firms will select PCs which credibly signal their quality through salient organizational attributes which are indicators of their value, for example their patents (Hsu and Ziedonis, 2007). Entrepreneurial companies with patents have a higher probability of receiving VC and receive VC earlier (Haeussler et al., 2009). As cross-border VC firms face relative informational disadvantages compared to domestic and branch VC firms, patents will be a more important signal for cross-border VC firms than for

domestic and branch VC firms. Hence, we expect that cross-border VC firms will have a higher tendency to invest in PCs with more patents. Foregoing arguments lead to our first hypothesis:

H1: Compared to domestic or branch VC investors, cross-border VC investors have a lower relative probability to match with high information asymmetry companies.

3.2.2.2. Impact of syndicate composition on matching: Supply viewpoint

Next to applying more restrictive selection criteria and thereby limiting their range of investment opportunities they are willing to consider, cross-border VC firms may mitigate information problems and value adding through syndicate partners (Meuleman et al., 2010). Cross-border VC firms may outsource their deal flow generation, monitoring and value adding functions to branch or domestic co-investors, which are not hindered by geographical, cultural or institutional distance (Mäkelä and Maula, 2008; Chemmanur et al., 2012; Sorenson and Stuart, 2001).

In the absence of public information about companies, personal and professional relationships provide one of the primary vehicles for disseminating timely and reliable information about promising new investments especially over large spatial distances (Sorenson and Stuart, 2001). Thin markets for information arise both because high-tech companies are secretive in order to protect their competitive position, and because there may be few alternate channels outside of a trusted third party for information dissemination (Hsu, 2004). Moreover, the unavailability of clear information is especially problematic for cross-border VC firms who have more limited access to soft information compared to domestic and branch VC firms. As a result, when the quality of a start-up cannot be directly observed, external investors rely on the characteristics of the start-up's affiliates (Hsu, 2004). Deal flow generation may also experience LOF, as foreign VC firms originate fewer unsolicited deals compared to domestic VC firms (Lu and Hwang, 2010). Based upon cases of nine Finnish VC backed PCs, Mäkelä and Maula (2008) indeed show the importance of domestic VC firms in attracting cross-border VC firms. Domestic and branch VC firms can thus play a particularly important brokerage role to cross-border VC firms and have a major impact on its probability to make foreign investments, thereby expanding its spatial investment radius (Cumming and Dai, 2010; Iriyama et al., 2010; Sorenson and Stuart, 2001).

Next to reducing information asymmetries, syndication partners can play an important role in adding value to PCs (Manigart et al., 2006). By nature, domestic and branch VC firms have a higher possibility of adding value to their PCs (Hochberg et al., 2010; Sapienza and De Clercq, 2000). Geographical and cultural proximity benefits frequent and open communication with entrepreneurs and allows obtaining a good fit, which is essential to build trust in the VC firm-entrepreneur relationship (Shepherd and Zacharakis, 2001). This, in turn, positively impacts a VC firm's value-added contribution and subsequent PC performance (De Clercq and Fried, 2005). In emerging countries, it has been shown that farther away cross-border VC firms are (marginally significantly) more likely to syndicate with domestic VC firms (Chemmanur et al., 2012) and when they syndicate with domestic VC firms, cross-border VC firms invest in more informationally opaque PCs (Dai et al, 2012). In view of domestic and branch VC firms' ability to reduce information asymmetries and enhance value creation, we

expect that especially cross-border VC firms will benefit from having a domestic or branch VC firm as syndicate partner. We hence hypothesize:

H2a Compared to domestic or branch VC investors, cross-border VC investors have a higher relative probability to match with companies if domestic or branch VC investors are already part of the company's investment syndicate.

Another way in which syndicate partners may reduce LOF is through certification. Endorsement of a PC by a third party such as another VC firm enables the PC to build a reputation (Rao, 1994; Sahlman, 1990), thereby reducing uncertainty surrounding the PC. The signalling value of third-party endorsements in reducing the degree of uncertainty depends upon the number of certifying organizations and the status of the certifying organization (Bell et al., 2012; Nahata, 2008). Therefore, a PC backed by a larger investment syndicate or by a highly experienced VC firm has a more powerful endorsement, whereby the VC firm act as a reputational source of legitimacy. Cross-border VC firms - in contrast to domestic and branch VC firms - face LOF making endorsement from co-investors' more valuable compared to domestic and branch VC firms and as a result increasing their relative probability to invest.

A second benefit of larger investment syndicates or highly experienced syndicate partners is that they bring more valuable resources and capabilities to the PCs, further enhancing value creation. As VC firms gain more experience, they are more likely to secure the expertise required to facilitate their start-up PCs in acquiring resources for successful development (Hsu, 2004). Moreover, VC firm's information network extends with each additional investment made, either by gaining important social contacts or by securing experience in effective structuring deals or monitoring entrepreneurs (Sorenson and Stuart, 2001). For example, highly experienced VC firms are more adept to help find key management team members and to shape strategy (Timmons and Bygrave, 1986). As a result, PCs backed by larger investment syndicates or more experienced VC firms are more successful (Cumming and Waltz, 2010; Fitza et al., 2009; Sorenson, 2007; Nahata, 2008).

Cross-border VC firms have higher needs for more syndicate partners or more experienced syndicate partners in order to mitigate LOF. Endorsement by more co-investors and more experienced co-investors will alleviate issues related to institutional and cultural distance. Foregoing leads to following hypothesis:

H2b: Compared to domestic or branch VC investors, cross-border VC investors have a higher relative probability to match with companies if more resourceful VC investors are already part of the company's investment syndicate.

3.2.3. Demand perspective: the resource-based view

The resource-based view (RBV) defines a company as a collection of resources and states that the characteristics of the available resources affect the competitive advantage and thereby the growth of a company (Barney, 1986, 1991; Penrose, 1958; Wernerfelt, 1984). Companies that possess more valuable, scarce, unique and imperfectly mobile resources are expected to outperform their resource-constrained peers (Barney, 1991;

Chandler and Hanks, 1994; Cooper et al., 1994). While early resource-based scholars deemed it important to acquire or develop essential resources within the boundaries of an organization, later researchers have shown that companies may strongly benefit from the resource base of partner organizations (Bruneel et al., 2010; De Clercq and Dimov, 2008; Lee et al., 2001; Lockett et al., 2008). Given their experience and involvement in multiple companies, VC investors are instrumental in advancing their PCs by providing not only well-needed financial resources, but also intangible resources such as knowledge, access to networks and legitimacy (Arthurs and Busenitz, 2006; Hsu, 2004; Fernhaber and McDougall-Covin, 2009; Sapienza, 1992; Sapienza et al. 1996). Companies can hence spur their development by accessing the valuable intangible resources and capabilities provided by their VC investors (Carpenter et al., 2003; Vanaelst et al., 2006).

Not all VC investors provide similar resources, however. Companies should hence carefully assess which origin their VC investors should have and conscientiously time when to engage with them. More specifically, as PCs mature they face new challenges and require different capabilities and resources to cope with them. On the one hand, compared to domestic VC investors, cross-border and branch VC investors provide their PCs with more specific resources to grow internationally (Mäkelä and Maula, 2005, 2006). While on the other hand, proximity to their PCs enables branch and domestic VC firms to offer a more hands on approach, making them more valuable in the company's early phase than cross-border VC investors (Fritsch and Schilder, 2008). Consequently, PCs attracting VC should identify their resource needs and target VC firms who can provide access to the identified resource gaps.

More specifically, having cross-border or branch VC investors as opposed to domestic VC investors might also constrain PC's development. They may push PCs to pursue foreign markets which may be more difficult and slower to conquer or drive internationalization efforts of the company towards the investor's home market, which is not always the company's target market (Mäkelä and Maula, 2005). PCs should hence only target cross-border VC investors as opposed to domestic VC investors when they need the cross-border VC firm's specific resources. We hence take a life cycle perspective on the PCs' resource needs conditional on their development stage (Lockett et al., 2008; Vohora et al., 2004; Zahra et al., 2006).

3.2.3.1. Impact of PC's development stage on matching: Demand viewpoint

Early stage high-tech companies are often based upon proprietary technological know-how. They typically face liabilities of newness and smallness (Stinchcombe, 1965; Baum and Silverman, 2004) driven by an incomplete resource base, including a lack of organizational routines, networks, legitimacy in the local marketplace and managerial expertise (Stuart et al., 1999; Vohora et al., 2004). New opportunity identification and shaping, and subsequently investing in the resource base needed to pursue these opportunities are considered to be the "hallmark of entrepreneurial capabilities" (Arthurs and Busenitz, 2006: 199) and essential for an early stage company's future growth (Penrose, 1958).

The challenges of early stage high-tech companies are further compounded by the fact that they often operate in complex and highly volatile environments (Stuart et al., 1999). This makes that the opportunities, initially identified in the prestart-up phase, have to be tested in the market and redefined depending on feedback received

from different parties including potential customers (Vohora et al., 2004; Arthurs and Busenitz, 2006). Based on newly acquired knowledge, early stage high-tech companies thus have to continuously re-assess their key strategies (Vohora et al., 2004; Arthurs and Busenitz, 2006). Consequently, companies in their early phase need continuous experimentation with the opportunity including product specification, market framing and defining marketing strategies. This entails a constant search for feedback, followed by a repackaging of opportunities, before attaining a sustainable return phase (Vohora et al., 2004).

VC investors influence the opportunity shaping and resource acquisition processes by providing contacts to relevant external parties for soliciting feedback and by critically reassessing initial ideas based on this feedback (Gupta and Sapienza, 1992). We expect that domestic and branch VC investors are better positioned to assist their PCs in developing these early strategic processes than cross-border VC investors. Geographical distance and investing across boundaries creates an information disadvantage and makes it more difficult to add value and monitor companies closely (Dai et al., 2012). Moreover, telecommunication technology does not substitute yet for local presence and face-to-face contacts (Frisch and Schilder, 2008). Due to higher transaction costs, cross-border VC investors have additionally been found to devote less time to their PCs (Frisch and Schilder, 2008) and stop investing more promptly if their PCs fail to meet expectations (Mäkelä and Maula, 2006). Distance hence results in that cross-border VC investors are less closely involved with their PCs. This is especially detrimental in the early development stage where VC input is likely to be particularly beneficial to shape the opportunity, acquire early resources and develop organizational routines. Worst case, cross-border VC investors stop their financial support prematurely, which impacts technology-based companies' growth significantly as they typically require high upfront investments to develop their technology and products prior to sales generation.

Domestic and branch VC investors have a more fine-grained understanding of the legal and institutional environment in which the PC initially operates. As the interaction of new companies with the local environment is especially important to secure vital early resources, domestic and branch VC investors are expected to be able to provide more valuable and relevant advice to their PCs in the early development phase. Altogether, young early stage high-tech companies will initially benefit more from local VC investors compared to cross-border VC investors (Devigne et al., 2013).

A young company in the early phase of its technical and organizational development is hence more likely to require a higher level of involvement by a VC investor than a company at a later stage (Gupta and Sapienza, 1992). Consequently, domestic and branch VC investors will be more valuable in the company's early phase than cross-border VC investors and, as a result, companies in their early phase will have a higher propensity to attract domestic or branch VC investors as opposed to cross-border VC investors. We hence hypothesize:

H3a: Early stage companies have a higher probability to match with a domestic or branch VC investors as opposed to cross-border VC investors.

Once the entrepreneurial opportunity has been refined and initial resources have been put in place, high-tech companies enter a new stage in which they strive to attain sustainable returns through market development (Vohora et al., 2004). High-tech companies often have a narrow product scope based on a technology that may quickly become obsolete and for which the domestic market size is limited (Litvak, 1990; McDougall et al., 1994; Coviello and Munro, 1995; Knight and Cavusgil, 2004; Sapienza et al., 2006; Lutz and George, 2012). This forces high-tech companies to internationalize, especially in the European context where domestic markets are typically too small to reach a minimum efficient scale (Bruneel et al., 2010). The use of resources and the sale of outputs in multiple countries is hence critical for their further development (Oviatt and McDougall, 1994).

Compared to operating in domestic markets, expanding internationally entails costs that result from unfamiliarity with the foreign markets and from political, cultural and economic differences between foreign markets and the home market costs (Zaheer, 1995; Dai et al., 2012). These costs are especially difficult to overcome for young technology-based companies, as they often miss the resources and capabilities to deal with international expansion (Clarysse et al., 2007; Zahra et al., 2007). External board members, such as VC representatives, with varied skills and experiences in international markets may provide useful connections to existing institutions, companies and networks in target foreign markets (Fernhaber et al., 2009).

The international knowledge, networks and reputation of cross-border and branch VC investors can assist their PCs' internationalization, thereby facilitating the growth of more developed PCs (Dai et al., 2012; Lutz and George, 2012; Humphery-Jenner and Suchard, 2013). First, cross-border and branch VC investors may provide access to complementary knowledge-based resources in their country of origin; these would typically be unavailable to companies that raise finance exclusively from domestic VC investors. For instance, cross-border and branch VC investors may be particularly able to provide their PCs with knowledge and information about foreign legal and business issues (Mäkelä and Maula, 2005). Second, cross-border and branch VC investors may provide access to their international network, allowing companies to make contact with relevant foreign suppliers, customers, financiers, key executives and other potential stakeholders (Sapienza et al., 1996; Mäkelä and Maula, 2005). These relationships are likely to foster the growth of PCs (Yli-Renko et al., 2002). Networks in foreign markets may also increase the ability of PCs to identify new opportunities, which is expected to further enhance company growth (McDougall et al., 1994; Mäkelä and Maula, 2005). Finally, the mere fact of having a cross-border or a branch VC investor may provide endorsement benefits (Stuart et al., 1999; Mäkelä and Maula, 2005). More specifically, cross-border and branch VC investors are likely to legitimate their PCs in foreign markets, which is expected to benefit them when they need to mobilize resources from these markets (Hursti and Maula, 2007). Foregoing leads to following hypothesis:

H3b: Later stage companies have a higher probability to match with cross-border or branch VC investors as opposed to domestic VC investors.

3.2.3.2. Impact of syndicate composition on matching: Demand viewpoint

Syndication between cross-border or branch VC investors and domestic VC investors provides PCs access to a broader and complementary knowledge and resource base (Brander et al., 2002; Fritsch and Schilder, 2008; Dai et al., 2012). It provides access to an at least partially non overlapping combination of skill sets, experience and networks of a diversity of VC firms (Schertler and Tykvová, 2012).

Domestic and branch VC investors have a better knowledge of local market conditions and provide better access to local resources. Compared to cross-border VC investors, they may also allocate more time to monitoring their local PCs as they are confronted with lower transaction costs (Fritsch and Schilder, 2008). In contrast to domestic VC investors, cross-border and branch VC investors provide knowledge, networks and legitimacy that are particularly relevant in foreign markets. They may provide knowledge about foreign and legal issues (Dai et al. 2012), help in opening doors to foreign customers, suppliers, business partners and financiers (Mäkelä and Maula, 2005; Lutz and George, 2012) and endorse the PC in an international context (Stuart et al., 1999; Mäkelä and Maula, 2005).

Mixed syndicates consisting of domestic VC investors and cross-border or branch VC investors; or branch and cross-border VC investors thus offer complementary resources, increasing the resources, skills and information available for the monitoring and decision making of the PCs (Jääskeläinen, 2012). PCs backed by such a mixed syndicate therefore outperform those in which only domestic or only cross-border venture capital investors invest (Chemmanur et al., 2011; Cumming and Dai, 2010; Dai et al., 2012; Devigne et al., 2013; Hazarika et al., 2013; Humphery-Jenner and Suchard, 2013; Wang and Wang, 2012). More specifically, PCs with mixed syndicates are about 5% more likely to successfully exit (Dai et al., 2012). Foregoing arguments lead to the final hypotheses:

H4a: Companies in which only domestic VC investors are part of the investment syndicate have a higher relative probability to match with cross-border or branch VC investors compared to domestic VC investors.

H4b: Companies in which only cross-border VC investors are part of the investment syndicate have a higher relative probability to match with domestic or branch VC investors compared to cross-border VC investors.

3.3. Research method

3.3.1. Sample and data

The hypotheses are tested on a sample drawn from a novel dataset on European technology companies built by the pan-European VICO project (See chapter 2 for the description of the VICO sample).¹³ We focus on the first investment between the focal VC firm and a PC. We thereby exclude investments by the focal VC firm in subsequent investment rounds, as these may for instance be impacted by escalation of commitment (Guler, 2007). The sample contains data on 1770 first investments between 840 VC firms and 679 VC-backed

¹³ As government VC firms exhibit an investment pattern that differs from all other VC investor types, they are excluded from the sample we use in this study.

companies of which 1241 are made by domestic VC firms, 356 by cross-border VC firms and 126 by branch VC firms. The use of European data is particularly suited to test our hypotheses, as compared to the U.S. more European VC deals have international VC firm participation (Aizenman and Kendall, 2012).

Table 3.1. (Panel A) provides an overview of the PCs by company industry, country, founding period and focal VC firm's first investment year. The most important industry is the software industry (34%), followed by the biotech (21%) and the ICT industry (16%). Over 25% of the sample companies are located in the United Kingdom, 24% in France, 18% in Germany and 12% in Belgium. Italian companies represent 9% of the sample and Finnish and Spanish companies respectively 7 and 5%. The majority of PCs (48%) were founded between 1998 and 2000, 32% were founded between 1986 and 1997 and 20% between 2001 and 2004. The first investments of VC firms in the sample companies take place between 1994 and 2011. The VC firms have been active over the entire time frame of our study, although most VC firm's first investments in PCs are concentrated during the dot-com bubble and subsequent years.

Table 3.1.: Portfolio companies by country, founding year and industry group

	Panel A		Panel B					
	Full Sample		Domestic VC firm		Cross-border VC firm		Branch VC firm	
	1170		1241		356		126	
<i>Sample size</i>	Number	%	Number	%	Number	%	Number	%
<i>Industry</i>								
Software	598	33.8	441	35.5	108	30.3	35	27.8
Biotech	367	20.7	249	20.1	90	25.3	18	14.3
ICT								
manufacturing	287	16.2	211	17.0	57	16.0	14	11.1
Internet	198	11.2	127	10.2	40	11.2	23	18.3
TLC	101	5.7	60	4.8	26	7.3	10	7.9
Pharmaceutical	79	4.5	51	4.1	16	4.5	9	7.1
Web publishing	76	4.3	51	4.1	10	2.8	14	11.1
Other R&D*	64	3.6	51	4.1	9	2.5	3	2.4
<i>Country</i>								
U.K.	456	25.8	297	23.9	96	27.0	60	47.6
France	422	23.8	324	26.1	70	19.7	20	15.9
Germany	314	17.7	211	17.0	71	19.9	5	4.0
Belgium	216	12.2	156	12.6	55	15.4	5	4.0
Italy	156	8.8	104	8.4	32	9.0	11	8.7
Finland	116	6.6	78	6.3	26	7.3	12	9.5
Spain	90	5.1	71	5.7	6	1.7	13	10.3
<i>Founding year</i>								
1986-1997	565	31.9	391	31.5	117	32.9	52	41.3
1998-2000	853	48.2	589	47.5	174	48.9	56	44.4
2001-2004	352	19.9	261	21.0	65	18.3	18	14.3
<i>Focal VC firm's first investment year</i>								
1994-1999	310	17.7	233	18.8	46	12.9	30	23.8
2000-2005	1281	73.0	895	72.1	273	76.7	84	66.7
2006-2011	164	9.3	113	9.1	37	10.4	12	9.5

3.3.2. Variable definitions

The dependent variables of interest are three mutually exclusive dummy variables: *Domestic VC firm*, *Cross-border VC firm* and *Branch VC firm*. *Domestic VC firm*, *Cross-border VC firm* and *Branch VC firm* take the

value of 1 if the focal VC in a realized PC-VC match is respectively a domestic VC firm; a cross-border VC firm investing from head office and a cross-border VC firm investing through a local branch.

The key independent variables measure PC and co-investor characteristics which may drive the matching between focal VC firms and PCs. First, in order to test hypotheses 1, 3a and 3b we include measures that capture the level of information asymmetry embedded in the PC at time of the focal VC firm's first investment: (a) PC development stage (*seed stage*); (b) focal investor entry round (*first investment round*); and (c) PC technological transparency (*patents*). While *seed stage* and *first investment round* are dummy variables that are respectively equal to 1 if the PC is in the seed development stage and if the focal VC firm enters the PC in its first investment round, *patents* is the PC's number of patent applications which were pending and granted. Second, to test hypotheses 2a and 4b we constructed three dummy variables that capture the focal VC firms' co-investors' origin: (a) *synd_Domestic*; (b) *synd_Branch*; and (c) *synd_Cross-Border*. While *synd_Domestic* and *synd_Branch* equal 1 when there is at least one co-investor in the investment syndicate which is respectively a domestic VC firm or a branch VC firm; *synd_Cross-Border_only* equals 1 when there are only cross-border VC co-investors in the investment syndicate. Next, to test hypothesis 2b we constructed variables that measure the co-investors resources: (a) *syndication size*; and (b) *experience spill overs supply*. *Syndication size* takes into account the total amount of resources the co-investors may contribute to the focal VC and the PC, measured as the time varying cumulative count of VC investors that participated in prior financing rounds or in the focal round. *Experience spill overs supply* measures the potential experience flow from the co-investors to the focal VC firm and is computed by subtracting the focal VC firm's experience (who is entering the investment syndicate), measured as the total number of VC investments made prior to the focal VC investment, from the highest co-investors' experience. Prior to taking the natural logarithm, we truncate this variable at 0 as only positive differences denote a potential experience flow, i.e. from a more experienced co-investor to the focal VC entering the investment syndicate. Finally, to test hypothesis 4a we constructed one additional dummy variable *synd_Domestic_only* which equals 1 when there are only domestic VC co-investors in the investment syndicate.

We control for focal VC firm characteristics, market conditions, industry, year and country effects. For focal VC firm characteristics, we include a control for the *focal VC's experience*, since the probability to have positive experience flows from a co-investor depends on the focal VC firm's own experience level. *Focal VC's experience* is measured as the total number of VC investments made by the focal VC prior to the investment in the PC. To control for the general VC investment market conditions - which may affect a focal VC firm's probability to invest, the yearly total *number of VC investments* worldwide is added. We control for potential effects of the timing of the focal VC firm's first investment as both the timeframe of our study and the focus on high-tech sectors require us to control for the *focal VC firm's first investment year*. Companies in different industries and countries may differ in the probability to be invested. To control for potential industry and country effects, *industry* and *country dummies* are added. Finally, in the demand perspective models, we isolate the PC's quest for resources of a specific VC origin from the search for more experienced VC investors by including the control variable *experience spill overs demand*. *Experience spill overs demand* measures the experience flow from the focal VC firm to the PC and is computed by subtracting the highest experience of the

PC's existing investors, measured as the total number of VC investments made prior to the focal VC investment, from the focal VC firm's experience. Prior to taking the natural logarithm, we truncate this variable at 0 as only positive differences denote an experience flow, i.e. from a more experienced focal VC to the PC.

3.3.3. Method of Analysis

The differences in the probability of a match between companies and respectively cross-border, branch and domestic focal VC firms are tested with multinomial logistic models, an extension of the binary logistic model, as our dependent variable can take more than two discrete outcomes (see e.g. Cooper et al., 1994). For each unique VC-PC pair (n), the focal VC firm's origin (Y_n) is represented by a set of three mutually exclusive dummy variables that capture the origin of the focal VC.

The probabilities for each respective outcome can be represented as:

$$P_{n \text{ Domestic VC firm}} = P [Y_{n \text{ Domestic VC firm}} = 1]$$

$$P_{n \text{ Cross-border VC firm}} = P [Y_{n \text{ Cross-border VC firm}} = 1]$$

$$P_{n \text{ Branch VC firm}} = P [Y_{n \text{ Branch VC firm}} = 1]$$

The sum of these probabilities equals 1. The multinomial model determines these probabilities as a function of the observed independent variables and their estimated coefficients. The estimated coefficients represent the effect of the independent variables on the logarithm of the odds-ratio of the focal outcome (for instance a match with a focal cross-border VC firm or branch VC firm) compared to the normalized outcome (i.e. the reference category: in this case a match with a focal domestic VC firm). Consequently, the coefficients should be interpreted as the effect of the independent variables on the probability of a particular outcome (a match with a focal cross-border VC firm or branch VC firm) relative to the probability of the reference category (a match with a focal domestic VC firm).

Additionally, as it is useful to discuss the variable's marginal effects - i.e. how much a change in a variable changes the probability of the focal outcome - we report the average marginal effects next to the estimated coefficients (Hoetker, 2007). More specifically, we calculate the marginal effects by estimating the response for each observation and then average those responses as this is more informative than to set all variables at their mean (Hoetker, 2007). A marginal effect is hence computed for each case, and then all the computed effects are averaged. Finally, the average marginal effects are a zero-sum game: a specific focal VC firm origin's gain (or loss) in probability to match with a company, that has specific characteristics, is exactly balanced by the losses (or gains) of the probabilities of the other VC firm origins to match with that exact same kind of company.

To summarize, the coefficients and average marginal effects test different hypotheses: while the coefficient in a multinomial logit model shows the effect of a variable on the latent propensity for the focal category compared to the reference category, the average marginal effect displays an effect on the probability of a focal category for a typical company.

Analyses are clustered on the PC level, as multiple observations for the same PC could lead to correlations between the error structure and the independent variables and thus lead to underestimation of the standard errors.

3.4. Results

3.4.1. Descriptive statistics

Table 3.1. (Panel B) provides an overview of our sample, distinguishing between companies that raise financing from a domestic VC investor, a cross-border VC investor and a branch VC investor. Two particular observations are worth noting. First, the distributions of PC's industry, founding year and year of the focal VC firm's first investment are relatively similar for the different VC firm origins. Second, although the PC country distribution of the domestic VC firms' investments and cross-border VC firms' investments are similar, branch VC firms' investments mainly take place in the U.K. (48%). The fact that more branch VC firms are set up in the U.K. is, however, not surprising as the U.K. is the largest and most developed VC market in Europe and therefore the most attractive country in Europe for foreign VC firms to set up a local branch (Bottazzi and Da Rin, 2002).

Table 3.2. shows the description of the sample at time of first investment by the focal VC firm; Panel A records the PC information asymmetry variables. Domestic VC firms (23%) make approximately twice as much seed investments compared to cross-border (14%) and branch VC firms (14%). While domestic VC firms enter almost two thirds of their PCs in their first investment round (62%), cross-border VC firms and branch VC firms enter their PCs in the first investment round respectively in 40% and 53% of their investments. The mean PC holds 0.46 patents at time of entry of the focal VC firm. While domestic VC firm's (0.34) and branch VC firm's (0.31) PCs hold fewer patents, cross-border VC firm's (0.87) PCs on average hold more patents. Table 3.2. Panel B displays the descriptive statistics of the co-investors' origin. Compared to domestic and branch VC firms who co-invest with domestic VC firms in 66% of their investments, cross-border VC firms more frequently co-invest with domestic VC firms (86%). While domestic VC firms co-invest with branch VC firms in 11% of their investments, branch VC firms (24%) and cross-border VC firms (28%) co-invest with branch VC firms approximately twice as often. Moreover, branch VC firms (6%) co-invest exclusively with cross-border VC firms in twice as many of their investments compared to domestic (3%) and cross-border VC firms (2%). Finally, compared to domestic VC firms who co-invest exclusively with domestic VC firms in 43% of their investments, cross-border (28%) and branch VC firms (26%) co-invest less frequently with only domestic VC firms. Table 3.2. Panel C records the co-investor resources. A median cross-border VC firm has twice as many co-investors (4) compared to a median domestic (2) and branch VC firm (2). While a median domestic and branch VC firm has no positive experience flow from their most experienced co-investor (mean respectively 83.09 and 105.65 investments), a median cross-border VC firm's most experienced co-investor has made 42 (mean 245.18) investments more prior to the focal investment. Finally, Table 3.2. Panel D describes the control variables. While compared to its existing investors, a median PC has no positive experience flow from the new focal VC investor they attract (mean 40.77); a mean new focal domestic, cross-border and branch VC firm has made respectively 19.42 (median 0), 66.43 (median 0) and 159.81 (median 0) investments more than the PC's

existing VC investors prior to the focal investment. Branch VC firms are the most experienced (median 77 investments), followed by cross-border VC firms (17) and domestic VC firms (4). The mean total number of VC investments made in the focal investment year is relatively similar over the different VC origins.

Table 3.2.: Descriptive statistics at first investment of the focal VC firm

		Full Sample	Domestic VC firm	Cross-border VC firm	Branch VC firm
	<i>Sample size</i>	1770	1241	356	126
<i>Panel A: PC information asymmetry</i>					
Seed stage (D)	Mean	0.21	0.23	0.14	0.14
First investment round (D)	Mean	0.57	0.62	0.40	0.53
Patents	Mean	0.46	0.34	0.87	0.31
	Median	0.00	0.00	0.00	0.00
	S.D.	2.41	1.82	3.60	1.02
<i>Panel B: Co-investor origin</i>					
Synd_Domestic (D)	Mean	0.71	0.66	0.86	0.66
Synd_Branch (D)	Mean	0.15	0.11	0.28	0.24
Synd_Cross-Border_only (D)	Mean	0.03	0.03	0.02	0.06
Synd_Domestic_only (D)	Mean	0.38	0.43	0.28	0.26
<i>Panel C: Co-investor resources</i>					
Syndication size	Mean	3.03	2.51	4.86	2.90
	Median	2.00	2.00	4.00	2.00
	S.D.	3.24	2.82	3.92	3.42
Experience spill overs supply	Mean	117.41	83.09	245.18	105.65
	Median	1.00	0.00	42.00	0.00
	S.D.	252.33	206.10	355.01	218.20
<i>Panel D: Control variables</i>					
Experience spill overs demand	Mean	40.77	19.42	66.43	159.81
	Median	0.00	0.00	0.00	0.00
	S.D.	144.20	91.87	187.75	267.85
Focal VC's experience	Mean	57.66	27.89	104.36	210.82
	Median	6.00	4.00	17.00	77.00
	S.D.	157.39	95.87	207.75	289.26
Number of VC investments (x 10 ³)	Mean	11.46	11.35	11.80	11.49
	Median	7.17	7.17	7.17	9.04
	S.D.	6.43	6.34	6.67	6.46

3.4.2. Correlation matrix

The pairwise correlation matrix is provided in Table 3.3. All variables have correlations below 0.60 and the maximum variance inflation factors is 4.30, which is well below the usual warning level of 10 (Rao et al., 2001). The mean variance inflation factor is 1.73. This indicates that problems due to multicollinearity issues are limited.

Table 3.3.: Pairwise correlation matrix

Variable	1	2	3	4	5	6	7	8	9	10	11
<i>PC information asymmetry</i>											
1 Seed stage (D)											
2 First investment round (D)	0.26 ***										
3 Patents	-0.09 ***	-0.03									
<i>Co-investor origin</i>											
4 Synd_Domestic (D)	-0.16 ***	-0.48 ***	0.10 ***								
5 Synd_Branch (D)	-0.12 ***	-0.27 ***	0.04 *	0.11 ***							
6 Synd_Cross-Border_only (D)	-0.01	0.07 ***	-0.03	-0.26 ***	-0.07 ***						
7 Synd_Domestic_only (D)	0.00	-0.10 ***	-0.06 **	0.51 ***	-0.33 ***	-0.13 ***					
<i>Co-investor resources</i>											
8 Syndication size	-0.21 ***	-0.53 ***	0.15 ***	0.53 ***	0.34 ***	-0.08 ***	-0.11 ***				
9 Experience spillovers supply	-0.16 ***	-0.41 ***	0.16 ***	0.43 ***	0.43 ***	-0.01	-0.14 ***	0.59 ***			
<i>Control variables</i>											
10 Experience spillovers demand	0.00	0.16 ***	-0.03	-0.16 ***	-0.15 ***	0.03	0.02	-0.23 ***	-0.53 ***		
11 Focal VC's experience	-0.05 *	0.00	0.09 ***	-0.04	0.03	0.08 ***	-0.07 **	0.00	-0.16 ***	0.69 ***	
12 Number of VC investments (x10 ³)	0.12 ***	0.25 ***	-0.06 ***	-0.05 **	0.01	0.03	-0.08 ***	-0.05 **	-0.04	-0.02	-0.04

(D) marks the dummy variables; *** p < .01, ** p < .05, * p < .10

3.4.3. Multivariate analysis of PC-VC matches

Table 3.4. and 3.5. present multinomial logit models of the likelihood of a match between a company - given its specific characteristics - and respectively a focal domestic, cross-border and branch VC firm. While Table 3.4. displays the focal VC firm's probabilities relative to a specific reference category, Table 3.5. displays the average marginal effects. Models 1 and 5 include only the control variables; subsequently in Models 2 and 6 the PC information asymmetry variables are added; next in Models 3 and 7 the co-investor variables from the investor's perspective are included; finally in Models 4 and 8 the co-investor variables from the company's perspective are added.

In line with the descriptive statistics, Model 1 shows that the cross-border and branch VC firms are significantly ($p < .01$) more experienced than domestic VC firms at time of the focal investment. Model 1 further shows that branch VC firms are significantly ($p < .01$) more experienced than cross-border VC firms. The total *number of VC investments* made worldwide has no significant impact on the relative probabilities of the VC firms to match. *PC industry*, *PC country* and *focal VC firm's first investment year* dummies are significant in all models. Adding the information asymmetry variables in Models 2 and 6 allows assessing whether the likelihood of a match between companies and respectively focal domestic, cross-border and branch VC firms differs based upon the level of information asymmetry embedded in the companies.

The negative coefficients of *seed stage* ($p < .05$) and *first investment round* ($p < .01$) in Model 2 show that, compared to focal domestic VC firms, focal cross-border VC firms have a lower probability to match with seed stage and first investment round companies. Model 6 displays the average marginal effects of *seed stage* (-7.0%; $p < .05$) and *first investment round* (-14.8%; $p < .01$) which indicate that focal cross-border VC firms have respectively a 7.0% and a 14.8% lower probability to match with a typical seed stage and a first investment round company. In contrast focal domestic VC firms have respectively a 8.3% ($p < .05$) and a 17.3% ($p < .01$) higher probability to match with a typical seed stage and a first investment round company. Moreover, the positive coefficient on *patents* ($p < .05$) in Model 2 implies that, compared to focal domestic VC firms, focal cross-border VC firms have a higher probability to invest in companies which hold more patents. The average marginal effect on *patents* (0.8%; $p < .05$) in Model 6 implies that adding one patent to a typical company increases its probability to match with a focal cross-border VC firm by 0.8%. Model 2 further shows there are no significant differences between focal branch VC and focal cross-border VC firms in the information asymmetry level of the companies with whom they match. Finally, while the coefficients on *seed stage* and *patents* in Model 2 are not significant, the negative coefficient of *first investment round* ($p < .01$) shows that compared to focal domestic VC firms, focal branch VC firms have a lower probability to match with first investment round companies. The average marginal effects in Model 6 however show that none of the information asymmetry level variables of a typical company significantly impacts its probability to match with a focal branch VC firm. These results are partially in line with our first and third hypothesis. Although we show that, compared to focal domestic VC firms, focal cross-border VC investors have a lower relative probability to match with high information asymmetry PC, we find no significant differences between focal cross-border and

focal branch VC firms in terms of PC information asymmetry or between focal branch and focal domestic VC firms in terms of PC stage.

3.4.3.1. Supply perspective

When we include co-investor's origin and resource variables from the investor's perspective in Models 3 and 7, the significant results on the company information asymmetry variables displayed in Models 2 and 6 disappear. Instead, Model 3 shows that, compared to focal domestic VC firms, the relative probability that focal cross-border VC firms match with a company increases if at least one domestic VC ($p < .01$) or branch VC firm ($p < .05$) co-invests, but not when only cross-border VC firms co-invest. The average marginal effects on *synd_Domestic* (10.5%; $p < .01$) and *synd_Branch* (7.9%; $p < .05$) in Model 7 imply that the probability of focal cross-border VC firms to match with a typical company increases with 10.5% and 7.9% higher if respectively at least one domestic VC or branch VC firm co-invests. In contrast focal domestic VC firms have respectively an 11.3% ($p < .01$) and a 7.5% ($p < .05$) lower probability to match with a typical company if at least one domestic VC or branch VC firm co-invests. The relative coefficients on *synd_Domestic* and *synd_Branch* of focal branch VC as opposed to focal domestic and focal cross-border VC firms in Model 3 are, together with the average marginal effects of focal branch VC firms in Model 7, however not significant. These results are hence only partially in line with our hypothesis 2a as we did not find a positive significant difference in the relative probability of focal cross-border VC firms, as opposed to focal branch VC firms, to match with companies who have at least one domestic or branch VC co-investing. Model 3 further shows that the relative probability of focal cross-border VC firms, compared to focal domestic VC firms, to match with a company increases when syndicates are larger ($p < .01$) or when more experienced co-investors ($p < .01$) co-invest. The average marginal effect on *syndication size* (1.3%; $p < .01$) and on *experience spill overs supply* (1.9%; $p < .01$) in Model 7 indicates that focal cross-border VC firms have respectively a 1.3% and a 1.9% higher probability to match with a typical company if one co-investor is added to the syndicate or when the experience of more experienced co-investors increases with one. In contrast focal domestic VC firms have respectively a 1.5% ($p < .01$) and a 2.2% ($p < .01$) lower probability to match with a typical company if one co-investor is added to the syndicate or when the potential experience flow from more experienced co-investors increases with one. The relative coefficients on *syndicate size* and *experience spill overs supply* of focal branch VC as opposed to focal domestic and focal cross-border VC firms in Model 3 are, together with the average marginal effects of focal branch VC firms in Model 7, however not significant. These results are partially in line with our hypothesis 2b.

3.4.3.2. Demand perspective

In contrast to the investor's perspective, when we include the co-investor's origin and resource variables from the company's perspective in Models 4 and 8, the significant results on the company *information asymmetry* displayed in Models 2 and 6 do not fully disappear. Although the coefficient (Model 4) and the average marginal effect (Model 8) on *seed stage* of focal cross-border as opposed to focal domestic VC firms is no longer significant, the negative coefficient ($p < .01$) and average marginal effect (-7.8%; $p < .01$) on *first investment round*, and the positive coefficient ($p < .10$) and average marginal effect (0.5%; $p < .05$) on *patents* remain significant. Additionally, Model 4 demonstrates that, compared to focal domestic VC firms, the relative

probability that focal cross-border VC firms match with a company decreases if only domestic VC firms ($p < .10$) co-invest, but not when only branch VC firms co-invest. The average marginal effect on *synd_Domestic_only* (-5.0%; $p < .10$) in Model 8 implies that focal cross-border VC firms have a 5.0% lower probability to match with a typical company if only domestic VC firms co-invest. In contrast focal domestic VC firms have a 6.3% ($p < .05$) higher probability to match with a typical company if only domestic VC firms co-invest. Moreover, Models 4 and 8 show that there is no significant impact on the probability of a match between companies and any focal VC firm origin if only cross-border VC firms are co-investing. We hence find no support for hypothesis 4a and 4b. We will further analyse these unexpected results in the post hoc analysis hereafter.

Table 3.4.: Results of multinomial models predicting the relative probability of companies to match with domestic VC firms, cross-border VC firms or branch VC firms

Focal VC	Model 1			Model 2			Model 3			Model 4		
	Cross-border VC	Cross-border VC	Branch VC	Cross-border VC	Cross-border VC	Branch VC	Cross-border VC	Cross-border VC	Branch VC	Cross-border VC	Cross-border VC	Branch VC
Reference category	Domestic VC	Branch VC	Domestic VC	Domestic VC	Branch VC	Domestic VC	Domestic VC	Branch VC	Domestic VC	Domestic VC	Branch VC	Domestic VC
<i>PC information asymmetry</i>												
Seed stage (D)				-0.549 **	-0.166	-0.383	-0.341	-0.063	-0.279	-0.320	-0.085	-0.235
First investment round (D)				-1.158 ***	-0.410	-0.748 ***	-0.298	0.013	-0.311	-0.651 ***	-0.102	-0.548 *
Patents				0.061 **	0.064	-0.003	0.010	0.051	-0.040	0.036 *	0.061	-0.025
<i>Co-investor origin</i>												
Synd_Domestic (D)							0.858 ***	0.479	0.379			
Synd_Branch (D)							0.625 **	0.504	0.121			
Synd_Cross-Border_only (D)							0.531	-0.466	0.997	-0.148	-0.833	0.685
Synd_Domestic_only (D)										-0.420 *	-0.096	-0.324
<i>Co-investor resources</i>												
Syndication size							0.110 ***	0.045	0.065	0.191 ***	0.082	0.110 *
Experience spillovers supply							0.157 ***	0.066	0.091			
<i>Control variables</i>												
Experience spillovers demand										0.045	-0.017	0.062
Focal VC's experience	0.004 ***	-0.002 ***	0.006 ***	0.004 ***	-0.002 ***	0.006 ***	0.005 ***	-0.001 ***	0.006 ***	0.004 ***	-0.002 **	0.005 ***
# of VC investments (x10 ³)	0.009	0.019	-0.011	0.036	0.039	-0.003	0.030	0.041	-0.012	0.027	0.036	-0.009
PC industry (D)	Included	Included		Included	Included	Included	Included	Included	Included	Included	Included	Included
First investment year (D)	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
PC country (D)	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
<i>Constant</i>	-1.608 ***	0.700	-2.308 ***	-1.307 **	0.564	-1.871 **	-3.185 ***	-0.516	-2.669 ***	-1.927 ***	0.228	-2.155 ***
Observations	1,436	1,436	1,436	1,423	1,423	1,423	1,360	1,360	1,360	1,360	1,360	1,360
Log likelihood	-944.9	-944.9	-944.9	-897.4	-897.4	-897.4	-826.3	-826.3	-826.3	-845.0	-845.0	-845.0
Pseudo R-squared	0.13	0.13	0.13	0.17	0.17	0.17	0.21	0.21	0.21	0.20	0.20	0.20

(D) marks the dummy variables; *** p < .01, ** p < .05, * p < .10

Table 3.5.: Results of multinomial models predicting the average marginal effects on the probability of companies to match with respectively cross-border VC firms, branch VC firms and domestic VC firms

Average marginal effects (%)	Model 5			Model 6			Model 7			Model 8		
	Domestic VC	Cross-border VC	Branch VC	Domestic VC	Cross-border VC	Branch VC	Domestic VC	Cross-border VC	Branch VC	Domestic VC	Cross-border VC	Branch VC
<i>PC information asymmetry</i>												
Seed stage (D)				8.3 **	-7.0 **	-1.4	5.1	-3.9	-1.1	4.7	-3.8	-0.9
First investment round (D)				17.3 ***	-14.8 ***	-2.5	4.7	-3.3	1.4	9.9 ***	-7.8 ***	-2.1
Patents				-0.7	0.8 **	-0.1	0.1	0.2	-0.3	-0.3	0.5 **	-0.2
<i>Co-investor origin</i>												
Synd_Domestic (D)							-11.3 ***	10.5 ***	0.8			
Synd_Branch (D)							-7.5 **	7.9 **	-0.4			
Synd_Cross-Border_only (D)							-10.4	5.1	5.3	-1.4	-3.2	4.6
Synd_Domestic_only (D)										6.3 **	-5.0 *	-1.3
<i>Co-investor resources</i>												
Syndication size							-1.5 ***	1.3 ***	0.2	-2.7 ***	2.4 ***	0.3
Experience spillovers supply							-2.2 ***	1.9 ***	0.3			
<i>Control variables</i>												
Experience spillovers demand										-0.8	0.5	0.3
Focal VC's experience	-0.1 ***	0.1 ***	0.0 ***	-0.1 ***	0.1 ***	0.0 ***	-0.1 ***	0.1 ***	0.0 ***	-0.1 ***	0.0 ***	0.0 ***
# of VC investments (x10 ³)	-0.1	0.1	-0.1	-0.4	0.5	-0.1	-0.3	0.4	-0.1	-0.3	0.4	-0.1
PC industry (D)	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
First investment year (D)	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
PC country (D)	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Observations	1,436	1,436	1,436	1,423	1,423	1,423	1,360	1,360	1,360	1,360	1,360	1,360
Log likelihood	-944.9	-944.9	-944.9	-897.4	-897.4	-897.4	-826.3	-826.3	-826.3	-845.0	-845.0	-845.0
Pseudo R-squared	0.13	0.13	0.13	0.17	0.17	0.17	0.21	0.21	0.21	0.20	0.20	0.20

(D) marks the dummy variables; *** p < .01, ** p < .05, * p < .10

3.4.3.3. Post hoc analyses

In order to gain more fine-grained insights into the dynamics of the drivers of the mutual matching process, we reran models 3, 4, 7 and 8 on subsamples divided based upon the development stage of the companies in Tables 3.6. and 3.7.: seed stage versus other investment stages. As a result, Models 9 (13) and 10 (14) are identical to Model 3 (7) except that Models 9 and 13 use a subsample consisting only of seed stage companies while Models 10 and 14 a subsample of only non-seed stage companies. In the same vein, Models 11 (15) and 12 (16) are identical as Model 4 (8) except that Models 11 and 15 use a subsample consisting only of seed stage companies while Models 12 and 16 a subsample of only non-seed stage companies.

While the results of the non-seed stage company subsample models (Models 10 and 14) are almost identical to the full sample models from the investor's perspective (Model 3 and 7), the results of the seed company subsample models (Model 9 and 13) differ in several ways. In what follows, we will focus on these differences. First, the negative ($p < .10$) and positive ($p < .05$) coefficient on *patents* is significant in the models comparing respectively focal cross-border as opposed to focal branch VC firms and focal branch VC firms as opposed to focal domestic VC firms. Only the average marginal effect of focal branch VC firms on *patents* is, however significant (4.0%; $p < .05$). Model 9 further shows that while, compared to focal domestic VC firms, the relative probability that focal cross-border VC firms match with a seed stage company increases if at least one domestic VC ($p < .01$) or branch VC firm ($p < .01$) co-invests, it decreases for seed stage companies when only cross-border VC firms ($p < .01$) co-invest. Moreover, compared to focal branch VC firms, the relative probability that focal cross-border VC firms match with a seed stage company also decreases ($p < .01$) if only cross-border VC firms co-invest. The average marginal effects in Model 13 imply that a typical seed stage company has a 17.8% ($p < .05$) lower and a 15.9% ($p < .01$) higher probability to match with respectively a focal domestic and a focal cross-border VC firm if at least one domestic VC firm co-invests. Similarly, a typical seed stage company has a 22.5% ($p < .01$) lower and 18.1% ($p < .01$) higher probability to match with respectively a domestic and a cross-border VC firm when at least one branch VC firm co-invests. Finally, while seed stage companies have a 108.5% ($p < .01$) and 18.7% ($p < .05$) higher probability to match with respectively focal domestic and focal branch VC firms when only cross-border VC firms co-invest, they have a 127.2% ($p < .01$) lower probability to match with a cross-border VC firm. Compared to the full sample models, the *syndication size* is no longer significant in the seed stage Models 9 and 13. In contrast, the *experience spill over supply* variable stays positive and significant ($p < .05$) in the model comparing focal cross-border and focal domestic VC firms. The average marginal effect of *experience spill overs supply* in Model 13 is however no longer significant for focal domestic VC firms, but stays positive and significant (2.0%; $p < .05$) for focal cross-border VC firms. The models on the seed stage company sample provide evidence that the focal cross-border VC firms are more strict when evaluating seed stage companies compared to non-seed stage companies. More specifically, while the number of co-investors has no impact on their probability to invest, the characteristics (i.e. co-investor experience and origin) of the co-investors are more important when making the investment decision.

In the same way as from the investor's perspective, the results of the non-seed stage company subsample models (Models 12 and 16) from the company's perspective are almost identical to the full sample models (Model 4 and

8). The results of the seed company subsample models (Model 11 and 15) however, again differ in several ways. Consequently, we will focus mainly on the differences with the full sample models. First, the negative ($p < .10$) and positive ($p < .05$) coefficients on *patents* are significant in the models comparing respectively focal cross-border as opposed to focal branch VC firms and focal branch VC firms as opposed to focal domestic VC firms. Moreover, the coefficient on *patents* is no longer significant in the model comparing the relative probability to match of focal cross-border and focal domestic VC firms. Only the average marginal effect of focal branch VC firms on *patents* is significant (3.3%; $p < .01$). Model 11 further shows that while, compared to focal domestic VC firms, the relative probability that focal cross-border VC firms match with a seed stage company is no longer significantly impacted when only domestic VC firms co-invest, the relative probability that focal cross-border VC firms match with a seed stage company decreases when only cross-border VC firms ($p < .01$) co-invest. Moreover, compared to focal branch VC firms, the relative probability that focal cross-border VC firms match with a seed stage company also decreases ($p < .01$) if only cross-border VC firms co-invest. The average marginal effects in Model 15 imply that while a typical seed stage company has a 143.5% ($p < .01$) and 17.6% ($p < .01$) higher probability to match with respectively focal domestic and focal branch VC firms when only cross-border VC firms co-invest, they have a 161.0% ($p < .01$) lower probability to match with a focal cross-border VC firm. Compared to the full sample, the syndication size is no longer significant in the seed stage subsample model comparing the relative probability to match of focal branch VC firms as opposed to focal domestic VC firms. Consequently, the average marginal effect of syndication size is no longer significant for focal domestic VC firms in Model 15. Similarly to the investor's perspective, the results show that seed stage companies put more importance to which VC firms they target given their available resource base. More specifically, seed stage companies who only have cross-border VC firms as investors target focal local VC firms.

Table 3.6.: Post hoc analysis: multinomial models predicting the relative probability of companies to match with domestic VC firms, cross-border VC firms or branch VC firms on a sample split by seed versus non-seed stage companies

Focal VC Reference category	Model 9			Model 10			Model 11			Model 12		
	Cross-border VC	Cross-border VC	Branch VC	Cross-border VC	Cross-border VC	Branch VC	Cross-border VC	Cross-border VC	Branch VC	Cross-border VC	Cross-border VC	Branch VC
	Domestic VC	Branch VC	Domestic VC	Domestic VC	Branch VC	Domestic VC	Domestic VC	Branch VC	Domestic VC	Domestic VC	Branch VC	Domestic VC
	<i>Seed stage companies</i>			<i>Non-seed companies</i>			<i>Seed stage companies</i>			<i>Non-seed companies</i>		
<i>PC information asymmetry</i>												
First investment round (D)	-0.704	-1.153	0.449	-0.137	0.138	-0.276	-1.604 **	-1.601	-0.003	-0.453 **	0.019	-0.472
Patents	0.466	-0.715 *	1.181 **	0.012	0.107	-0.095	0.041	-0.864 *	0.906 **	0.033 *	0.115	-0.082
<i>Co-investor origin</i>												
Synd_Domestic (D)	2.215 ***	1.256	0.959	0.669 **	0.228	0.441						
Synd_Branch (D)	2.579 ***	0.867	1.713	0.526 **	0.585	-0.059						
Synd_Cross-Border_only (D)	-16.800 ***	-18.550 ***	1.748	0.595	-0.572	1.167	-18.850 ***	-19.780 ***	0.925	-0.029	-0.876	0.847
Synd_Domestic_only (D)							-0.347	0.364	-0.711	-0.413 *	-0.225	-0.188
<i>Co-investor resources</i>												
Syndication size	0.053	0.099	-0.046	0.128 ***	0.053	0.075	0.263 *	0.144	0.119	0.188 ***	0.074	0.115 *
Experience spillovers supply	0.271 **	0.300	-0.029	0.134 ***	0.034	0.100						
<i>Control variables</i>												
Experience spillovers demand							0.226 *	-0.233	0.459 *	0.004	0.007	-0.003
Focal VC's experience	0.007 ***	-0.001	0.008 **	0.005 ***	-0.002 ***	0.006 ***	0.003	-0.001	0.003	0.004 ***	-0.002 ***	0.006 ***
# of VC investments (x10 ³)	-0.069	-0.044	-0.024	0.032	0.047	-0.015	0.001	-0.042	0.043	0.031	0.042	-0.012
PC industry (D)	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
First investment year (D)	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
PC country (D)	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
<i>Constant</i>	-3.757 *	0.963	-4.720 *	-3.010 ***	-0.377	-2.633 ***	-2.145	3.567	-5.713 *	-1.841 ***	0.167	-2.008 ***
Observations	265	265	265	1,095	1,095	1,095	265	265	265	1,095	1,095	1,095
Log likelihood	-96.8	-96.8	-96.8	-697.7	-697.7	-697.7	-107.2	-107.2	-107.2	-708.6	-708.6	-708.6
Pseudo R-squared	0.40	0.40	0.40	0.21	0.21	0.21	0.33	0.33	0.33	0.20	0.20	0.20

(D) marks the dummy variables; *** p < .01, ** p < .05, * p < .10

Table 3.7.: Post hoc analysis: multinomial models predicting the average marginal effects on the probability of companies to match with respectively cross-border VC firms, branch VC firms and domestic VC firms on a sample split by seed versus non-seed stage companies

Average marginal effects (%)	Model 13			Model 14			Model 15			Model 16		
	Domestic VC	Cross-border VC	Branch VC	Domestic VC	Cross-border VC	Branch VC	Domestic VC	Cross-border VC	Branch VC	Domestic VC	Cross-border VC	Branch VC
	<i>Seed stage companies</i>			<i>Non-seed companies</i>			<i>Seed stage companies</i>			<i>Non-seed companies</i>		
<i>PC information asymmetry</i>												
First investment round (D)	3.4	-5.6	2.2	2.9	-1.3	-1.6	12.5 *	-13.6 **	1.2	7.7 **	-5.4 *	-2.2
Patents	-6.7	2.6	4.0 **	0.3	0.4	-0.7	-3.0	-0.3	3.3 ***	0.0	0.6 ***	-0.6
<i>Co-investor origin</i>												
Synd_Domestic (D)	-17.8 **	15.9 ***	1.9	-10.0 **	8.4 **	1.6						
Synd_Branch (D)	-22.5 ***	18.1 ***	4.5	-6.0	7.4 **	-1.5						
Synd_Cross-Border_only (D)	108.5 ***	-127.2 ***	18.7 **	-12.5	5.9	6.6	143.5 ***	-161.0 ***	17.6 ***	-3.6	-2.1	5.7
Synd_Domestic_only (D)							4.8	-2.4	-2.4	5.9	-5.4 *	-0.4
<i>Co-investor resources</i>												
Syndication size	-0.2	0.4	-0.2	-1.9 ***	1.6 ***	0.2	-2.4	2.1 *	0.2	-2.8 ***	2.4 ***	0.4
Experience spillovers supply	-1.7	2.0 **	-0.3	-2.1 ***	1.7 **	0.4						
<i>Control variables</i>												
Experience spillovers demand							-3.1 **	1.6	1.5 *	0.0	0.1	0.0
Focal VC's experience	-0.1 ***	0.0 ***	0.0 **	-0.1 ***	0.1 ***	0.0 ***	0.0	0.0	0.0	-0.1 ***	0.0 ***	0.0 ***
# of VC investments (x10 ³)	0.5	-0.5	0.0	-0.3	0.5	-0.2	-0.1	0.0	0.2	-0.3	0.5	-0.1
PC industry (D)	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
First investment year (D)	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
PC country (D)	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Observations	265	265	265	1,095	1,095	1,095	265	265	265	1,095	1,095	1,095
Log likelihood	-96.8	-96.8	-96.8	-697.7	-697.7	-697.7	-107.2	-107.2	-107.2	-708.6	-708.6	-708.6
Pseudo R-squared	0.40	0.40	0.40	0.21	0.21	0.21	0.33	0.33	0.33	0.20	0.20	0.20

(D) marks the dummy variables; *** p < .01, ** p < .05, * p < .10

3.4.3.4. Robustness analyses

Additional models of Model 3 and 7 were fitted to test for the robustness of our findings and assess the strength of alternative explanations. Alternative co-investor spill over variables are incorporated, that could not be included in the main models due to high correlations with the *experience spill overs supply* variable. First, co-investors' general *experience spill overs supply* variable is substituted with respectively their country specific experience, stage specific experience and IPO experience spill overs from the supply perspective, together with the focal VC firm's respective control variable *focal VC's country specific experience*, *focal VC's stage specific experience* and *focal VC's IPO experience* instead of its *focal VC's (general) experience*. Next, the total *number of VC investments* worldwide is replaced by the *total amount of VC money* raised worldwide in all models. All main results remained unchanged.

3.5. Discussion and conclusion

While VC firms increasingly invest across borders (Cumming and Dai, 2010), this geographic expansion impacts the mutual sorting process between VC firms (i.e. the supply side) and companies (i.e. the demand side). From a supply perspective, international expansion confronts VC investors with LOF (Wright et al., 2005). From a demand perspective, it provides companies access to international VC firms' specific resources. The goal of this paper is to study the differences in the drivers of the mutual matching process between companies - with specific characteristics - and respectively domestic, cross-border and branch VC firms. On the one hand, we argue that international VC firms use different investment strategies to mitigate LOF. They may focus on specific characteristics of the investment targets, leverage syndicate partners or use structural strategies such as investing from a local branch office. On the other hand, entrepreneurs adopt a life cycle approach to identify their company's resource needs - given its development stage - and target specific VC firms who can provide access to the identified resource gaps.

We show that, in the European VC market, cross-border VC firms have a lower probability of matching with informationally opaque firms, consistent with VC firms' behaviour in emerging economies (Dai et al., 2012). This finding is non-trivial as, compared to emerging markets, LOF are expected to be much lower in developed markets such as Europe. Interestingly, including co-investor variables from the investor's perspective shows that having local syndicate partners, more syndicate partners or more experienced co-investors allows cross-border VC firms to broaden their investment strategy and to invest in more informationally opaque firms. The probability of cross-border VC firm investment increases when local VC firms, larger investment syndicates and more experienced VC firms co-invest. In addition, no significant economic effects were found for branch VC firms. Including co-investor variables from the company's perspective instead of from the investor's perspective shows that less developed companies - holding fewer patents and being in their first investment round - have a higher likelihood to match with domestic VC firms as opposed to cross-border VC firms. This finding supports the resource-based view on the matching viewed from the entrepreneur's side. Moreover, contradicting our hypothesis, companies in which only domestic VC firms co-invest have a higher probability to attract additional domestic VC firms as opposed to cross-border VC firms. We also found no significant impact of having only

cross-border VC co-investors on the probability to match with local VC firms. Both unexpected results however disappear when splitting the sample in seed and non-seed stage, thereby further underlining that entrepreneurs follow a life cycle approach when evaluating which VC to attract. Entrepreneurs assess their companies' resource gaps at each stage of the companies' life cycle and consequently target VC investors with specific geographic origins based upon the required resources. In the same way as the supply perspective, no significant average marginal effects were found for branch VC firms.

Post hoc analyses on subsamples separating seed from non-seed companies further underline the life cycle nature of the matching process. First, syndication size is not a significant determinant in the matching of seed companies with VC firms of different origins. Second, a seed stage company in which only cross-border VC firms co-invest has a lower probability to match with other cross-border VC firms and a higher probability to match with a domestic or a branch VC firm. Having only cross-border co-investors does not impact the probability of matching with a specific type of VC investor in other companies, however. These results are in line with our hypothesis: given its early development stage, a seed stage company needs tighter monitoring and closer interaction with its investors to shape its opportunity and to develop early organizational resources and routines. Local investors, including both domestic and branch VC investors, perform better in this phase as their geographic, legal and cultural distance with their PC is smaller and their local institutional knowledge is higher. In contrast to later stage companies, seed stage companies put more importance to which VC firms they target given their available resource base. These findings strongly support life cycle approach we take on the resource-based view.

We extend previous literature by showing that local branches of VC firms are less prone to LOF and hence present an interesting strategy for international VC firms to overcome LOF. First, branch VC firms invest in the same type of companies as domestic VC firms, irrespective of potential syndicate partners, but they preferably target companies with more patents when investing in seed stage companies. Second, cross-border VC firms consider branch VC firms as equally appealing to overcome LOF, as the effects of syndicating with at least one domestic VC firm or branch VC firm are the equally positive. Having a local presence is hence an effective way to overcome LOF. Moreover, we further contribute to extant literature by displaying that the local knowledge and value adding capabilities of branch VC firms are acknowledged by PCs. More specifically, our results indicate that seed stage companies who have only cross-border VC firms have a higher probability to attract a branch VC firms or a domestic VC firm.

As such, this study provides more fine grained insights in what the different drivers of the matching process between companies and respectively domestic, cross-border and branch VC firms are. From a supply perspective, cross-border VC firms mitigate their LOF and expand their investment options through syndicate partners. From a demand perspective, entrepreneurs aim to tailor their companies' resource base given the resources at hand and the ones needed to facilitate future company development. Finally, we show how setting up a local branch allows to act as a domestic VC firm both from a supply as from a demand perspective.

As with all research, this study has limitations. First, although we estimate separate models for the supply and the demand perspective, the realization of a match is always the result of both the investor's and the entrepreneur's preferences. We are hence unable to fully disentangle both perspectives. In the same vein, we are unable to determine the relative importance of the agency theory and resource-based view as drivers of the results. Second, although we investigate the different strategies behind the matching process, we do not investigate the impact of these strategies on the investment outcome. We hence are unable to acknowledge whether these strategies are beneficial. Third, our sample is limited to the European VC market. This may limit the generalizability of our results as for instance LOF faced by cross-border VC firms may differ between developed and emerging VC markets (Chemmanur et al., 2012). Moreover, companies established in countries with large internal markets such as the U.S. may not need to internationalize and as a result foreign VC firms' resources. Nevertheless, given that large-scale studies on the investment behaviour of international VC firms are limited to emerging markets (Chemmanur et al., 2012; Dai et al., 2012) and that the demand perspective has not yet been thoroughly investigated, our study provides an interesting contribution to extant literature. We show that from the investor's perspective, PC information opacity is a lower concern in our setting compared to the emerging markets setting, but highlight that syndicate partners also play an important role in alleviating LOF. It would be interesting to understand whether being locally present through a branch VC firm in emerging markets allows to alleviate LOF to the same extent as in our more developed VC setting. Fourth, our large scale study prevents to provide a more fine grained insight in the matching processes used by VC firms to mitigate LOF or by entrepreneurs to obtain the required resources. For example, understanding how the PCs' board activities are impacted when a cross-border VC firm enters – with or without local syndicate partner – or understanding the interaction between cross-border VC firms and their co-investors provide interesting avenues for future research. Fifth, extremely industry specialized VC investors could be especially interesting for entrepreneurial companies as they could have lower LOF. Unfortunately we do not have the data to control for the industry experience of the VC investors. Finally, a representative sample containing companies that have tried but failed to raise domestic, cross-border and branch VC, together with information on domestic, cross-border and branch VC firms that were interested in a company but failed to invest, would help to analyse more accurately the matching process.

Despite these limitations, the present study provides valuable insights to VC investors and high-tech entrepreneurs. Our research contributes to the VC practitioners as it shows that different geographical focuses may have a significant impact on their investment strategy. Moreover, we provide further evidence that entrepreneurs in their search for finance should carefully evaluate the potential investors and target investors that match their own and the investors' needs. Finally, entrepreneurs should realize that their company's resource need evolves with the development stage of the company. Entrepreneurs should hence continuously reassess their company's resource base and the resource need, and target specific VC investors if the current investors lack the required resources.

3.6. References

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Chapter 4

The role of domestic & cross-border VC investors in the growth of portfolio companies

David Devigne^a, Tom Vanacker^b, Sophie Manigart^{a, b}, Ine Paeleman^b

^a *Competence Centre Accounting & Finance, Vlerick Business School, Belgium*

^b *Department Accountancy & Corporate Finance, Ghent University, Belgium*

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Abstract

This paper studies how the presence of cross-border as opposed to domestic venture capital (VC) investors is associated with the growth of portfolio companies (PCs). For this purpose, we use a longitudinal research design and track sales, total assets and payroll expenses in 761 European technology companies from the year of initial VC investment up to seven years thereafter. Findings demonstrate how companies initially backed by domestic VC investors exhibit higher growth in the short term compared to companies backed by cross-border investors. In the medium term, companies initially backed by cross-border VC investors exhibit higher growth compared to companies backed by domestic investors. Finally, companies that are initially funded by a syndicate comprising both domestic and cross-border VC investors exhibit the highest growth. Overall, this study provides a more fine-grained understanding of the role that domestic and cross-border VC investors can play as their PCs grow and thereby require different resources or capabilities over time.

4.1. Introduction

The venture capital (VC) industry has long been a local industry (Cumming and Dai, 2010), with geographic proximity to investment targets deemed necessary to locate and evaluate them (Sorenson and Stuart, 2001) and to efficiently provide post-investment monitoring and value adding services (Sapienza et al., 1996; Mäkelä and Maula, 2006). Nevertheless, the last decade has witnessed a strong growth in the international flows of VC worldwide (Alhorr et al., 2008; Meuleman and Wright, 2011). Driven by increased competition in a maturing industry, VC investors have more intensively searched for investment opportunities outside their home regions. Moreover, broad-scale economic integration policies in the European Union have further contributed to increasing the speed of internationalization of the European VC industry (Alhorr et al., 2008).

So far, scholars have primarily focused on the drivers of the VC internationalization process at the macro or industry level (e.g., Mäkelä and Maula, 2005; Alhorr et al., 2008; Madhavan and Iriyama, 2009; Guler and Guillén, 2010a) and the strategies deployed by VC investors to overcome liabilities of distance and liabilities of foreignness (e.g., Cumming and Macintosh, 2001; Wright et al., 2002; Pruthi et al., 2003; Bruton et al., 2005; Fritsch and Schilder, 2008; Pruthi et al., 2009; Guler and Guillén, 2010b; Lu and Hwang, 2010; Meuleman and Wright, 2011). Despite increasing interest in the VC internationalization process, research on the impact of cross-border VC investors on the growth of PCs is scarce. Cross-border VC investors are defined as investors that manage the investment from another country than the one in which the PC started its operations (Mäkelä and Maula, 2005). The research question we address in this paper is: How does the presence of cross-border, as opposed to domestic VC investors, relate to the growth of PCs?

This question is non-trivial as, compared to domestic VC investors, cross-border VC investors might spur as well as constrain the growth of their PCs. Cross-border investors may contribute to the internationalization and hence to a stronger growth of their PCs by sharing their knowledge pertaining to internationalization and international markets (Fernhaber et al., 2009; Lutz and George, 2012) and by legitimizing the unknown company in their home market (Mäkelä and Maula, 2005; Hursti and Maula, 2007). Nevertheless, cross-border

VC investors may also constrain company growth. First, they may drive internationalization efforts of the company towards the investor's home market, which is not always the company's target market (Mäkelä and Maula, 2005). Second, they stop active contribution to their PCs much earlier than domestic VC investors when the prospects of companies have fallen (Mäkelä and Maula, 2006). Prior studies show that while the probability of a successful exit is lower when VC investors invest across borders, it increases when distant VC investors syndicate with domestic VC investors (Chemmanur et al., 2012; Cumming and Dai, 2010; Moser, 2010). These studies, however, provide few insights into how different investors influence the growth of their PCs between investment and exit. Moreover, a successful exit from the perspective of VC investors is not necessarily successful from the perspective of entrepreneurs or their PCs (Gompers, 1996).

This paper aims to compare the growth of young technology-based companies based on the location of their shareholders. Specifically, we distinguish between companies backed by domestic VC investors, by cross-border VC investors, and by a syndicate comprising both domestic and cross-border VC investors. We draw upon the resource-based view of the firm theory to build a life cycle model on the association between the geographic origin of VC investors and PC growth. We hereby address the call by Zahra and colleagues (2007) to develop a more complete understanding of the role played by different VC investors as their PCs develop.

Given the liabilities of newness and the lack of resources that young technology companies face (Vohora et al., 2004), a young company in the early phases of its technical and organizational development is more likely to require a higher level of involvement by a VC investor than a company at a later stage (Gupta and Sapienza, 1992). We hence hypothesize that companies backed by domestic VC investors will initially exhibit higher growth compared to companies exclusively backed by cross-border VC investors, as value added from domestic investors will benefit them most in this early stage (Lockett et al., 2008). As companies age, the international knowledge, networks and reputation of cross-border VC investors will assist their internationalization, enabling a higher later stage growth. We further expect that companies raising VC from both domestic and cross-border VC investors will exhibit the highest growth rates, as they combine the complementary benefits of "localness" and of "foreignness".

We use a sample of 761 technology-based companies from seven European countries that received initial VC between 1994 and 2004, and track sales, total assets and payroll expenses in these companies from the year of initial VC investment up to seven years after the investment. Random coefficient modelling is used as an appropriate longitudinal technique to model the dynamic nature of growth over time (Bliese and Ployhart, 2002; Holcomb et al., 2010). We find broad support for our hypotheses.

Our research contributes to the VC and entrepreneurship literature. We argue that the resource needs of companies change over time, and show that different types of VC investors may address different resource needs. Domestic VC investors are better at supporting a company in its early growth, while the resources of a cross-border VC investor are especially valuable in a later phase when international expansion becomes more important. Hence, we provide a life cycle perspective on the resources VC investors may provide to their PCs.

We furthermore show that bundling the diverse resources from different types of VC investors allows overcoming the shortcomings of one particular type of investor.

The rest of the paper is organized as follows. Section 2 provides the theoretical background and develops hypotheses on the role of domestic and cross-border VC investors in PC growth. Section 3 describes the research method. Section 4 presents the main research findings. Finally, section 5 concludes by discussing the results from both a theoretical and a practical perspective.

4.2. Theory and Hypotheses

The resource-based view of the firm (RBV) defines a company as a collection of resources and states that the characteristics of the available resources affect the competitive advantage and thereby the growth of a company (Penrose, 1958; Wernerfelt, 1984; Barney, 1986; Barney, 1991). Companies that possess more valuable, scarce, unique and imperfectly mobile resources are expected to outperform their resource-constrained peers and exhibit higher growth over time (Barney, 1991; Chandler and Hanks, 1994; Cooper et al., 1994). While high-tech companies are often based upon proprietary technological know-how, essential resources such as physical capital, human capital, financial capital or organizational resources may be lacking (Heirman and Clarysse, 2004; Clarysse et al., 2007; Lockett et al., 2008). A major challenge of a company is hence to identify and acquire a relevant initial resource base (Penrose, 1958). While early resource-based scholars deemed it important to acquire or develop essential resources within the boundaries of an organization, later researchers have shown that companies may strongly benefit from the resource base of partner organizations (Lee et al., 2001; De Clercq and Dimov, 2008; Lockett et al., 2008; Bruneel et al., 2010).

VC investors are important by providing not only well-needed financial resources, but also intangible resources such as knowledge, access to networks and legitimacy (Sapienza, 1992; Sapienza, et al. 1996; Fernhaber, et al. 2009). Through monitoring and governance activities, they actively foster the growth of their PCs (Carpenter et al., 2003; Vanaelst et al., 2006). Companies can hence spur their growth through access to valuable intangible resources and capabilities provided by VC investors. Not all VC investors provide comparable resources, however. Compared to domestic VC investors, cross-border VC investors provide their PCs with more specific resources to grow internationally (Mäkelä and Maula, 2005, 2006). Hence, getting VC from cross-border investors may impact PCs differently compared to getting VC from domestic investors only.

In what follows we elaborate on the processes that explain why different configurations of initial VC investors will relate differently to company growth over time. We hereby take a life cycle point of view, acknowledging that the needs of high-tech companies may change as they develop (Vohora et al., 2004; Zahra et al., 2006; Lockett et al., 2008). We argue that PCs first have to refine their opportunities based on market feedback and put essential initial resources into place before they can enter a next phase in which they strive to achieve sustainable returns through market development. There are at least two reasons why we focus on the role of *initial* providers of VC in the subsequent growth of their PCs. First, it is difficult to separate the influence of later-round investors from first-round investors (Sorensen, 2007). For example, although later-round cross-

border VC investors may influence subsequent PC growth, the ability of the PC to attract later-round cross-border VC investors may also reflect the value adding of the initial domestic VC investor. Second, by focusing on the initial providers of VC we minimise selection issues. Indeed, Bertoni et al. (2011) show that value adding effects have a large economic impact immediately after the initial investment, while the economic impact of selection is more modest.

4.2.1. The role of domestic VC investors in a company's early growth phase

Young high-tech companies face liabilities of newness and smallness (Stinchcombe, 1965; Baum and Silverman, 2004) driven by an incomplete resource base, including a lack of organizational routines, networks, legitimacy in the marketplace and managerial expertise (Stuart et al., 1999; Vohora et al., 2004). Identifying and shaping new opportunities and subsequently investing in the resource base needed to pursue these opportunities are considered to be the “hallmark of entrepreneurial capabilities” (Arthurs and Busenitz, 2006: 199). Given their experience and involvement in multiple companies, VC investors are instrumental in advancing their PCs by assisting in shaping the opportunity, acquiring essential resources and developing organizational capabilities (Arthurs and Busenitz, 2006). We argue that domestic VC investors will be more valuable in the initial growth phase than cross-border VC investors and hence that PCs backed by domestic VC investors will initially exhibit superior growth compared to companies backed by cross-border VC investors.

The challenges of early stage high-tech companies are compounded by the fact that they often operate in complex and highly volatile environments (Stuart et al., 1999). This makes that the opportunities, initially identified in the prestart-up phase, have to be tested in the market and redefined depending on feedback received from different parties including potential customers (Vohora et al., 2004; Arthurs and Busenitz, 2006). Based on newly acquired knowledge, early stage high-tech companies thus have to continuously re-assess their key strategies (Vohora et al., 2004; Arthurs and Busenitz, 2006). For example, early market feedback enables entrepreneurs to evaluate and reassess initial ideas, hereby addressing weaknesses and deficiencies in the initial offering of services and/or products to the market (Vohora et al., 2004). Consequently, the early growth phase is one of continuous experimentation with the opportunity including product specification, market framing and defining marketing strategies. This entails a continuous search for feedback, followed by a repackaging of opportunities, before attaining a sustainable return phase (Vohora et al., 2004).

Next to clearly defining the opportunity and value creation model, the initial resource base has to be developed and organizational knowledge, capabilities and routines have to be shaped (Gupta and Sapienza, 1992; Arthurs and Busenitz, 2006; Zahra et al., 2006). Critical early resource acquisition activities include purchasing materials, buying or renting facilities and equipment and hiring employees (Newbert, 2005). These are necessary to pursue the opportunity and implement a value-creating strategy (Arthurs and Busenitz, 2006). Since the resources of young high-tech companies are limited at start-up, they continuously need to identify, acquire and integrate resources in their organization and subsequently re-configure those resources during the early start-up and initial growth phase (Vohora et al., 2004; Arthurs and Busenitz, 2006).

VC investors influence the opportunity shaping and resource acquisition processes by providing contacts to relevant external parties for soliciting feedback and by critically reassessing initial ideas based on this feedback (Gupta and Sapienza, 1992). We expect that domestic VC investors are better positioned to assist their PCs in developing these early strategic processes than cross-border VC investors. Geographical distance and investing across boundaries creates an information disadvantage and makes it more difficult to monitor companies closely (Dai et al., 2012). Telecommunication technology does not substitute yet for local presence and face-to-face contacts (Frisch and Schilder, 2008). Moreover, cross-border VC investors have been found to devote less time to their PCs due to higher transaction costs (Frisch and Schilder, 2008). In addition they stop investing more promptly if their PCs fail to meet expectations (Mäkelä and Maula, 2006). Distance hence makes that cross-border VC investors are less closely involved with their PCs. This is especially detrimental in the early development stage where VC input is likely to be especially beneficial to shape the opportunity, acquire early resources and develop organizational routines. Worst case, cross-border VC investors stop the financial support prematurely, which impacts technology-based companies' growth significantly as they typically require high upfront investments to develop their technology and products prior to sales generation.

Furthermore, in contrast to domestic investors, who initially direct the PCs to domestic and nearby markets which may be easier and faster to conquer, cross-border VC investors may push PCs to pursue foreign markets which may be more difficult and slower to conquer (Mäkelä and Maula, 2005).

Finally, domestic VC investors have a more fine-grained understanding of the legal and institutional environment in which the PC initially operates. As the interaction of new companies with the local environment is especially important to secure vital early resources, domestic VC investors are expected to be able to provide more valuable and relevant advice to their PCs in the early development phase. Altogether, young early stage high-tech companies will initially benefit more from domestic VC investors compared to cross-border VC investors, leading to the first hypothesis:

Hypothesis 1: PCs that raise initial finance from domestic VC investors initially exhibit higher growth compared to companies that raise initial finance exclusively from cross-border VC investors.

4.2.2. The role of cross-border VC investors in a company's later growth phase

Once an entrepreneurial opportunity has been refined and initial resources have been put in place, high-tech companies enter a new phase in which they strive to attain sustainable returns through market development (Vohora et al., 2004). High-tech companies often have a narrow product scope based on a technology that may quickly become obsolete and for which the domestic market size is limited (Litvak, 1990; McDougall et al., 1994; Coviello and Munro, 1995; Knight and Cavusgil, 2004; Sapienza et al., 2006; Lutz and George, 2012). This forces high-tech companies to internationalize, especially in the European context where domestic markets are typically too small to reach a minimum efficient scale (Litvak, 1990; McDougall et al., 1994; Coviello and Munro, 1995; Knight and Cavusgil, 2004; Bruneel et al., 2010). The use of resources and the sale of outputs in multiple countries is hence critical for their further growth (Oviatt and McDougall, 1994).

Compared to operating in domestic markets, expanding internationally entails costs that result from unfamiliarity with the foreign markets and from political, cultural and economic differences between foreign markets and the home market, causing liabilities of foreignness (Zaheer, 1995; Dai et al., 2012). These liabilities of foreignness are especially difficult to overcome for young technology-based companies, as they often miss the resources and capabilities to deal with international expansion (Clarysse et al., 2007; Zahra et al., 2007). Both internal employees and external board members with varied skills and experiences in international markets may provide useful connections to existing institutions, companies and networks in target foreign markets (Fernhaber et al., 2009).

Cross-border VC investors may facilitate the growth of their PCs (Dai et al., 2012; Lutz and George, 2012) by limiting their liabilities of foreignness. First, cross-border VC investors may provide access to complementary knowledge-based resources in their country of origin; these would typically be unavailable to companies that raise finance exclusively from domestic VC investors. For instance, cross-border VC investors may be particularly able to provide their PCs with knowledge and information about foreign legal and business issues (Mäkelä and Maula, 2005).

Second, cross-border VC investors may provide access to their international network, allowing companies to make contact with relevant foreign suppliers, customers, financiers, key executives and other potential stakeholders (Sapienza et al., 1996; Mäkelä and Maula, 2005). These relationships are likely to foster the growth of PCs (Yli-Renko et al., 2002). Networks in foreign markets may also increase the ability of PCs to identify new opportunities, which is expected to further enhance company growth (McDougall et al., 1994; Mäkelä and Maula, 2005).

Finally, the mere fact of having a cross-border VC investor may provide endorsement benefits (Stuart et al., 1999; Mäkelä and Maula, 2005). More specifically, cross-border VC investors are likely to legitimate their PCs in foreign markets, which is expected to benefit them when they need to mobilize resources from these markets (Hursti and Maula, 2007). The arguments above lead to the second hypothesis:

Hypothesis 2: PCs that raise initial finance from at least one cross-border VC investor exhibit higher growth in a later stage compared to companies that raise initial finance exclusively from domestic VC investors.

4.2.3. Combining domestic and cross-border VC investors

We further claim that combining domestic with cross-border VC investors will be most beneficial for PC growth. We expect that PCs financed through a syndicate comprising both domestic and cross-border VC investors will exhibit higher growth rates than PCs that are financed only by cross-border or by domestic VC investors.

Partnerships between cross-border and domestic VC investors provide PCs access to a broader and complementary knowledge and resource base (Brander et al., 2002; Fritsch and Schilder, 2008; Dai et al., 2012). Domestic VC investors may have a better knowledge of local market conditions and provide better access to

local resources. As they are confronted with lower transaction costs, they may allocate more time to monitoring their local PCs (Fritsch and Schilder, 2008). Conversely, cross-border VC investors provide knowledge, networks and legitimacy that are particularly relevant in foreign markets. They may provide knowledge about foreign and legal issues (Dai et al., 2012), help in opening doors to foreign customers, suppliers, business partners and financiers (Mäkelä and Maula, 2005; Lutz and George, 2012), endorse the PC in an international context (Stuart et al., 1999; Mäkelä and Maula, 2005) and hence help to reduce the liabilities of foreignness (Mäkelä and Maula, 2005). Cross-border and domestic VC investors thus offer complementary resources, increasing the resources, skills and information available for the monitoring and decision making of the PCs (Jääskeläinen, 2012).

We therefore expect that PCs in which cross-border and domestic VC investors form a syndicate will outperform those in which only domestic or only cross-border VC investors invest. This leads to the final hypothesis:

Hypothesis 3: PCs initially backed by a syndicate of domestic and cross-border VC investors exhibit higher growth rates than PCs backed exclusively by either domestic or cross-border VC investors.

4.3. Method

4.3.1. Sample and Data

Data were collected through the VICO project¹⁴ (See chapter 2 for the description of the VICO sample), which is a multi-country project on the financing of entrepreneurial companies in Europe. Table 4.1. (Panel A) provides an overview of the 761 VC-backed companies in the sample by company founding period, first investment year, country and industry. The most important industry is the software industry (34%), followed by the biotech (18%) and the ICT industry (17%). Over 23% of the sample companies come from the U.K., 18% from Germany, 15% from France and 13% from Italy. Belgian companies represent 12% of the sample and Spanish and Finnish companies approximately 10%.

¹⁴ The initial database VICO 1.0 including 761 VC-backed companies was used in this study.

Table 4.1.: Description of the sample

	Panel A				Panel B					
	Total sample		Domestic standalone		Domestic syndicate		Cross-border		Mixed syndicate	
	Number	%	Number	%	Number	%	Number	%	Number	%
<i>Foundation period</i>										
1984-1989	22	2.9	20	4.2	1	0.6	0	0.0	1	1.3
1990-1994	95	12.5	68	14.2	16	9.4	4	11.4	7	9.1
1995-1999	340	44.7	210	43.9	79	46.2	15	42.9	36	46.8
2000-2004	304	39.9	180	37.7	75	43.9	16	45.7	33	42.9
<i>Year first investment</i>										
1994	11	1.4	10	2.1	0	0.0	1	2.9	0	0.0
1995	17	2.2	16	3.3	1	0.6	0	0.0	0	0.0
1996	31	4.1	24	5.0	2	1.2	2	5.7	3	3.9
1997	51	6.7	44	9.2	4	2.3	3	8.6	0	0.0
1998	52	6.8	36	7.5	10	5.8	2	5.7	4	5.2
1999	79	10.4	46	9.6	24	14.0	3	8.6	6	7.8
2000	184	24.2	105	22.0	42	24.6	9	25.7	28	36.4
2001	127	16.7	74	15.5	28	16.4	9	25.7	16	20.8
2002	75	9.9	45	9.4	19	11.1	4	11.4	7	9.1
2003	66	8.7	42	8.8	19	11.1	0	0.0	5	6.5
2004	68	8.9	36	7.5	22	12.9	2	5.7	8	10.4
<i>Country</i>										
Finland	69	9.1	60	12.6	4	2.3	0	0.0	5	6.5
Spain	82	10.8	72	15.1	9	5.3	0	0.0	1	1.3
Belgium	90	11.8	55	11.5	24	14.0	1	2.9	10	13.0
Italy	98	12.9	72	15.1	10	5.8	11	31.4	5	6.5
France	112	14.7	40	8.4	63	36.8	0	0.0	9	11.7
Germany	134	17.6	81	16.9	18	10.5	14	40.0	21	27.3
U.K.	176	23.1	98	20.5	43	25.1	9	25.7	26	33.8
<i>Industry</i>										
Energy	3	0.4	1	0.2	2	1.2	0	0.0	0	0.0
Robotics	16	2.1	14	2.9	2	1.2	0	0.0	0	0.0
Other R&D	23	3.0	18	3.8	4	2.3	0	0.0	1	1.3
Pharmaceutical	26	3.4	17	3.6	6	3.5	1	2.9	2	2.6
Web publishing	36	4.7	25	5.2	6	3.5	0	0.0	5	6.5
TLC	44	5.8	24	5.0	12	7.0	4	11.4	4	5.2
Internet	98	12.9	63	13.2	12	7.0	10	28.6	13	16.9
ICT manufacturing	126	16.6	77	16.1	35	20.5	3	8.6	11	14.3
Biotech	133	17.5	80	16.7	31	18.1	5	14.3	17	22.1
Software	256	33.6	159	33.3	61	35.7	12	34.3	24	31.2
Total	761	100	478	100	171	100	35	100	77	100

4.3.2. Variable definitions

4.3.2.1. Dependent variables

Prior growth studies are often criticized because they do not take into account the multidimensional nature of growth (Weinzimmer et al., 1998; Delmar et al., 2003). The classification of a company as a growing company largely depends on the growth concept used (Delmar et al., 2003). This study takes into account the multidimensional nature of growth by using multiple growth concepts. We track changes in *sales*, *total assets* and *payroll expenses* (all measured in thousands of Euros) from the year of initial VC investment up to seven years after the investment (whenever data is available).¹⁵ We refrain from using accounting-based indicators of profitability, which are inappropriate for young technology-based companies since most of these companies do not generate any profit during their first years of operations (Shane and Stuart, 2002).

Sales, total assets and payroll expenses are the dependent variables as they are most commonly used growth concepts in empirical growth research (Delmar et al., 2003). Sales is often viewed as the most appropriate measure of company growth, since it applies to most companies and it is rather insensitive to capital intensity (Delmar et al., 2003). Sales is, however, not always a perfect indicator of growth. Especially in high-tech start-ups, the accumulation of assets and employment rather than sales, lead the growth process (Delmar et al., 2003). We use payroll expenses instead of the number of employees as the former measure is highly correlated with the number of employees and has less missing data.

4.3.2.2. Independent variables

Independent variables capture the origin of the VC investors in the initial VC financing round. Companies backed by a single domestic investor serve as the base category against which all other companies are compared. In order to test hypotheses 1 and 2, a dummy variable *CBVC* is constructed which takes the value of 1 if a company raised VC from at least one cross-border VC investor. In order to test hypothesis 3, a second dummy variable, *MIXED*, takes the value of 1 if a syndicate of domestic and cross-border VC investors invested. If the results would indicate a stronger growth of companies backed by a mixed syndicate, however, this might either be explained by the difference in origin of the syndicate partners (as hypothesized) or merely by the broader resource base available through the VC syndicate (Manigart et al., 2006; Jääskeläinen, 2012). Therefore, a third dummy variable is added in order to disentangle the effects of the origin of VC investors from the effects of syndication. The dummy variable *SYND* takes the value of 1 if a company is backed by a syndicate comprising at least one domestic VC investor. Including this dummy allows comparing the growth of companies starting with a syndicate comprised exclusively of domestic investors with that of companies starting with a mixed syndicate.¹⁶

¹⁵ The timeframe of our study (seven years) covers the typical lifespan of VC investments which is between three and seven years.

¹⁶ We also developed count variables measuring the number of VC investors, rather than dummy variables. Results remained robust. As the use of dummy variables fits better with the theoretical arguments, we focus on the analyses with

4.3.2.3. Control variables

We control for VC investor characteristics, industry effects, year effects, country effects and PC characteristics. For VC investor characteristics, we include *VC investor age*, measured as the difference between the investment year and founding year of the lead VC investor providing initial financing. This measure partially controls for the fact that older VC investors may have more experience and may have established a broader network in the VC community (Sorenson and Stuart, 2001). We further control for the type of VC investor. VC investors are often affiliated with other organizations. These affiliations shape their strategies and objectives, which may influence the growth of their PCs. For instance, bank-related VC investors may invest in companies, for which they can then provide further financial services, including debt finance (Hellmann et al., 2008). We include four non-mutually exclusive dummy variables, which are equal to one when at least one VC investor that provides initial financing is respectively a *bank-related investor*, *corporate investor*, *university-related investor*, *government-related investor*, and zero otherwise. *Independent* VC investors serve as the reference category.

The industries in which companies operate may significantly influence their growth patterns. We therefore include *industry dummies* in our models to control for potential industry effects. Industry classifications are based on 4 digit NACE codes retrieved from the Amadeus database. We also include *year dummies* for the wide variety of investment periods included in our sample. Such controls are important since companies may exhibit different growth patterns depending upon the investment period when they received their initial VC investment. We further include *country dummies* to control for potential country effects.

For PC characteristics, we include *PC age*, measured as the difference between the year of the initial VC investment and company founding year, since it is well-established in the growth literature that age effects cause differences in growth patterns. We also control for the *initial amount of finance* raised by the PCs. This is important since companies that raise more finance are able to mobilize more strategic resources early-on, and as such these companies are likely to develop a competitive advantage over their resource-constrained peers (Lee et al., 2001). In order to control for the number of subsequent investments in the PC, we included a dynamic variable that captures the *number of rounds* the company has received. To control for possible differences in growth potential between companies, we include the *intangible assets ratio*, measured as the ratio of intangible assets to tangible assets. Prior research demonstrates that the ratio of intangible assets to tangible assets, as opposed to the absolute level of intangible assets, is a better predictor of growth potential (Villalonga, 2004). As an additional control for possible differences in growth potential between the PCs we included the *number of patents* applied for prior the initial investment and which were eventually granted. Companies use patents to signal their value and commercial potential to outside stakeholders, including VC investors (Hsu and Ziedonis, 2008). Hence, the patent stock is likely to represent one important factor on which VC investors select. The patent stock at the year of first investment is computed with a 15% yearly decay rate for each company.

the dummy variables in the remainder of the paper. For instance, it may be sufficient to have one domestic VC investor investing together with one cross-border VC investor to diminish the information asymmetries experienced by the latter.

There is obviously natural heterogeneity among companies in many extraneous variables besides our controls. Although these extraneous variables are not of any substantive interest, they might have an impact on the growth curve of companies. The strength of the longitudinal research design adopted in this paper is that any extraneous factors (regardless of whether they have been measured or not) that influence the growth of companies but whose influence is constant over time, are eliminated or blocked out as the size of companies is compared at several occasions (Fitzmaurice et al., 2004).

4.3.3. *Econometric approach*

Random Coefficient Modelling (RCM), also referred to as mixed modelling or growth modelling, is used as an appropriate longitudinal technique to study changes in sales, total assets and payroll expenses over time. Many of the standard statistical techniques, including Ordinary Least Squares (OLS) regressions, are not appropriate when data consist of repeated measures that are correlated within companies as it invalidates the basic assumption of independence (Fitzmaurice et al., 2004). In order to deal with longitudinal data, scholars have often used general multivariate regression models that require longitudinal data where all companies have the same number of repeated measures, taken at time points, which are also the same for all companies (Fitzmaurice et al., 2004). These strict assumptions are rarely fulfilled in longitudinal studies and are not required when using a RCM framework (Fitzmaurice et al., 2004). Recent applications of the RCM framework in the management and entrepreneurship literature are available (e.g., Bliese and Ployhart, 2002; Holcomb et al., 2010).

It is conceptually convenient to depict RCM as multilevel models (Fitzmaurice et al., 2004). The multilevel perspective is most useful if one assumes that companies randomly vary in terms of their initial size and growth trajectory. We discuss two levels of equations.

The first level in the hierarchy is the individual-level model, which specifies the nature of change for each individual company. The simplest model of individual company change is the straight-line (linear) growth model:

$$DV_{ij} = \beta_{1i} + \beta_{2i} t_{ij} + e_{ij} \quad (1)$$

where DV_{ij} is the i th company's sales, total assets or payroll expenses, at the j th time point. t_{ij} is a simple count measure representing the successive years after the initial VC investment (0, 1, 2, ..., 7) which is used to fit a linear trend to the i th company's data across time. β_{1i} and β_{2i} are the company specific intercept and linear coefficient respectively. The values of the β s can vary among companies. The e_{ij} are the residuals. Equation (1) illustrates the flexibility of the RCM framework. Each company can have a different number of time points, data of each company may be measured at different times and each company can have a different growth trajectory (Fitzmaurice et al., 2004). RCM can also accommodate non-linear change. The simplest non-linear model is a quadratic model, which is specified by adding $\beta_{3i} t_{ij}^2$ to equation (1):

$$DV_{ij} = \beta_{1i} + \beta_{2i} t_{ij} + \beta_{3i} t_{ij}^2 + e_{ij} \quad (2)$$

Group-level models constitute the second level in the hierarchy. Though the above individual regression equations are informative, researchers are usually interested in group effects. Conceptually, the random change parameters from the individual-level model (e.g., β_{1i} , β_{2i} and β_{3i} or company specific intercept, linear coefficient and quadratic coefficient respectively) are treated as response variables in a second set of models. Considering the quadratic individual change model (equation (2)), the group level equations are:

$$\beta_{1i} = \beta_1 + b_{1i} \quad (3)$$

$$\beta_{2i} = \beta_2 + b_{2i} \quad (4)$$

$$\beta_{3i} = \beta_3 + b_{3i} \quad (5)$$

where β_1 , β_2 and β_3 are the fixed intercepts in the level 2 equations and thus the averages of the individual-level parameters. β_1 , β_2 and β_3 indicate the nature of change for the group as a whole, where β_1 is the group mean intercept or mean initial sales, total assets or payroll expenses; β_2 is the group mean linear change and β_3 is the group mean quadratic change or curvature. The β 's are fixed effects, because they do not vary among companies. b_{1i} , b_{2i} and b_{3i} are the level 2 residual terms reflecting individual company differences from the fixed effects.

The unconditional RCM discussed above can be extended by incorporating predictors of change. The key predictors of change in this paper are the cross-border VC variable, the mixed syndication variable and the domestic syndication variable. These variables are all measured at the time of the initial investment. We examine whether the individual change parameters (β_{1i} , β_{2i} and β_{3i}) vary as a function of cross-border VC involvement, mixed or domestic syndication. These predictors of change are static covariates which are incorporated in the group-level equations. Considering the individual-level quadratic change model (2) above, the group level equations studying change conditional on cross-border VC involvement and mixed or domestic syndication then become:

$$\beta_{1i} = \beta_1 + \beta_4 \text{CBVC}_i + \beta_5 \text{MIXED}_i + \beta_6 \text{SYND}_i + b_{1i} \quad (6)$$

$$\beta_{2i} = \beta_2 + \beta_7 \text{CBVC}_i + \beta_8 \text{MIXED}_i + \beta_9 \text{SYND}_i + b_{2i} \quad (7)$$

$$\beta_{3i} = \beta_3 + \beta_{10} \text{CBVC}_i + \beta_{11} \text{MIXED}_i + \beta_{12} \text{SYND}_i + b_{3i} \quad (8)$$

where CBVC_i indicates whether cross-border VC was raised, MIXED_i if the first investment was syndicated with at least one cross-border and one domestic investor, and SYND_i indicates whether the first investment was syndicated with at least one domestic investor measured at the time of the initial VC investment for the i -th company. β_4 represents the cross-border VC by intercept interaction and shows how the mean initial sales, total assets or payroll expenses of companies is dependent upon having cross-border VC. β_7 is the cross-border VC by linear trend interaction and indicates how the mean linear trend in sales, total assets or payroll expenses is dependent upon the receipt of cross-border VC. β_{10} is the cross-border VC by quadratic trend interaction and indicates how curvature in sales, total assets or payroll expenses is dependent upon the receipt of cross-border

VC. Similar interpretations hold for coefficients relating to the mixed syndication dummy and the domestic syndication dummy.

4.4. Results

4.4.1. Descriptive Statistics

Table 4.1. (Panel B) provides an overview of our sample, distinguishing between companies that raise financing from a standalone domestic investor, a cross-border investor (or multiple cross-border investors), a syndicate of domestic investors and a syndicate with at least one cross-border and one domestic investor. Two particular observations are worth noting. First, cross-border VC investors have been active over the entire timeframe of our study, although most cross-border investments are concentrated during the dot-com bubble and subsequent years. Second, while previous studies have stressed the importance of domestic investors in order for PCs to raise cross-border VC (Mäkelä and Maula, 2008), 5% of the PCs in our sample receive first round VC from cross-border investors only.

Table 4.2. gives an overview of the mean values of the control variables. The lead VC investor is on average (median) 13.9 years (5.0 years) old when investing in a PC. PCs are on average 2.2 years (1.0 year) old, obtain €3,150,000 (€860,000) of initial VC finance, have 24% (8%) of intangible assets to total assets and hold 0.28 (0.00) patents when receiving the first VC investment. In 62.9% of PCs at least one of the VC investors providing initial finance is an independent investor. In contrast, only 24.4% of PCs received initial finance from government-related investors, 17.2% from bank-related investors, 14.1% from corporate investor and 6.7% from university-related investors.

Table 4.2.: Descriptive statistics of control variables

	Mean	Median	SD
VC investor age (years)	13.86	5.00	47.87
PC age (years)	2.24	1.00	2.66
Initial amount of finance (x €1.000)	3150.09	860.00	8415.53
Intangible asset ratio (%)	23.66	8.30	132.83
Number of patents	0.28	0.00	1.51

Table 4.3. shows the origin of the cross-border investors in our sample. Most cross-border investors (43%) come from a Continental European country and a similar percentage come from the U.K. and Ireland (25%) and the U.S. (28%). Very few cross-border investors originate from other countries. U.K. and Irish cross-border VC investors invest relatively more frequently without local investors compared to U.S. and Continental European cross-border VC investors.

Table 4.3.: Origin of cross-border VC (CBVC) investors

	Total sample		Cross-border		Mixed syndicate	
	Number	%	Number	%	Number	%
CBVC from other countries	5	3.85	2	5.26	3	3.26
CBVC from U.K. and Ireland	33	25.38	13	34.21	20	21.74
CBVC from North America	36	27.69	8	21.05	28	30.43
CBVC from Continental E.U.	56	43.08	15	39.47	41	44.57
Total	130	100	38	100	92	100

Table 4.4. reports descriptive statistics on sales, total assets and payroll expenses from the year of investment up to seven years after the initial VC investment. It confirms that the average VC backed company in our sample demonstrates significant growth over time. The large difference between mean and median indicates the distribution of sales, total assets and payroll expenses is skewed towards the higher values. We use the natural logarithm of sales, total assets and payroll expenses in all subsequent analyses, which has the advantage that it functions as a normalizing transformation and decreases the probability that extreme observations will drive our findings (Hand, 2005).

Table 4.4. further indicates the varying sample size for the dependent variables at various points in time. Sample size changes as companies may fail or cease to operate over the timeframe of the study. We did not completely eliminate these companies from the sample, as this would introduce survivorship bias (Cassar, 2004). Rather, we used as much of the data that is available on the failed companies and hence include observations for the years these companies operated. A second source of missing data is due to the recent time when companies received initial VC. For instance, when a company received initial VC in 2004, data are simply unavailable for seven years after the initial investment. Our econometric technique takes this into account as we control for the investment year.¹⁷

Table 4.4.: Descriptive statistics for dependent variables (in 000 EUR)^a

A. Sales								
Time	0	1	2	3	4	5	6	7
Mean	2161.15	2685.91	3314.47	4680.29	5695.20	7440.91	9629.89	11746.97
Median	421.00	699.49	875.50	1123.63	1597.50	1853.16	2297.50	2513.00
Std. Deviation	8094.23	7457.81	8248.71	12628.74	14282.56	18719.66	30794.00	42455.75
N	429	505	524	482	448	365	312	226

¹⁷ Traditional longitudinal techniques require either complete data or assume data are missing completely at random (MCAR), implying that an unconditional random process is responsible for the missing data. A major advantage of the RCM framework is that, missing data can be accommodated under the assumption of missing at random (MAR) (Long et al. 2009). MAR is less strict than MCAR and implies that a conditional random process was responsible for the missing data. The conditioning is assumed to be on another variable. In this study, the bulk of missing sales data at the end of the timeframe are due to the recent time when companies received initial VC. For instance, when a company received initial VC in 2004, data is simply unavailable for seven years after the initial investment. MAR still yields unbiased estimates when using the RCM framework as long as the proper conditioning variables are included in the analysis, which is the case in our study as we control for the investment year.

B. Total assets								
Time	0	1	2	3	4	5	6	7
Mean	3841.74	4546.80	5236.35	10291.33	11586.54	12788.96	15574.59	18923.61
Median	1024.00	1164.00	1465.00	1579.34	1737.36	1829.00	2079.90	2295.00
Std. Deviation	11554.63	12210.30	14943.00	106998.94	110608.27	121286.61	127689.63	123888.73
N	459	557	565	532	476	409	346	261

C. Payroll expenses								
Time	0	1	2	3	4	5	6	7
Mean	863.98	1312.38	1595.97	1659.62	2013.30	2227.11	2571.62	2963.22
Median	256.97	430.50	626.00	667.00	841.50	928.00	1092.98	1117.00
Std. Deviation	2262.30	2697.08	2870.92	2652.05	3311.03	3363.71	3976.40	5148.30
N	393	470	475	449	406	337	285	215

^aTime is a simple count measure representing successive years where zero equals the year of the initial VC investment.

4.4.2. Model Development

Any longitudinal study should start with fitting unconditional models, which do not incorporate predictors of change (Singer and Willet, 2003). These models provide insights into the pattern of change in the entire sample of VC backed companies, which is critical in order to be able to answer questions about the effects of particular covariates on this growth pattern. The results of the unconditional analyses for sales, total assets and payroll expenses are shown in Table 4.5. Model 1 reports the means model or no change model, which will serve as the baseline model in order to determine whether more complex growth models are needed. Model 2 reports the linear growth model, in which a linear time predictor is introduced to the means model. Model 3 reports the quadratic growth model, in which the quadratic time predictor is added to the linear model.

Successively more complex growth models were evaluated for improvement in model fit over the baseline model by using the -2 log-likelihood (-2LL) statistic (Bliese and Ployhart, 2002). The difference in -2LL is tested for statistical significance using a chi-square test. When comparing more complex models with more parsimonious models, the quadratic growth models for sales, total asset and payroll expenses (Model 3) have a significantly better fit than their respective linear growth models (Model 2) and the no growth models (Model 1). We discuss the quadratic growth model in more detail below. We focus on the sales models, but modelling total assets or payroll expenses yields similar results.

The quadratic growth model specifies a curvilinear change in sales, estimating initial sales, instantaneous rate of change in sales and curvature (which is a parameter that describes a changing growth rate of sales over time). Model 3 indicates that the average PC has positive non-zero sales (5.537; $p < .001$) in the year of the initial VC investment. Because the instantaneous rate of change is positive, sales grow by .591 ($p < .001$) in the first year after VC investment. But the negative curvature (-.053; $p < .001$) indicates that this growth does not persist: with each passing year, the magnitude of the growth in sales diminishes. In the next section further complexity to the unconditional quadratic growth models is introduced by including the controlled effect of the presence of at least one cross-border investor, syndication with both domestic and cross-border investors and syndication

with domestic investors on sales, total assets and payroll expenses growth in VC-backed companies. This allows testing the hypotheses.

Table 4.5.: Unconditional RCM

	Model 1		Model 2		Model 3	
<u>A. Sales</u>						
Initial Size	6.607	***	5.857	***	5.537	***
Instantaneous growth rate			0.265	***	0.591	***
Curvature					-0.053	***
-2LL	12348		11230		11065	
Number of observations	3291		3291		3291	
<u>B. Total assets</u>						
Initial Size	6.137	***	5.650	***	5.308	***
Instantaneous growth rate			0.176	***	0.527	***
Curvature					-0.058	***
-2LL	10682		9501		9213	
Number of observations	3030		3030		3030	
<u>C. Payroll expenses</u>						
Initial Size	7.242	***	6.941	***	6.786	***
Instantaneous growth rate			0.104	***	0.261	***
Curvature					-0.025	***
-2LL	11223		10136		10054	
Number of observations	3605		3605		3605	

† p < .10, * p < .05, ** p < .01 and *** p < .001 (Conservative two-tailed tests).

4.4.3. Hypotheses Tests

Table 4.6. models the controlled effect of receiving first round VC financing from domestic VC investors, cross-border VC investors or syndicates with a mix of domestic and cross-border investors on the growth of VC-backed companies. We control for the age of the lead VC investor at the time of investment, VC investor types involved in the initial investment, PC age, country effects, year effects, industry effects, the number of investment rounds in the company, the pre-investment number of patents, the first round investment amount and the relative amount of intangible assets at time of the first investment.

The growth pattern of the dependent variable is summarized in three parameters: the initial size, instantaneous rate of change (linear growth) and curvature (quadratic growth). We fail to find an effect of cross-border VC, either exclusively or in combination with domestic VC, on the initial level of sales, assets or payroll expenses. This suggests that the initial size of the PC is not related to the probability of being funded by either cross-border or domestic investors (or a combination of both).

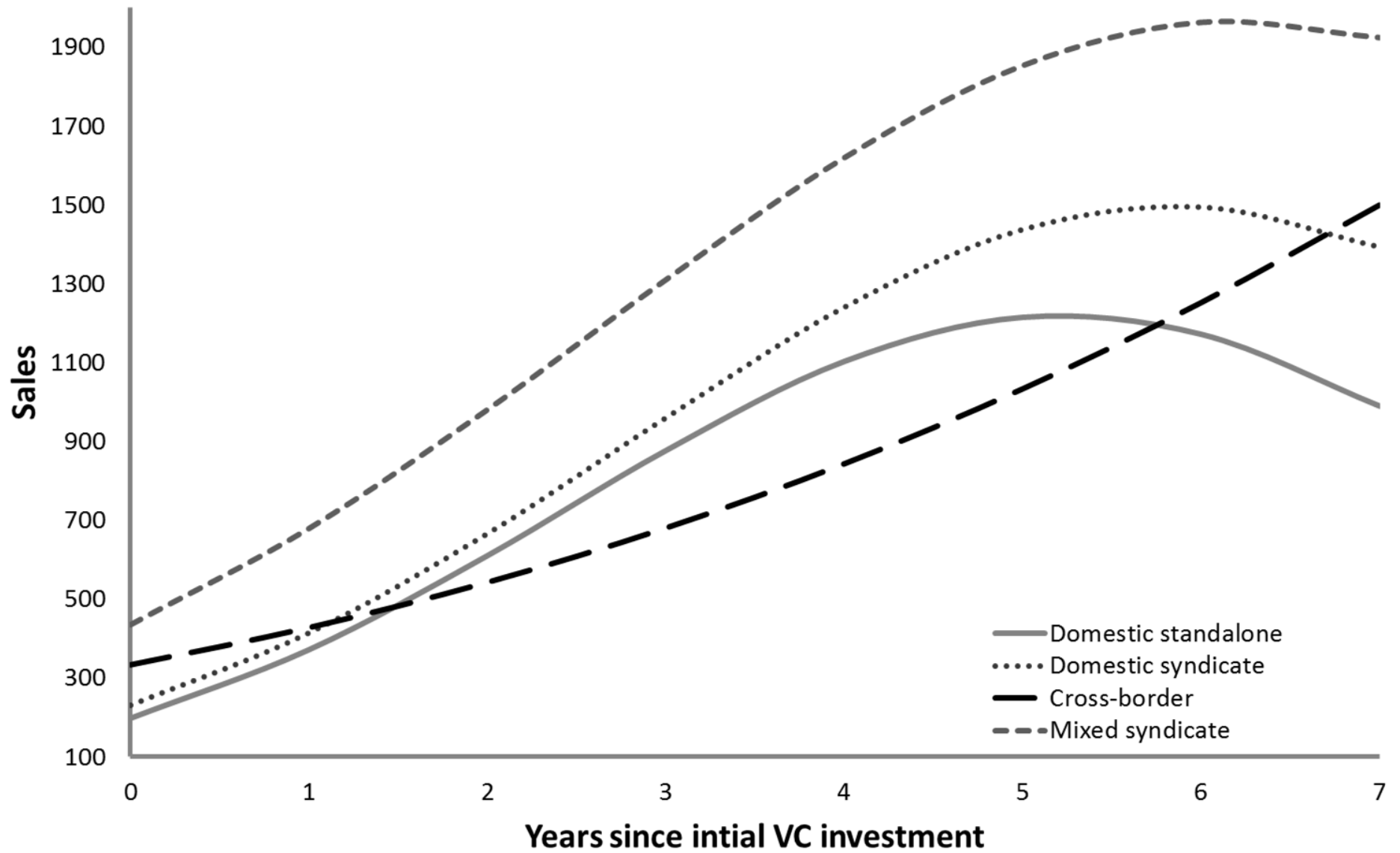
However, receiving initial finance from at least one cross-border VC investor significantly affects the growth of sales, assets and payroll expenses. Specifically, companies backed exclusively by cross-border VC investors exhibit a significantly lower instantaneous growth rate in sales (-.496; p < .01), in total assets (-.297; p < .05) and in payroll expenses (-.321; p < .05) compared to PCs backed by domestic VC investors. This provides

support for our first hypothesis: companies backed by domestic VC investors initially exhibit higher growth compared to companies that raise initial finance exclusively from cross-border VC investors.

Companies backed exclusively by cross-border VC investors have a lower instantaneous growth rate, but curvature is significantly higher and positive for sales (.076; $p < .01$) and assets (.032; $p < .05$). Although the coefficient of payroll expenses curvature has the expected sign, it is not significant. This indicates that although sales and total assets initially increase at a higher rate in companies backed by domestic investors, their sales and total assets growth level off more quickly over time compared to companies backed by cross-border investors. This implies that, as time proceeds, the growth rate of companies backed by cross-border investors will eventually exceed the growth rate of companies backed by domestic investors. This provides support for our second hypothesis: companies backed exclusively by cross-border VC investors exhibit higher growth in later stages compared to companies that raise initial finance exclusively from domestic VC investors. Figure 4.1. shows that sales of the mean company, backed exclusively by cross-border VC investors, initially grows more slowly after investment than the mean company, backed exclusively by domestic VC investors. After six years, sales of companies backed by cross-border VC investors fully catch up with those of companies backed by domestic VC investors and their growth rates are higher.¹⁸ This suggests that cross-border investors may be more beneficial in the long run compared to domestic investors, even if the initial growth of their PCs is slower in the early years after the investment.

¹⁸ The predicted growth curves for total assets and payroll expenses are not included due to space considerations, but are available from the authors upon simple request.

Figure 4.1.: Predicted growth curves for PC sales (in 000 EUR)



PCs initially backed by a mixed syndicate including both cross-border and domestic VC investors show a significantly higher instantaneous rate of change in sales (.505; $p < .05$), total assets (.329; $p < .05$) and payroll expenses (.325; $p < .10$) than companies backed exclusively by domestic VC companies. Heterogeneous syndicates hence benefit the growth of PCs. Nevertheless, in contrast to total assets and payroll expenses, the curvature for the change in sales of companies backed by mixed syndicates is negative and significant (-.069; $p < .05$), implying that their steep growth rates level off. Figure 4.1. shows that, although companies backed by a mixed syndicate have similar first year sales compared to other VC backed companies, they develop into the biggest sales generators after seven years. Our findings thus provide strong support for hypothesis 3: a syndicate comprising domestic and cross-border VC investors positively moderates the relationship between the presence of cross-border VC investors and sales, total assets and payroll expenses growth. Sales, total assets and payroll expenses of companies, backed by a mixed syndicate comprised of domestic and cross-border VC investors are higher than those of all other companies during the whole observation period.

Table 4.6.: Conditional RCM with the natural logarithm of sales, total assets and payroll expenses as dependent variables

		A. Sales	B. Total assets	C. Payroll expenses
Initial Size	Intercept	1.409 *	2.910 ***	2.215 ***
	Cross-Border	-0.312	-0.053	0.093
	Mixed syndicate	0.278	0.220	-0.085
	Syndication	-0.216	-0.017	0.134
Instantaneous growth rate	Intercept	1.107 ***	0.332 **	0.644 ***
	Cross-Border	-0.496 **	-0.297 *	-0.321 *
	Mixed syndicate	0.506 *	0.329 *	0.325 †
	Syndication	-0.089	0.054	0.021
Curvature	Intercept	-0.082 **	-0.016	-0.049 *
	Cross-Border	0.076 **	0.032 *	0.031
	Mixed syndicate	-0.069 *	-0.029	-0.023
	Syndication	0.025 †	-0.002	-0.003
Control variables ^a		Included	Included	Included
-2 LL		7658.3	6601.7	7346.6
Number of observations		2379	2960	2676

† $p < .10$, * $p < .05$, ** $p < .01$ and *** $p < .001$ (Conservative two-tailed tests)

^a Included control variables: Lead VC investor age, VC investor type dummies, PC age, country dummies, year dummies, industry dummies, number of investment rounds, number of patents, investment size and intangible assets ratio

4.4.4. Robustness Tests

We fitted several additional models to test for the robustness of our findings and assess the strength of alternative explanations. We focus on three potential concerns. First, as the results may be attributed to matching on the basis of unobservable characteristics, endogeneity is a concern (Shaver, 1998). More specifically, cross-border (domestic) VC investors may select companies with different growth potential, or alternatively companies with different growth potential may select cross-border (domestic) VC investors (Eckhardt et al., 2006). Therefore, we carefully assess this concern. Second, although we focus on the initial providers of VC financing, the timing of entry of the cross-border VC investor may impact the results. A further robustness check hence estimates the effect of the timing of investment of a cross-border VC investor on sales growth. Finally, the observed dynamics might be stronger for more distant cross-border VC investors, in line with our theory development. We thus additionally estimate the impact of distance between a cross-border investor and the PC.¹⁹

We performed two tests in an effort to assess potential endogeneity concerns empirically (besides controlling for a company's growth potential in our main analyses). First, we analysed a subsample of companies for which data were available from two to one year before the initial VC investment was made. Pre-investment growth rates do not differ between companies exclusively backed by domestic investors, by cross-border investors, or by a mix of cross-border and domestic investors. This implies that, compared to domestic VC investors, cross-border VC investors do not select companies with higher pre-investment growth rates.

Second, we analysed failures in greater detail. The proportion of failures in each group is relatively similar, with failure rates somewhat higher for companies backed exclusively by cross-border VC investors. This suggests that cross-border VC investors (whether they invest alone or in a syndicate with a domestic investor) do not necessarily have access to the highest or lowest quality companies. Additionally, we reran the RCM models, first including the failed companies with zero sales for each year in which they could have had sales if they had lived (following Eisenhardt and Schoonhoven 1990); thereafter we excluded the companies that eventually failed from the sample. The results remain robust in these modified samples.. The results remain robust in these modified samples. Overall, these additional tests indicate that it is unlikely that selection is entirely driving our results.

In order to assess the impact of the timing of entry of the cross-border VC investor on company growth we estimated three additional models. In a first model, we only considered companies that were exclusively backed by domestic VC investors in the first round. Within this subsample, the growth pattern of PCs with only domestic VC investors in later rounds are compared to companies that raise VC from cross-border investors in a later round. Unreported results indicate that attracting cross-border VC in a later round significantly increases company growth, consistent with our main analysis which showed that initial cross-border VC investors are associated with a positive effect on growth.

¹⁹ The additional models are not reported in detail due to space considerations, but they are available from the authors upon request.

In a second model, the growth of companies initially backed by a mixed syndicate is compared to the growth of companies initially backed by domestic investors that attract cross-border investors in a later round. There are no significant differences in the growth pattern between the two groups of companies. Hence, starting with a domestic VC investor and adding a cross-border VC investor in a later round leads to a comparable growth of the PC as starting with a mix of domestic and cross-border investors in the initial investment round.²⁰

Finally, a third model compares the growth of companies which are initially exclusively backed by cross-border VC investors to that of companies initially exclusively backed by domestic investors that attract cross-border investors in a later round. The latter exhibit a higher initial growth and show a lower curvature compared to the former, confirming that initial domestic VC investors are associated with a stronger initial growth of their PCs. In all, these additional analyses strongly suggest that, conditional on raising domestic VC in the first investment round, the growth of a PC is similar when a cross-border investor is added to the syndicate in the first or in a subsequent investment round.

As a final robustness check, the distance between the cross-border VC investor and its PC is analysed. We reran the RCM models substituting the cross-border VC dummy with a dummy that captures whether the cross-border investor originated from an Anglo-Saxon country. In order to fully observe the impact of the geographical, cultural and legal distance between investors and PCs, we excluded the U.K. PCs from this analysis.²¹ The results are broadly consistent with those of the main models and the dynamics are often even stronger. This is in line with our theory as we focus in this analysis on Continental European PCs and Anglo-Saxon investors, for whom the geographical, cultural and legal distance are higher than between PCs and investors operating in different countries within Continental Europe (Mäkelä and Maula, 2006).

4.5. Discussion and Conclusion

While it is widely acknowledged that VC investors have on average a positive contribution on the growth of their PCs (Puri and Zarutskie, 2011), evidence is increasing that not all VC is the same. In this paper we investigate how the presence of cross-border, as opposed to domestic VC investors, relate to the growth of PC. This research question is non-trivial as compared to domestic VC investors, cross-border VC investors might spur as well as constrain the growth of their PCs. This paper hence contributes to management literature by investigating the differential impact of domestic and cross-border VC investors on PC growth. While previous studies indicate that cross-border VC is an increasingly important phenomenon, especially for high-tech companies with high growth potential (Mäkelä and Maula, 2008), there is little evidence on the relationship between raising VC from cross-border investors and the growth of PCs. Based upon a sample of 761 young high-tech companies from seven European countries and using a longitudinal research strategy, we have shown that companies backed by domestic VC investors grow initially at a higher rate than companies backed by cross-border VC investors. In later years, however, companies backed by cross-border VC investors exhibit higher

²⁰ There is one exception: companies getting cross-border VC in a later round exhibit a subsequent larger increase in total assets. This is not surprising as this larger increase in total assets is likely to reflect the investment by the cross-border VC investor.

²¹ Inclusion of the U.K. portfolio companies rendered similar results.

growth rates. Companies backed by a mixed syndicate comprising both domestic and cross-border VC investors grow more strongly, both in the short and in the long run, than other VC backed companies. We further showed that it generally does not matter for PC growth when a cross-border VC investor invests, conditional on starting with a domestic VC investor.

Our findings suggest that proximity and knowledge of the local institutional and legal environment are important for VC investors investing in young companies. Domestic VC investors are better equipped than cross-border VC investors to overcome information asymmetries and to provide the resources relevant in the early growth phase. Refining the opportunity and building the early resource base is important in this phase, and domestic VC investors are better equipped to provide support in these matters. Cross-border VC investors, on the other hand, have a better knowledge of external markets and are able to provide legitimacy to PCs in their home markets. These resources are especially beneficial for more developed companies. Our findings hence provide further support for the view that external parties may provide important resources to support the growth of entrepreneurial companies, but not all parties provide the same resources. PCs exhibit the strongest growth when combining local knowledge and support provided by domestic investors with international knowledge and legitimization provided by cross-border investors. We hence provide further evidence of the complimentary valuable resources that investors may bring to a heterogeneous VC syndicate (Dai et al., 2012).

A life cycle model emerges from our results: a young PC benefits from tight monitoring and close interaction with its investors to shape its opportunity and to develop early organizational resources and routines. Domestic VC investors perform better in this phase as their geographic, legal and cultural distance with their PC is smaller and their local institutional knowledge is higher. Alternatively, young companies backed exclusively by cross-border investors might be pushed to internationalize too early, while their resources are not yet into place. PCs benefit from cross-border investors in a later phase (whether they invest in the first or a later investment round), by facilitating entry in international markets through their knowledge and legitimacy. Combining the complementary resources of domestic and cross-border investors is hence relevant for company growth.

These findings are important, as few studies have disentangled the effects of domestic and cross-border VC investors on the growth of their PCs. Most studies on the effects of VC have studied performance at the VC investor or fund level, focusing on PC exit and/or survival, or focusing on post-IPO performance (limiting these studies to the most successful PCs). This study, in contrast, is one of the first to focus on the growth of the PC from the initial VC investment throughout the typical lifespan of a VC investment. This is important for entrepreneurs, as the goals of investors and entrepreneurs are not always aligned. Understanding how PCs grow after having received VC, and how different types of investors contribute differently to company growth, is hence relevant.

In contrast to most studies on PC growth we use a longitudinal approach. Moreover the specific analysis in this study offers an important methodological contribution to growth research, which typically measures growth as the difference in size between two points in time, thereby ignoring growth in-between these two points (Weinzimmer et al., 1998; Delmar et al., 2003). Our study demonstrates how different conclusions may be

drawn when using different timeframes. For instance, if we would have focused on the short term, our analyses would have indicated that first round cross-border VC involvement is associated with lower growth as the instantaneous growth rate in sales is lower in companies backed exclusively by cross-border investors. Yet, if we would have focused on the long term, our analyses would have indicated that cross-border VC is associated with higher growth as the growth rates of companies backed by at least one cross-border investor increases more strongly over time. Our dynamic approach hence allowed a more fine-grained understanding of the relationship between different VC investors and the growth of their PCs. Taking advantage of recent developments in longitudinal data analysis to study the dynamic nature of growth over time is hence a fruitful avenue for future research. The results on the impact of the timing of entry of the cross-border VC investors suggest that there is no significant difference in growth between PCs that obtain cross-border VC in the first round (together with a domestic VC investors) or in a later round. This surprising finding calls for future research. As the timing of the entry of a cross-border VC investor does not seem to impact PC growth, an interesting avenue for future research could be to investigate why some cross-border VC investors invest from the first round when they could wait, thereby reducing uncertainty, and invest later-on? What are the benefits of investing in the first round? Further, why do some cross-border VC investors invest alone, without syndicating with a domestic VC investor in the first round, as this seems to be a suboptimal strategy? We leave these questions for future research.

Our study contributes to management literature by showing that PCs' resource need follow a life cycle model. While it is clear that young entrepreneurial companies need resources in order to grow, we show that the timing of these resources have a significant impact. High-tech early stage companies need local resources to set up the initial business, in a later stage however, these companies' growth benefits more from international resources. Entrepreneurs should hence continuously evaluate in which specific phase of the life cycle their company is, and accordingly target investors' resources which benefits the company most.

As with all research, this study also has some limitations. First, cross-border investors may differ from domestic investors in both their selection behaviour and their involvement in PCs after the investment. While we have provided descriptive evidence that neither cross-border nor domestic investors have a tendency to select companies that exhibit significant growth before the investment, different types of investors may still select PCs on the basis of unobservable characteristics (Dai et al., 2012). However, the main purpose of this study was to gain an insight into how the presence of a cross-border investor is associated with the growth of PCs. Whether these differences are due to selection or value adding is another question which warrants further study. Second, we acknowledge that understanding how cross-border investors influence internationalization of their PCs, for instance by analysing exports, would be interesting. Such data is however not available in the current database.

Despite its limitations, the study provides valuable insights to high-tech entrepreneurs. Given the difficulty to raise finance from outside investors, high-tech entrepreneurs are under pressure to accept finance when and where they can find it. Yet, as we have demonstrated, early finance decisions may have a long-lasting impact on subsequent company growth. While PCs of domestic investors are more likely to exhibit high growth early-on,

companies backed by cross-border VC investors have more sustainable growth rates in the long run. Especially when domestic VC investors co-invest with cross-border VC investors. Overall, our findings suggest that it might be worthwhile for entrepreneurs to extend their search for finance and target a broad and diverse investor base. Our study also has important implications for public policy makers. Public policy programs that aim to develop a strong local VC industry in order to foster the growth of local entrepreneurial companies should recognize that stimulating cross-border investments is beneficial. This not only increases the pool of financial capital available for entrepreneurial companies, but also provides them with complementary resources that help them to develop and grow more strongly.

4.6. References

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Chapter 5

Distressed portfolio company exit & cross-border VC investors

David Devigne^a, Sophie Manigart^{a, b}, Mike Wright^{b, c}

^a *Competence Centre Accounting & Finance, Vlerick Business School, Belgium*

^b *Department Accountancy & Corporate Finance, Ghent University, Belgium*

^c *Imperial College Business School, London, U.K.*

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Cross-Border Investments, Exit, Venture Capital, Escalating Commitment, Divestment

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Abstract

Drawing upon an escalation of commitment framework, this study investigates how differences between cross-border and domestic venture capital investors in access to information, social and structural factors affect their decision to terminate an unsuccessful investment. We track the exit outcome of 1060 venture capital investments in 684 European technology companies. Results show that domestic investors have a high tendency to escalate their commitment to a failing course of action. In contrast, cross-border investors terminate their investments efficiently, even when investing through a local branch. This is explained by cross-border investors having more limited access to soft information, a lower social involvement with the project and a lower embeddedness in the local economic and social environment, which are all factors that contribute to lower escalation of commitment. Local branches of cross-border investors are further shielded from escalation of commitment through structural safeguards. Domestic investors may hence benefit from mimicking the behaviour of cross-border investors.

5.1. Introduction

Terminating an investment project is one of the most difficult and painful decisions for organizations to make (Boddeyn, 1983). Such divestments are nevertheless a fundamental aspect of business and are the outcome of ever-changing processes that keep companies and whole economies rejuvenated (Benito, 2005). When investments fail to meet initial expectations, decision makers face a “liquidation dilemma”: they may favour to continue financing the project to retain the option of improvement or they may decide to terminate, which results in the crystallization of certain losses. Persisting to invest in a poorly performing project that eventually fails, however, not only wastes financial and temporal resources but alternative and more promising investment opportunities are foregone. Pursuing a project despite information suggesting that the marginal costs of continuing the project outweigh its marginal benefits is irrational behaviour labelled escalation of commitment.

Venture capital (VC) firms are professional investors who take equity stakes in young, growth-oriented companies. They are particularly prone to face “liquidation dilemmas” and thus at risk to escalate their commitment, as 32 percent of their investments eventually fail (Puri and Zarutski, 2012). They therefore put several mechanisms into place to prevent this irrational behaviour. Notwithstanding these mechanisms, VC firms are still prone to escalation of commitment (Birmingham et al., 2003; Guler, 2007). Not all VC firms are the same, however (Elango et al., 1995) and different types of VC firms may exhibit different probabilities to escalate commitment. One source of VC firm heterogeneity is its geographical origin, i.e. VC firms may invest domestically or across borders.

The VC industry has long been viewed as a purely domestic industry (Cumming and Dai, 2010), with geographic proximity to investment targets regarded as essential for efficient deal flow generation, post-investment monitoring and value adding services (Mäkelä and Maula, 2006). Driven by increased competition in their home countries, VC firms have nevertheless started searching more intensively for investment opportunities in foreign markets (Madhavan and Iriyama, 2009). This shift in geographical focus merits more research attention (Wright et al., 2005).

Our first goal is to investigate the propensity of cross-border VC firms as opposed to domestic VC firms to escalate commitment when PCs do not meet expectations. We argue that increased cultural and geographical distance and associated information issues faced by cross-border VC firms reduces decision biases. Moreover, establishment of a local branch office is a widely-used strategy to mitigate the frictions associated with geographic and cultural distance (Dai et al., 2012). A second goal of our research is to explore how the probability to escalate commitment to a failing course of action differs when investing from abroad or investing from a local branch.

To address our research questions, we use a unique hand collected sample of technology based companies from seven European countries that received initial VC between 1994 and 2004. The sample contains longitudinal data on 1618 unique rounds of VC investments by 1060 VC firms in 684 ventures. We model the effect of investor origin on the hazards of successful and unsuccessful exits in a competing risks model. We show that while domestic VC firms escalate their commitment towards a failing course of action, cross-border VC firms exit unsuccessful ventures in a rational way. Further, domestic VC firms have a significantly higher probability to escalate commitment compared to cross-border VC firms investing from a local branch (hereafter: branch VC firms). We fail to find differences in the probability to escalate commitment between cross-border VC firms investing from their headquarters or from a local branch, which suggests that the risk of escalation behaviour can be reduced through structural safeguards such as the use of a firm-level investment committee that includes distant members.

Our study makes specific and general contributions. Specifically, we first contribute to understanding behavioural differences between domestic and cross-border VC firms, as previous studies have mainly focused on either the rationale for international investments or on explaining successful investments (Mäkelä and Maula, 2006; Wright et al., 2005). We also add to the few studies that examine unsuccessful exits by VC firms (Cumming and Dai, 2010). More generally, we contribute to the international management literature by enhancing understanding of how international firms behave when cross-border activities fail to meet expectations (Benito, 2005). Finally, we contribute to the escalation of commitment literature by showing how structural safeguards may prevent escalation behaviour. This aspect has largely been neglected (Sleesman et al., 2012).

The rest of the paper is organized as follows. We first briefly describe the VC research setting. Thereafter, hypotheses are developed on the impact of VC firm origin and its investment structure on the probability to escalate commitment in unsuccessful investments. Next, we outline our research method, including the sample, the measurement of escalation of commitment, variables and method of analysis. This is followed by a presentation of the main findings, including robustness tests. Finally, a discussion of the results from both a theoretical and a practical perspective concludes this paper.

5.2. Research setting

The VC industry is an attractive setting to study decisions to exit from unsuccessful projects in an international setting for several reasons. First, VC firms are expert and experienced decision makers used to uncertainty as they typically invest in high-risk investments, such as nascent, high-technology companies with unproven products (Wright and Robbie, 1998). Second, VC investment managers are incentivized to make the best possible investment decisions, as the investment outcomes determine the VC firms' return and survival but also the reward of individual VC investment managers (Sahlman, 1990). Third, exiting is a fundamental part of business for VC firms as they are not interested in taking permanent equity positions in their PCs. VC investment managers are hence experienced in making exit decisions as they liquidate their investments after an investment holding period of typically five to seven years (Wright and Robbie, 1998). VC firms are frequently confronted with exit decisions of underperforming PCs, which should make them experts in dealing with these adverse situations (Sahlman, 1990). Finally, most VC firms are aware of the possibility of individual decision biases, such as escalation of commitment to a failing course of action, and have put several structural safeguards in place to protect against them such as investment staging, taking investment and exit decisions in committees and syndication with other VC firms (Guler, 2007). VC firms stage the infusion of capital which grants the opportunity to gather information and monitor the progress of their PCs, which provides the flexibility to discontinue funding projects of which the prospects have fallen (Gompers, 1995). Individual VC executive decision-making biases are minimized as investment decisions typically require recommendations to be approved by one or more investment committees (Wright and Robbie, 1998). Finally, VC firms frequently co-invest or syndicate investments with other VC firms which provides a "second opinion" from their peers.

Despite these organizational and structural safeguards, U.S. VC firms nevertheless escalate their commitment due to political and institutional influences (Guler, 2007). Investment norms of the VC industry may dissuade investment termination, and nonconformity to the commonly accepted norms may be punished by the syndication network. Our research advances this research stream by differentiating between cross-border and domestic VC firms.

Our hypotheses are tested on a sample of VC investments in PCs located in Europe. Europe offers an interesting environment for our research questions for two reasons. First, European VC investments have more international VC participation than U.S. VC investments (Schertler and Tykvová, 2011). Second, Europe is the second largest VC market in the world, after the U.S. (Schertler and Tykvová, 2011). The European VC industry therefore provides an attractive context in which to examine whether being a cross-border VC as opposed to a domestic VC investor impacts the probability of escalation of commitment.

5.3. Development of hypotheses

Prior research suggests that investors do not always behave rationally and tend to escalate commitment based upon their past actions, instead of terminating the investment when new information shows it does not meet expectations (Guler, 2007). An early stream of research focused on individuals as decision makers to explain

escalation of commitment (Staw, 1997). Yet, investment decisions are usually not made by individuals in isolation but are multi party events where choices are made in an organizational context and have to be answered to the firm's internal and external stakeholders. Therefore, escalation of commitment has been considered a multidetermined outcome, influenced by more than one level of analysis. Following Staw and Ross (1987) and Sleesman and colleagues (2012), information, social and structural antecedents of escalation of commitment in terminating investments are considered.

We first theorize on how differences between cross-border and domestic investors in access to information and in social determinants influence their tendency to escalate commitment to a failing course of action. Thereafter, we theorize on how investing from a local branch may affect escalation of commitment driven by structural determinants.

5.3.1. Domestic versus cross-border VC firms

Compared to domestic VC firms, cross-border VC firms face challenges of larger geographic distance but also of larger cultural and legal differences. These lead to differences in access to information and in social embeddedness, which is expected to impact escalation of commitment. We expand on both hereafter.

5.3.1.1. Access to information

Access to information is an important driver of escalation of commitment (Bragger et al., 1998). Information on PCs are not objective facts neutrally processed by decision makers (Staw, 1997). Instead, decision makers process information cognitively and affectively (Sleesman et al., 2012). One of the most pertinent individual biases to investment situations is overconfidence (Zacharakis and Shepherd, 2001). Overconfident decision makers discount negative information and believe they can overcome the negative aspects of a situation, thereby increasing decision persistence. We argue that compared to cross-border VC firms, domestic VC firms' access to more soft information may impact their probability to escalate commitment directly by increasing project equivocality and indirectly by enhancing their overconfidence. First, the importance of access to reliable information and of objective assessment of relative project performance in a decision context is explained. Next, we show how differences in access to information may lead to equivocality and increased overconfidence which increases a domestic VC firm's probability to escalate commitment.

As VC firms typically invest in young, high-tech entrepreneurial companies, assessment of future prospects is difficult. To evaluate PCs' future prospects and make rational investment decisions, VC investors need to identify relevant information and benchmark it objectively. Such information enables VC firms to evaluate PC progress, and provides flexibility to discontinue projects whose prospects have fallen (Gompers, 1995).

When VC investors have insufficient, unreliable information or are unable to identify the relevant information, they face equivocality which implies that both positive and negative conclusions on the company's performance can be drawn (Bragger et al., 1998). Under equivocality, termination decisions are delayed to offer VC investors the opportunity to collect more reliable information (Bragger et al., 1998). However, the world is clouded with

imperfect information confounding a decision maker's judgment and increasing equivocality. Moreover, decision makers' sense-making urge in equivocal situations may cause them to form predictions about PC prospects based upon causal information embedded in useless or random information, even though they may know that the information is non-credible and other more reliable (non-causal) information is available (Difonzo and Bordia, 1997). Thus investors' predictions and subsequent investment decisions may be less rational than if they have no information at all.

While cross-border VC firms have mainly access to hard information, domestic VC firms have additionally access to soft information. Soft information relates to qualitative private information and entrepreneurs' or decision makers' own assessments, which is not easily observed, verified or transmitted to others (Berger and Udell, 2002). In contrast, hard information refers to quantitative information such as that found in financial statements. While hard information has a meaning upon which everyone agrees, soft information - even when perfectly observed - is subjective in nature as it may have different meanings for different people (Berger and Udell, 2002).

Domestic VC firms are geographically closer to their PCs than cross-border VC firms which impacts the amount, the type and the ease in accessing information on PCs. Moreover, proximity enables high frequency social interaction between VC firms and the entrepreneur and exposes the VC firm to a broad and deep set of soft information not otherwise readily available (De Clercq and Sapienza, 2006). More distant cross-border VC firms rely more on hard information which is largely numerical, making it easier to collect, store and transmit (Stein, 2002).

Decision makers typically put more effort into soft information acquisition when hard information shows PCs are not meeting expectations (Campbell and Loumioti, 2012). VC firms turn to entrepreneurs for more informed explanations about the technological or economic underperformance. But the context specificity and non-numerical nature makes interpretation of this soft information difficult to verify. As a result, equivocality of the decision is increased which may result in undesired continuation of the investment. Cross-border VC firms, in contrast, mainly have access to hard information and are hence not confounded by soft information. This will make it easier to terminate underperforming companies.

Once reliable information is obtained, VC investors need to objectively benchmark PC performance. Decision makers may however, be subjective in benchmarking due to overconfidence, that is their subjective confidence in judgments is greater than their objective accuracy. Overconfidence may increase decision stubbornness, as overconfident decision makers disregard negative feedback and strongly believe they can overcome the negative aspects of a situation (Zacharakis and Shepherd, 2001). Greater amounts of information draw the VC firm's attention to the more striking information at cost of other factors that are more pertinent to the decision. As a result, more information does not yield improved decision accuracy, but increases VC firm's confidence (Zacharakis and Meyer, 2000). When information is structured in a case specific way decision makers need to decipher what each piece of information means and how it impacts their decision accuracy. This makes the VC firms deviate from their intuitive style and forces them out of their comfort zone which increases

overconfidence as it has a greater negative impact on their decision accuracy than on their confidence (Zacharakis and Shepherd, 2001).

Cross-border VC firms, in contrast to domestic VC firms, mainly have access to hard information which is standardized and can be processed automatically, which will make them less overconfident. This, in turn, is expected to result in a less biased view on PC performance. Cross-border VC firms are thus expected to be less prone to view their actions as successful, and will therefore focus more on avoiding failure (Zhang and Baumeister, 2006). We therefore expect domestic VC firms to have a higher probability to escalate commitment to a failing course of action compared to cross-border VC firms.

5.3.1.2. Social determinants

Another category of drivers of escalation behaviour are social determinants. Stakeholders of decision makers can give rise to escalation of commitment as they may get emotionally involved with the stakeholders or may want to strategically manage the impressions others have of them (Sleesman et al., 2012). The level of escalation of commitment that decision makers face may thus be contingent upon the extent that doing so will portray them in a more favourable light towards external stakeholders. Escalation of commitment is therefore more likely to occur when signals indicate that continuing is more socially appropriate than quitting.

A first direct key stakeholder for VC firms is the entrepreneur in whom they invest. Domestic VC firms have more frequent social interaction with entrepreneurs, creating positive feelings (De Clercq and Sapienza, 2006) and emotional attachment, increasing the pressure to safeguard the PC and in the end leading to a higher probability to escalate commitment (Wong et al., 2006). The greater geographical and social distance cross-border VC firms face will make it more difficult for them to have frequent informal contacts and thus to build and maintain high quality social and emotional relationships. Moreover, cross-border VC firms generally face a greater cultural distance to the entrepreneur compared to domestic VC firms. This may cause difficulties in effective communication and lead to lower mutual levels of trust and emotional attachment (Guiso et al., 2008). This leads cross-border VC firms to adopt a more transactional approach, as evidenced by the use of high-powered contracts with well-defined and strict benchmarks (Dai et al. 2012). The transactional approach makes it easier for a cross-border VC firm to exit compared to domestic VC firms (Mäkelä and Maula, 2006).

Other local community stakeholders have a strong interest in the survival of the PC. VC firms may escalate their commitment in order to manage the impression of these stakeholders. As domestic investment managers are geographically and culturally more proximate to the PC they are more embedded in the local community and likely have a higher nationalistic bond (Guler, 2007). The social pressures associated with terminating a PC in their home market may hence impact a domestic VC firm more strongly compared to cross-border VC firms terminating an investment in a foreign country, as it is more distant from their local ecosystem. The higher embeddedness and nationalistic bond may cause domestic VC firms to face higher social pressures from the local stakeholders and hence to enrol in impression management by continuing to invest. In contrast, cross-border VC investment managers decide more easily to divest, as they are less personally involved or

emotionally attached to the PC's community (Boddeyn, 1983). We thus expect domestic VC firms to be more prone to escalate commitment compared with the cross-border VC firms.

Based on the differences between domestic and cross-border VC firms in their access to information, overconfidence, social and emotional pressures we propose:

Hypothesis 1: The probability of escalation of commitment towards investing in unsuccessful PCs will be higher for domestic VC firms compared to cross-border VC firms.

5.3.2. Cross-border investments from headquarters versus from a local branch

To mitigate liabilities of foreignness, VC firms pursuing an internationalization strategy may establish a local branch, thereby sharing characteristics of both domestic and cross-border VC investors.

5.3.2.1. Access to information

Cross-border VC firms investing through a local branch are expected to have access to similar amounts and types of information as domestic VC firms and are thus presumed to rely more on soft information compared to cross-border VC firms investing from head office (Berger and Udell, 2002). We expect branches to face similar levels of equivocality and overconfidence as domestic VC firms and as a result to have a higher probability to escalate commitment as opposed to cross-border VC firms investing from a head office.

5.3.2.2. Project determinants

The nature of the sunk costs is different when investing from a branch compared to when investing from headquarters. The establishment of a local branch necessitates predominantly a financial investment, while investing across borders from headquarters requires higher temporal investments. Temporal investments have, however, a much smaller mental impact than financial investments, leading to lower sunk cost effects (Soman, 2001). Branches are therefore associated with larger sunk costs creating a "zone of inaction" above and below the point where profits are equal to costs in which decision makers do not exit the investment situation until sunk costs have been accounted for (Bragger et al., 1998). We therefore expect branches to have a wider zone of inaction and as a result to have a higher probability to escalate commitment as opposed to cross-border VC firms investing from head office.

5.3.2.3. Social determinants

The establishment of a local branch is the most far-reaching form of local embeddedness a cross-border VC firm can display in the focal country. A VC firm will only be willing to bear the high investment if it envisages expanding its activities in that region. Branches will therefore want to build and maintain a strong local reputation and avoid the exit cost of negative publicity surrounding the failure of a PCs, as a strong reputation is essential to attract high quality deal flow (Hsu, 2004) and syndication partners (Mäkelä and Maula, 2006). As a result of the stronger local embeddedness and the strategic importance of the focal country for future investments, cross-border VC firms investing through a local branch may, as opposed to investing from head

office, be more susceptible to normative pressure from the local investment network and from the local community. We thus expect that the probability to escalate commitment of branches will be higher compared to cross-border VC firms investing from head office.

Given the similarities between domestic and branch VC firms in access to information, social and emotional pressures, and the difference in sunk costs faced as opposed to cross-border VC firms, we propose:

Hypothesis 2: The probability of escalation of commitment towards investing in unsuccessful PCs will be higher for cross-border VC firms investing through a local branch as opposed to cross-border VC firms investing from headquarters.

5.3.3. Investing from a local branch versus from a domestic VC firm

Local branches of foreign VC firms are structurally different from domestic VC firms. Structural determinants include the constitutional features of an organization and its interaction patterns (Staw and Ross, 1987). In a VC context, each PC is followed by an investment manager, but all investments have to be approved by an investment committee. Investment committees are specifically designed to mitigate individual biases of the VC investment managers. The additional layer of organizational hierarchy which branches have impacts their decision making process. More specifically, local branch decision making differs as it is primarily made by investment committees that combine the expertise and experience of branch executives and head office executives (Pruthi et al., 2009). Head office executives have a lower nationalistic bond and an increased geographical and cultural distance to the PC or its country of origin. They are therefore less emotionally attached to local PCs and as a result have a more unbiased view on their performance. The influence of head office executives in the investment committee should therefore at least partially mitigate the probability of escalating commitment, compared to decision making in investment committees of domestic VC firms. We hence expect branch VC firms to have a lower probability to escalate commitment as opposed to the domestic VC firms.

Based upon the difference in organizational structure between domestic VC firms and branch VC firms, we propose our third hypothesis:

Hypothesis 3: The probability of escalation of commitment towards investing in unsuccessful PCs will be lower for international VC firms investing through a local branch as opposed to domestic VC firms

5.4. Method

5.4.1. Sample and data

Our sample is drawn from a novel dataset on European technology companies built by the pan-European VICO project (See chapter 2 for the description of the VICO sample).²² The sample used in this study contains

²² As government VC firms exhibit an investment pattern that differs from all other VC investor types, we exclude the portfolio companies that received only government VC financing in order to test the hypotheses.

longitudinal data on 1618 unique rounds of VC investments by 1060 VC firms in 684 VC-backed PCs. Each PC received an average of 2.37 VC rounds. PCs that exit unsuccessfully have on average 2.88 investment rounds while PCs that successfully exit have on average 2.63 investment rounds. The dataset includes 2136 unique VC firm-PC pairs, representing a total of 3445 investment decisions of which 2399 by domestic VC firms, 568 by cross-border VC firms and 255 by branch VC firms. Table 5.1. provides the descriptive statistics on the average number of investment rounds in which VC firms participate, split by VC firm origin and exit type. Each VC firm takes part in an average of 1.62 financing rounds. This is higher for domestic VC firms (1.68) and branch VC firms (1.96) and lower for cross-border VC firms investing from a head office (1.57). Successful PCs have more investment rounds compared to unsuccessful (1.78 versus 1.43) for all VC firm origins. Unsuccessful PCs backed by cross-border VC firms go through the lowest number of rounds (1.35), while successful PCs backed by branch VC firms have the highest number of rounds (2.38).

Table 5.1.: Average number of investment rounds by VC firm origin and exit success

	All VC firms	Domestic VC firm	Cross-border VC firm	Branch VC firm
Full sample	1.62	1.68	1.57	1.96
Successful exit	1.78	1.78	1.78	2.38
Unsuccessful exit	1.43	1.51	1.35	1.70

Table 5.2. provides an overview of the distribution of PCs and financing rounds by company founding period and industry. The majority of PCs (44%) were founded between 1998 and 2000, 35% were founded between 1986 and 1997 and 21% between 2001 and 2004. The most important industry is software (34%), followed by biotechnology (18%) and ICT manufacturing (16%). The average number of investment rounds a PC receives is relatively constant over time and industries.

Table 5.2.: PCs by founding year and industry group

<i>Founding year</i>	PCs		Financing Rounds		Average number of rounds
	Number	%	Number	%	
1986-1997	240	35.09	534	33.00	2.23
1998-2000	302	44.15	748	46.23	2.48
2001-2004	142	20.76	336	20.77	2.37
Total	684	100.00	1618	100.00	2.37
<i>Industry</i>					
Software	234	34.21	559	34.55	2.39
Biotech	122	17.84	314	19.41	2.57
ICT manufacturing	113	16.52	275	17.00	2.43
Internet	90	13.16	177	10.94	1.97
TLC	39	5.70	90	5.56	2.31
Web publishing	33	4.82	77	4.76	2.33
Other R&D	29	4.24	69	4.26	2.38
Pharmaceutical	24	3.51	57	3.52	2.38
Total	684	100.00	1618	100.00	2.37

* Other R&D includes companies active in the aerospace, energy, nanotech and robotics industry

5.4.2. *Measuring escalation of commitment*

Following Guler (2007), a two-stage analysis was implemented in order to investigate VC firms' behaviour in sequential investment decisions. Controlling for PC characteristics, VC firm characteristics, deal characteristics and market conditions, industry, year and country effects, the hazard of a successful exit is estimated as a function of the number of financing rounds invested in the PC by the focal VC firm, differentiating between domestic VC firms, cross-border VC firms and branch VC firms. A similar equation is estimated for unsuccessful exits. In the second stage, the impact of the number of financing rounds on the hazard of successful exits and unsuccessful exits are compared. If VC firms are rational they should increasingly terminate investments that have a decreasing probability of success over financing rounds. In contrast, if the updated information on the PC is favourable at each new financing round, the likelihood of a successful exit - conditional on this new information - increases over time and the probability of an unsuccessful exit (i.e. investment termination) should decrease over financing rounds. If the updated information is on the contrary negative, the probability of a successful exit given this updated information declines over financing rounds and the likelihood of an unsuccessful exit should therefore increase. To conclude, if VC firms behave rationally, the probability of an unsuccessful exit should be inversely proportional to the conditional likelihood of a successful exit (Guler, 2007).

5.4.3. *Variable definitions*

5.4.3.1. Dependent variables

As financial return data on individual investments are not available in the European VC industry, the exit route is used as a proxy to evaluate the performance of VC investments (Guler, 2007). The first dependent variable embodies the hazard of an unsuccessful exit for a PC at time t . The second dependent variable represents the hazard of successful exit for a PC at time t . Exits hence need to be classified as successful or unsuccessful (Birmingham et al., 2003; Guler, 2007). In line with the VC literature, IPOs are categorized as successful exits (Gompers, 1995). Liquidations, bankruptcies and buy-backs by entrepreneurs are classified as unsuccessful exits.

Finally, exits through a trade sale or a buy-out are commonly considered as a successful exit (Guler, 2007). However, unsuccessful PCs may also be sold for a nominal value to a trade or financial acquirer in a fire sale. Consequently we performed bankruptcy-prediction type analyses to classify trade sales and buy-outs as successful or unsuccessful exits. This procedure is explained in more detail in Appendix 5.1. Finally, following Guler (2007, p264) we coded a "VC firm-investment relationship as terminated if the VC firm did not appear in any of the subsequent investment rounds or if the focal round was also the final round of financing for the venture." In the former, VC investors are washed out by dilution when they are not participating in subsequent rounds. In this case we assumed that the termination event occurred at the earliest round date at which the VC firm no longer appeared as an investor. In the latter, we assumed that it occurred within 1888 days after the final round of financing, with 1888 days being the 75 percentile time to exit of the sample.

Table 5.3. shows that 634 (29.68%) unique VC-PC pairs are successful exits, while 998 (46.72%) VC-PC pairs are unsuccessful exits. The ratio of successful versus unsuccessful exits is 0.64 for the full sample, but higher for cross-border VC investments (0.76) and branch VC investments (0.86).

The dependent variable measures the time in months from a VC firm’s first investment date in a specific PC until exit. Investments of VC firms in PCs for which no exit information is available are treated as right censored.

Table 5.3.: VC firm - PC pairs by investment outcome and VC firm origin

	All VC firms	Domestic VC firms	Cross-border VC firms	Branch VC firms
Full Sample	2136	1432	360	131
Successful exit	634	409	130	48
Unsuccessful exit	998	645	170	56
Missing exit	504	378	60	27
Ratio*	0.64	0.63	0.76	0.86

* Ratio is defined as the number of successful exits divided by the number of unsuccessful exits

5.4.3.2. Independent variables

The key independent variables measure VC firm origin and the number of financing rounds invested by each VC firm. VC firm origin is captured by three mutually exclusive dummy variables that equal one if the focal VC firm satisfies the origin condition of the respective dummies and zero otherwise: *domestic VC firm*, *cross-border VC firm*, *branch VC firm*. The *ROUNDS (R)* variable captures the investment round number since the initial investment of the focal VC firm. Cash investments occurring within a 6 months period are aggregated and treated as a single round. To circumvent potential multicollinearity issues, the *ROUNDS* variable is centred by subtracting the mean. The interaction terms between the origin dummies and the *ROUNDS* variable test our hypotheses.

5.4.3.3. Control variables

We control for PC characteristics, VC firm characteristics, deal characteristics, market conditions, industry, year and country effects. Since the relative efficacy of de-escalation strategies may vary based on the level project completion (Sleesman et al., 2012), PC characteristics variables at time of investment or exit are included: *PC age*, *number of patents*, the natural logarithm of a PC’s *sales* and the development *stage* of the PC at the time of VC firm entry. Table 5.4. gives an overview of the PC development *stage* at entry of the different VC firms. While the majority of investments are made in PCs in the start-up and expansion stage, domestic VC firms (22%) make approximately twice as much seed investments compared to cross-border VC firms (12%) and branch VC firms (13%). Branch VC firms invest in a lower proportion of PCs in the start-up stage and a higher proportion in the expansion stage (56%) compared to domestic (39%) and cross-border VC firms (46%). Table 5.5. shows the description of the sample at first investment of the focal VC firm; Panel A records the PC characteristics. Compared to the median PC backed by a domestic VC firm, the median PC backed by a cross-border or a branch VC firm is one year older at time of entry of the focal VC firm (three years versus two). The

median PC holds no *patents* (mean 0.44) and generates *sales* of respectively €171,000, €504,000 and €114,000 at time of entry of a domestic VC firm, a cross-border VC firm and a branch VC firm.

Table 5.4.: VC firm stage of entry

	Full sample	%	Domestic VC firm	%	Cross-border VC firm	%	Branch VC firm	%
Investor Entry Stage								
Seed	397	20.01	307	21.77	43	11.98	17	13.18
Start-up	764	38.51	546	38.72	145	40.39	34	26.36
Expansion	796	40.12	538	38.16	168	46.80	72	55.81
Later Stage	27	1.36	19	1.35	3	0.84	4	3.10
Total	1984	100.00	1410	100.00	359	100.00	129	100.00
Missing	152	NA	22	NA	1	NA	2	NA

Table 5.5.: Descriptive statistics at first investment of the focal VC firm

<i>Panel A: Company characteristics</i>		Full Sample	Domestic VC firm	Cross-border VC firm	Branch VC firm
PC age	Mean	3.42	3.15	3.74	3.65
	Median	3.00	2.00	3.00	3.00
	S.D.	3.02	2.94	2.98	3.19
	N	2133	1430	361	130
Patents	Mean	0.44	0.33	0.88	0.30
	Median	0.00	0.00	0.00	0.00
	S.D.	2.23	1.72	3.59	1.00
	N	2133	1430	361	130
Sales (in €1,000)	Mean	1762.92	1551.44	1973.87	2046.12
	Median	225.00	171.00	504.00	114.00
	S.D.	5985.25	6113.82	3204.87	4149.39
	N	1727	1161	290	99
<i>Panel B: VC firm characteristics</i>		Full Sample	Domestic VC firm	Cross-border VC firm	Branch VC firm
VC firm age	Mean	13.50	13.27	15.13	12.33
	Median	6.00	5.00	8.00	7.50
	S.D.	42.58	46.81	22.59	22.66
	N	1522	1180	245	96
VC firm total experience	Mean	52.15	25.95	96.73	207.06
	Median	6.00	4.00	17.00	78.00
	S.D.	146.87	90.17	194.76	285.44
	N	1591	1183	281	121
VC firm country experience	Mean	14.67	17.13	4.95	13.88
	Median	2.00	3.00	0.00	2.00
	S.D.	46.21	51.74	19.32	27.73
	N	1591	1183	281	121
VC firm IPO track record	Mean	3.69	0.76	8.51	21.28
	Median	0.00	0.00	1.00	3.00
	S.D.	15.22	4.48	18.78	39.95
	N	1591	1183	281	121
Lead investor (dummy)	Mean	0.56	0.62	0.40	0.56
	N	1782	1189	309	116

<i>Panel C: Deal characteristics</i>		Full Sample	Domestic VC firm	Cross-border VC firm	Branch VC firm
Distance to PC (in kilometers)	Mean	794.05	164.19	3385.86	565.19
	Median	164.00	75.00	1091.00	81.00
	S.D.	2041.79	217.01	3553.97	1806.87
	N	1919	1430	359	130
VC firm investment amount (in millions of €)	Mean	2.23	1.77	3.15	5.06
	Median	1.20	1.00	2.40	2.53
	S.D.	3.50	2.50	2.94	8.86
	N	1421	894	277	98
VC firm entry round	Mean	1.89	1.65	2.34	1.88
	Median	1.00	1.00	2.00	1.00
	S.D.	1.27	1.02	1.50	1.24
	N	2131	1430	361	129
Syndication (dummy)	Mean	0.79	0.74	0.92	0.77
	N	2133	1430	361	130
Syndication size	Mean	3.20	2.53	4.95	3.10
	Median	2.00	2.00	4.00	2.00
	S.D.	3.35	2.76	4.03	3.58
	N	2133	1430	361	130
Mixed syndicate (dummy)	Mean	0.34	0.22	0.84	0.33
	N	2133	1430	361	130

Table 5.5. Panel B displays the descriptive statistics of the VC firm characteristics. *VC firm age* is included, as older VC firms are more likely to stage their investments (Chemmanur et al., 2012). Compared to the median cross-border and branch VC firm, a median domestic VC is three years younger at time of first investment in the PC. As a VC firm's experience may impact the probability of a successful exit, the number of prior PCs the VC firm invested in is measured (Dai et al. 2012). Both a VC firm's *general experience* and its *country specific experience* are included. The median domestic VC firm has the lowest general experience (4 investments) but the highest country specific experience (3). The median cross-border VC firm has no country specific experience, but has invested in 17 PCs worldwide. While the median branch VC firm has the highest *general experience* (78 investments), its *country specific experience* is in between that of domestic and of cross-border VC firms (2 investments). Since VC firms' reputational concerns may impact exit timing, their reputation is included and measured as the *number of IPO exits* (Cumming and Dai, 2010). While the median domestic VC firm has no IPO experience, the median cross-border VC firm and branch VC firm have brought respectively one and three PCs to the stock market before investing in the focal PC. Finally, a dummy variable indicating whether the VC firm is the *lead investor* in the round is included. Domestic, cross-border and branch VC firms act as lead investor in respectively 62, 40 and 56 percent of the investments.

Following deal characteristics are included (see Table 5.5., Panel C): *geographic distance*, *cumulative amount invested*, *VC firm entry round*, *syndication size* and *mixed syndicate*. As geographical proximity impacts a VC firm's information gathering, monitoring and advising functions, the *geographical distance* is included and measured by computing the natural logarithm of the physical distance in kilometres between the focal VC firm

and the PC's headquarter. The median distance between a VC firm and its PC is respectively 75, 1091 and 81 kilometres for domestic, cross-border and branch VC firms. The *cumulative amount of investments* made in the PC by a VC firm prior to the focal round is a proxy of its sunk costs, which may influence escalation of commitment. This measure is computed as the sum of euro amount (in millions of euro) that the VC firm invested in the PC in all rounds prior to the focal round. Domestic, cross-border and branch VC firms invest a median amount of respectively 1.00, 2.40 and 2.53 million euro in the entry round. The *VC firm entry round* is defined as the round in which the VC firm first appears as an investor in the PC, because the likelihood of termination may be different for VC firms that join the syndicate earlier rather than later (Guler, 2007). While a median domestic and branch VC firm enters the PC in the first investment round, a median cross-border VC firm enters in the second investment round. *Syndication size*, measured as the time-varying cumulative count of VC investors that participated in prior financing rounds or in the focal round, controls for a possible effect of co-investor pressure (Guler, 2007). Respectively 74, 92 and 77 percent of the first round investments of domestic, cross-border and branch VC firms are syndicated. A median cross-border VC firm has twice as many co-investors (4) compared to a median domestic and branch VC firm (2). Finally, a dynamic variable that captures whether there was a syndicate comprised of both domestic and cross-border VC firms is added to control for a possible effect of the syndicate composition (Chemmanur et al., 2012). Domestic, cross-border and branch VC firms enter in a *mixed syndicate* at first investment in respectively 22, 84 and 33 percent of the investments.

To control for general market conditions, the yearly *total number of VC backed IPOs* is added. This can affect a PC's probability to go public, as well as VC investment practices (Guler, 2007). Finally, companies may exhibit different development patterns depending upon the time when they received their first VC investment. Both the time frame of our study and our focus on high-tech sectors require us to control for the *year of first VC investment*. Companies in different industries may differ in terms of the milestones they need to meet, the number of rounds they typically receive, and the time they take before exiting (Guler, 2007). To control for potential industry and country effects, *industry* and *country dummies* are added.

5.4.4. Method of Analysis

Event-history analysis (also known as hazards or survival analysis) is used to dynamically estimate the investment process by comparing the distributions of the hazards of successful and unsuccessful exits (Guler, 2007). Survival models can be viewed as consisting of two parts: the underlying hazard function, often denoted $\lambda_0(t)$, describing how the hazard (risk) changes over time at baseline levels of covariates; and the effect parameters, describing how the hazard varies in response to explanatory covariates. The hazards of successful and unsuccessful exits are estimated using the semi-parametric competing risks Cox proportional hazard model, which does not require the distribution of time dependence of the hazard to be specified (Guler, 2007). Coefficients are estimated using partial likelihood estimation. In the estimation of the parameters (β) the baseline hazard function does not need to be explicitly estimated. This flexibility is perhaps the strongest feature of the Cox model. Moreover, in a proportional hazards model, the unique effect of a unit increase in a covariate is multiplicative with respect to the hazard rate. The Cox regression model quantifies the relative hazard of an

event (in this case successful exit and unsuccessful exit), at varying times after the initiation of treatment (in this case the entry time of the focal VC firm). The data consist of survival times, some of which are censored if the study ended before an exit event was observed. The data is hence set up so that every individual VC investment round is a spell, leading to 3445 spells. A spell is treated as right censored if it does not result in a successful or an unsuccessful exit. Following Guler (2007), unsuccessful (successful) exits are treated as right censored in the model estimating the hazards of successful (unsuccessful) exits. Analyses are clustered on VC firms, as multiple observations for the same VC firm investing in several PCs could lead to correlations between the error structure and the independent variables and thus lead to underestimation of the standard errors.

Potential selection effects are controlled for by using a two-stage model (Rao et al, 2001). First, a probit model for cross-border investor choice is estimated. The inverse Mill's ratios are then included as an instrument in the second stage event-history analyses.

5.5. Results

5.5.1. Main analyses

Table 5.6. presents the correlation matrix. All variables have variance inflation factors well below the usual warning level of 10 except for the *inverse mills ratio* (16.75) and the *syndication size* variable (10.12). The mean variance inflation factor is 2.52. This indicates that problems due to multicollinearity issues are limited.

Table 5.7. reports the results for the hazard of successful and unsuccessful exits. Model 1a models the hazard of a successful exit, while model 1b models the hazard of an unsuccessful exit. Taken together, models 1a and 1b allow to assess whether there is escalation of commitment by domestic, cross-border and branch VC firms. Models 2a, 2b, 3a and 3b test if there are significant differences in the probability to escalate commitment between the different categories of VC firm origin, allowing to test the hypotheses. The coefficients of the *inverse mills ratios* are statistically significant in all models indicating that there is a selection bias.

Table 5.6.: Correlations (N=1552)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<i>Independent variables</i>																
1 ROUNDS (centred)																
2 Domestic VC firm x R	0.78															
3 Cross-border VC firm x R	0.47	0.00														
4 Branch VC firm x R	0.41	-0.01	-0.01													
<i>Selection variable</i>																
5 Inverse Mills Ratio	-0.34	-0.28	-0.15	-0.11												
<i>PC characteristics</i>																
6 PC age	0.42	0.36	0.19	0.12	-0.22											
7 Patents	0.00	0.01	-0.01	-0.01	-0.20	0.06										
8 Sales (LN)	0.28	0.25	0.10	0.09	-0.25	0.61	0.09									
<i>VC firm characteristics</i>																
9 VC firm age	0.04	0.01	0.05	0.02	-0.09	0.06	0.01	0.02								
10 VC firm country experience	0.12	0.16	-0.02	0.02	-0.02	0.08	0.02	0.08	0.00							
11 VC firm IPO track record	0.12	0.01	0.14	0.10	-0.22	0.07	0.09	0.07	0.13	0.06						
12 Lead investor	-0.11	-0.11	-0.02	-0.04	0.40	-0.09	-0.09	-0.08	-0.02	0.06	-0.10					
<i>Deal characteristics</i>																
13 Distance (LN)	-0.01	-0.06	0.12	-0.07	-0.21	0.07	0.11	0.13	0.03	-0.06	0.13	-0.10				
14 Cumulative amount invested by VC	0.66	0.44	0.48	0.21	-0.32	0.40	0.06	0.27	0.04	0.16	0.19	-0.06	0.11			
15 Syndication size	0.37	0.31	0.14	0.13	-0.79	0.38	0.14	0.29	0.09	0.01	0.18	-0.43	0.21	0.33		
16 Mixed syndicate	0.16	0.14	0.09	0.01	-0.62	0.16	0.15	0.19	0.06	0.00	0.20	-0.37	0.23	0.20	0.57	
<i>Market conditions</i>																
17 IPO market conditions	-0.28	-0.25	-0.11	-0.09	0.18	-0.31	-0.05	-0.21	-0.06	-0.09	-0.06	0.14	-0.01	-0.22	-0.26	-0.09

Table 5.7.: Results of Cox models predicting the hazard of exit

	Main Models				Comparison of VC Firm Origins							
	Success		No Success		Success		No Success		Success		No Success	
	1a	1b	2a	2b	3a	3b	3a	3b	3a	3b		
<i>Independent variables</i>												
ROUNDS (centred)			0.118	-0.100	-0.257	*	-0.282	*				
Domestic VC firm			0.022	-0.154								
Cross-border VC firm	-0.022	0.154			-0.022		0.154					
Branch VC firm	-0.363	0.223	-0.341	0.069	-0.363		0.223					
Domestic VC firm * R	-0.257	*	-0.282	*	-0.375	**	-0.181					
Cross-border VC firm * R	0.118		-0.100		0.375	**	0.181					
Branch VC firm * R	0.074		-0.200		-0.100		0.331	*	0.082			
<i>Selection variable</i>												
Inverse Mills Ratio	-0.653	†	-0.805	**	-0.653	†	-0.805	**	-0.653	†	-0.805	**
<i>PC characteristics</i>												
PC age	-0.023		0.039		-0.023		0.039		-0.023		0.039	
Patents	0.070	*	0.071	***	0.070	*	0.071	***	0.070	*	0.071	***
Sales (LN)	0.126	***	-0.015		0.126	***	-0.015		0.126	***	-0.015	
<i>VC firm characteristics</i>												
VC firm age	-0.002		0.003	**	-0.002		0.003	**	-0.002		0.003	**
VC firm country experience	0.001	*	0.001	*	0.001	*	0.001	*	0.001	*	0.001	*
VC firm IPO track record	-0.002		-0.007		-0.002		-0.007		-0.002		-0.007	
Lead investor	-0.115		-0.156		-0.115		-0.156		-0.115		-0.156	
<i>Deal characteristics</i>												
Distance (LN)	0.078	*	-0.001		0.078	*	-0.001		0.078	*	-0.001	
Cumulative amount invested	0.010		-0.005		0.010		-0.005		0.010		-0.005	
VC firm entry round	0.304	***	0.107		0.304	***	0.107		0.304	***	0.107	
Syndication size	-0.004		-0.133	**	-0.004		-0.133	**	-0.004		-0.133	**
Mixed syndicate	0.208		0.506	**	0.208		0.506	**	0.208		0.506	**
<i>Market conditions</i>												
IPO market conditions	0.002	*	0.003	***	0.002	*	0.003	***	0.002	*	0.003	***
<i>Other</i>												
Investor entry stage	x		x		x		x		X		X	
First investment year	x		x		x		x		X		x	
PC industry	x		x		x		x		X		x	
PC country	x		x		x		x		X		x	
Observations	1,382		1,382		1,382		1,382		1,382		1,382	
Log likelihood	-1,516		-1,716		-1,516		-1,716		-1,516		-1,716	

*** p < .001, ** p < .01, * p < .05, † p < .10 (conservative two-tailed tests)

The coefficients of the following dummy variables are not reported due to space considerations: investor entry stage; first investment year; PC industry; PC country

x: variables are included in the models

Control variables are largely in line with prior findings. A PC's number of *patents*, *VC firm country experience* and *IPO market conditions* have a significant positive impact on the probability of both a successful and an unsuccessful exit. PCs that generate higher *sales*, that are located further away from the VC firm (consistent with Dai et al., 2012) and entering a PC in a later round are associated with a higher probability to have a successful exit, although these variables do not impact the probability to have an unsuccessful exit. While *VC firm age* has no impact on the hazard to have a successful exit, older VC firms have a higher probability to have an unsuccessful exit. While larger *syndicates* have lower probability of an unsuccessful exit, *mixed syndicates* have a higher probability of unsuccessful exit. Finally, *first investment year*, *industry* and *PC country dummies*

are significant in all models. Other control variables, including the *age* of the PC, a VC firm's *IPO track record*, investing as the *lead investor*, the *cumulative amount invested* and the *entry stage* have neither a significant impact on the probability to have a successful exit, nor to have an unsuccessful exit.

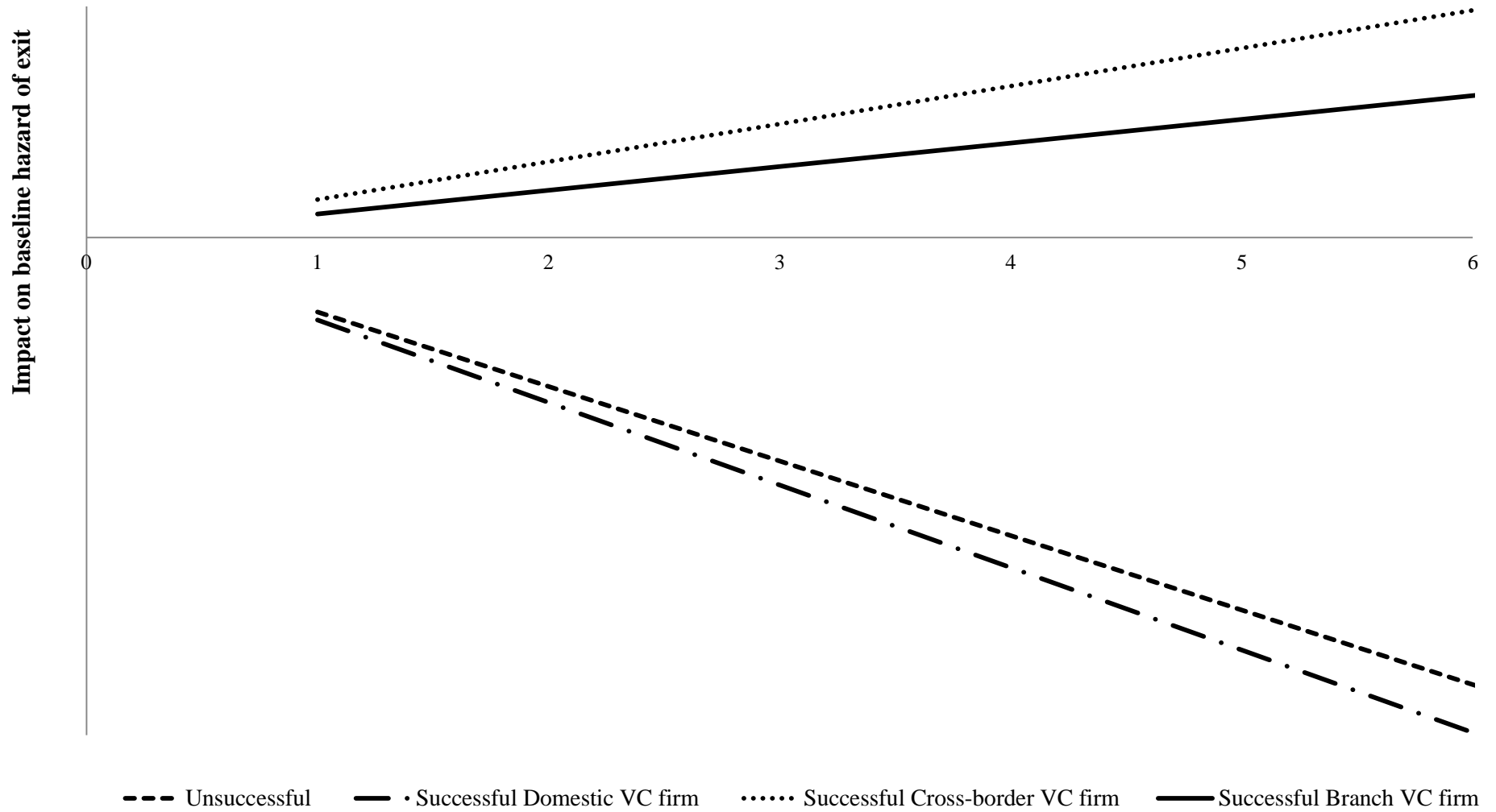
Comparing the distribution of successful and unsuccessful exits over rounds allows to assess whether VC firms show escalation of commitment (Guler, 2007). Interaction terms between *domestic*, *cross-border* and *branch VC firm dummies*, and the *ROUNDS* variable are therefore included in Models 1a and 1b. The *ROUNDS* variable is excluded from these analyses to avoid perfect multicollinearity between the independent variables. Models 1a and 1b estimate the relationship between the hazard of a successful (respectively unsuccessful) exit and the number of investment rounds of domestic, cross-border and branch VC firms. The coefficient of the interaction term between *domestic VC firm* and *ROUNDS* is negative and significant ($p < .05$) in both models. The negative coefficient implies that domestic VC firm's probability to have both a successful and an unsuccessful exit decreases with each additional investment round. As the probability to successfully exit goes down over rounds, if domestic VC firms behave rationally and maximize profits, the probability of termination and thus of an unsuccessful exit should increase over rounds. In contrast, the coefficients of the interaction terms between *ROUNDS* and *cross-border* and *branch VC firm* are not significant in neither model. The insignificant coefficient indicates that the number of investment rounds does not impact the probability to have either a successful or an unsuccessful exit for cross-border and branch VC firms. Our results hence suggest that domestic VC firms' likelihood to unsuccessfully exit a PC deviates from the conditional probability of having a successful exit, but not that of cross-border VC firms and branch VC firms. This strongly suggests that domestic VC firms escalate their commitment as they do not behave to maximize profits in sequential investment decisions. Cross-border and branch VC firms, in contrast, show no escalation of commitment. These results are in line with our hypotheses.

To test our first and second hypotheses, the escalation of commitment of domestic and branch VC firms is directly compared with the escalation of commitment of cross-border VC firms. Therefore, the interaction variable between *cross-border VC firms* and *ROUNDS* is dropped and the *ROUNDS* variable is included in models 2a and 2b. Cross-border VC firm is hence the reference category. Model 2a estimates the hazard of a successful exit. The results show that while the probability of having a successful exit declines significantly more over rounds for domestic VC firms compared to cross-border VC firms ($p < .01$), there are no significant differences in the probability to have a successful exit over rounds between branch VC firms and cross-border VC firms. Model 2b estimates the hazard of an unsuccessful exit. None of the coefficients of the interaction terms are significant, indicating that the distribution of unsuccessful exit events over rounds of both domestic and branch VC firms are not significantly different from those of cross-border VC firms. The results of both analyses together hence provide strong support for hypothesis 1: domestic VC firms have a significantly higher probability to escalate commitment to a failing course of action compared to cross-border VC firms. In contrast, we fail to find support for hypothesis 2 as no significant difference was found between branch VC firms and cross-border VC firms in their probability to escalate commitment.

The third hypothesis is tested in models 3a and 3b by including interaction terms between the *ROUNDS* variable and both the *cross-border* and *branch VC firm dummies*, and excluding the interaction term with the *domestic VC firm dummy*, making domestic VC firms the reference category. Compared to domestic VC firms, the probability of having a successful exit declines significantly less over rounds for branch VC firms ($p < .05$, model 3a), but there is no significant difference in the probability of termination over rounds between branch VC firms and domestic VC firms (model 3b). Combining these results with the earlier finding that branch VC firms do not escalate their commitment while domestic VC firms do, this provides strong support for hypothesis 3: branch VC firms are less prone to escalate commitment compared to domestic VC firms. In addition, models 3a and 3b again support the first hypothesis that domestic VC firms have a higher tendency to escalate their commitment than cross-border VC firms ($p < .01$).

Figure 5.1. graphically shows the impact of an additional round of finance on the baseline hazard of a successful and of an unsuccessful exit and this for each VC firm category. The figure clearly shows that, in contrast to cross-border VC firms, domestic VC firms' probability to both terminate and successfully exit investments declines as they participate in more financing rounds. Cross-border and branch VC firms also have a declining probability to terminate investments as they participate in more rounds, but, in contrast, their probability to have a successful exit increases over rounds.

Figure 5.1.: Impact of *ROUNDS* on the baseline hazard of exit



5.5.2. Robustness of results

Additional models were fitted to test for the robustness of our findings and assess the strength of alternative explanations. We focus on two potential concerns. First, alternative control variables are incorporated, that could not be included in the main models as they are highly correlated to other variables. Second, the potential multicollinearity issue is investigated in more detail.

Additional models were estimated using alternative control variables. First, VC firm's *general experience* is included instead of its *country specific experience*. A high correlation between both variables prevents us from including both variables in the same model. Second *IPO market condition* variable is replaced by respectively *the total number of VC-financed ventures worldwide*, *the total amount of VC money raised worldwide* and *the number of M&As in West Europe*. Third, because access to capital may affect the likelihood of success and failure, a control for the *cumulative total amount invested in the PC* by all the VC firms prior to the focal round instead of the *cumulative amount invested by the focal VC firm* is included (Guler, 2007). Finally, *PC sales* is replaced by the *number of people employed*. The main results remained unchanged.

Another potential problem is the presence of highly correlated explanatory variables. Multicollinearity makes the parameter estimates unreliable and inflates the standard errors (Van den Poel and Larivière, 2004). An additional difficulty is caused by the time-varying nature of multiple variables in our study. The intercorrelations should therefore be analysed dynamically. In an effort to assess potential multicollinearity concerns empirically, variables were added sequentially to the main models to assess the stability of the parameters and to ensure that multicollinearity has no harmful impact on the results (Van den Poel and Larivière, 2004). New models were estimated with a correlation cut-off of 0.6 and new control variables were sequentially introduced, based upon a less restrictive cut-off point. The results reveal that the coefficients and significance of the control variables and of the main independent variables remain highly stable in all models. It is hence unlikely that the results are impacted by potential multicollinearity problems.

5.6. Discussion and conclusion

Organizational decision makers have been shown to escalate their commitment towards a failing course of action (Guler, 2007). Research on the escalation of commitment behaviour has however, neglected the differential impact which organizations' origin may have on the probability to exhibit this decision bias. This paper contributes by differentiating between domestic and cross-border investors. Additionally, we investigate how the probability to escalate commitment differs for cross-border VC firms when investing through a local branch or from abroad. Therefore we scrutinized how cross-border, domestic and branch VC firms respectively differ in the antecedents of escalation of commitment.

The VC industry provides an attractive setting to investigate our research question as VC firms are expert decision makers, experienced in making exit decisions in a high-risk environment and have several structural safeguards in place to prevent irrational behaviour such as escalation of commitment. Despite these safeguards, extant literature has shown that VC firms escalate commitment when facing underperforming PCs but literature

has neglected the effects of VC firm origin. Our unique data enables us to fill this gap. Our findings show a robust and significant higher probability to escalate commitment for domestic VC firms as opposed to cross-border VC firms and branch VC firms. These results are consistent with our central theoretical prediction.

Multiple determinants lower cross-border VC firms' probability to escalate commitment as opposed to domestic VC firms. First, cross-border VC firms' access to lower amounts and mainly hard information decreases their overconfidence and decision's equivocality. Second, the larger geographical, cultural and legal distance they face combined with the lower strategic importance of the focal country makes cross-border VC firms less prone to social and emotional pressures from stakeholders surrounding the PC.

Although the employment of local investment managers and proximity to their PCs is expected to make branch VC firms behave similarly to domestic VC firms, investment committees including both local and head office executives prevents escalation of commitment. Results indeed show that branch VC firms behave as cross-border VC firms as their probability to escalate commitment is lower than domestic VC firms. Moreover, we find no significant difference in escalation probability between cross-border VC firms investing from head office or through a local branch. Geographical distance between the focal VC firm and its PC is hence not the only driver of the results, but cultural distance and legal differences faced by cross-border VC firms (head office) may play an important role.

5.7. Implications for research

Our findings contribute to research in several ways. First, by investigating organizations rather than individuals in a longitudinal escalation of commitment research setting, we answer a call from Sleesman and colleagues (2012) for more field research on organizations using longitudinal data. Second, extant literature on escalation of commitment mainly focused on the psychological and project determinants of escalation determinants, thereby disregarding largely the social and structural determinants. (Sleesman et al., 2012). We hence make a strong contribution to research on escalation of commitment by answering recent calls to study the impact of structural determinants on escalation behaviour (Sleesman et al., 2012). Controlling for sunk costs, we directly assess if organizational structural safeguards prevent escalation of commitment and show that these safeguards are powerful factors inhibiting the risk of escalation behaviour. This result has important implications as it demonstrates that structural safeguards can be employed as an effective tool to mitigate the risk to escalate commitment. Third, extant literature does not consider VC firms' heterogeneity and studies the impact of intra-organizational politics and investment norms on the probability of escalation (Birmingham et al., 2003; Guler, 2007). This study, in contrast, differentiates between domestic, cross-border and branch VC firms and acknowledges that escalation behaviour is determined by project, psychological, social and structural factors (Sleesman et al., 2012). The findings are of direct relevance for future research on escalation behaviour as organizations investing domestically or across-borders exhibit different probabilities to escalate commitment. Organizational origin should hence be included in future research on decision making behaviour and more specifically in escalation of commitment research.

Fourth, multiple studies underline that liabilities of foreignness only has detrimental effects on the foreign investor and increases the probability of divestment. These studies however, do not consider escalation of commitment in investments that fail to meet expectations and their results may as we show hence be driven by this decision bias. Our findings suggest that liabilities of foreignness may not always have a negative impact but can induce more rational decision making and as a result maximize value creation. This is important for foreign investors as they may be reluctant to invest abroad due to liabilities of foreignness while these liabilities may increase their rational behaviour. Understanding how foreign investors as opposed to domestic investors behave when facing underperforming investments is hence important.

Moreover, this study contributes to the organizational decision making literature. Extant literature mainly focused on one-time, non-profit and highly publicly visible projects (Guler, 2007). This study, adds to the few studies (see e.g. Guler, 2007) that empirically provides evidence for systematic errors in decision making by professional, competitive, experienced investors strongly incentivised to maximize profit. Moreover, we show that not all investors are the same. Investing from across borders and structural safeguards mitigate the probability to escalate commitment.

Finally, the logit analysis in this study to classify the trade sales and buy-outs as successful or unsuccessful exits offers an important methodological contribution to this stream of research, which typically views these exit types as successful, thereby ignoring fire sales (Guler, 2007). Our study hence provides a more fine grained classification and demonstrates that multiple trade sales and buy-outs should be classified as unsuccessful exits.

5.8. Implications for practitioners

Liabilities of foreignness may make foreign investors reluctant to invest across borders. We show that being foreign may also have positive effects as it reduces the probability to escalate commitment. Domestic VC firms on the other hand should be careful when evaluating PCs. They are prone to escalate commitment and should hence further improve their decision making process in order to avoid this irrational behaviour. Moreover, the finding that branch VC firms do not escalate commitment - despite the employment of local investment managers and the geographical proximity to the PCs - indicates that their structural safeguard provided by investment committees consisting of both local and head office executives prevents them to escalate commitment to a failing course of action. Domestic VC firms may hence implement this organizational safeguard by including distant executives in their investment committees.

Our study also has important implications for high-tech entrepreneurs. Given the difficulty to raise finance from outside investors, high-tech entrepreneurs are under pressure to accept finance when and where they can find it. Yet, as we have demonstrated, not all VC firms have the same commitment to PCs that do not meet expectations. While attracting cross-border VC or branch VC may be beneficial for PCs when they perform well, they terminate investments more easily when PCs do not meet expectations. Entrepreneurs should therefore carefully evaluate if they target domestic or cross-border VC investors. We hence provide further

evidence that entrepreneurs in their search for finance should carefully evaluate potential investors and target investors that match their needs.

5.9. Limitations and directions for future research

As with all research, this study also has some limitations. First, although we provide clear evidence that domestic VC firms are more prone to escalate commitment as opposed to cross-border VC firms and branch VC firms and discuss the multiple determinants theoretically, we are unable to assess the relative impact of each determinant separately. The relative importance of each determinant is another research question which warrants further more qualitative study. Second, we acknowledge that a classification of the exits based upon the actual returns of the VC firm would provide an even better categorization. Such data is however unavailable in the current database. Third, an interesting avenue for future research is the assessment of the impact of specific institutional distance measures on the probability to escalate commitment. Moreover, it would be interesting to investigate whether there are positive spill over effects when domestic VC firms syndicate with cross-border firms. More specifically, does syndication with a cross-border VC firm impact domestic VC firms' probability to escalate commitment? Another, related research question is what is the impact on syndicate partners when a co-investor stops investing in a specific portfolio company; is there a different impact if a domestic or a cross-border co-investors stops investing?

5.10. Appendix 5.1.: Logit failing prediction analysis

While the VICO database provides full exit information for some PCs, it lacks information on others. Therefore, based upon the characteristics of the companies for which it is known whether the exit was successful or not, we developed a model to predict whether an exit was successful, based upon pre-exit accounting data and company characteristics. This approach is comparable with failure prediction models (see e.g. Altman, 1968; Ohlson, 1980; Hol, 2007; Altman and Sabato, 2007).

The prediction model used the exit information of the known exits in the full VICO dataset (759 PCs). We classified an exit as successful if it was an IPO (54 PCs), a buy-out (5 PCs) or trade sale (35 PCs). For the latter two exit categories, the exit value had to exceed the total amount invested to be classified as successful. In similar vein, unsuccessful exits comprise liquidations (147 PCs), buy-backs (31 companies) and buy-out or trade sale exits with a transaction value below the total amount invested (11 PCs).

The 94 successful exits and 189 unsuccessful exits were used as the learning sample in our logit models (Ohlson, 1980; Hol, 2007; Altman and Sabato, 2007). The two different logit models were estimated in order to test the robustness of our classification (see output Table 5.8.). The dependent variable in both models is a dummy variable, taking the value of one if the exit was successful. Both models have a high predictive power, with adjusted R² values of 0.63 (model 1) and 0.60 (model 2). The characteristics were included based on their significance and their predictive power (Altman, 1968; Ohlson, 1980; Hol, 2007; Altman and Sabato, 2007). The contribution of the entire set of variables to the prediction model is assessed in order to obtain the combination that has the highest classification performance among the alternatives. Table 5.9. provides the

descriptive statistics of the variables included in the logit models and estimates whether there are significant differences between the mean values of the variables for successful as opposed to unsuccessful exits. Both logit models include PC characteristics: the first round investment amount, the pre-exit cash flow, assets and the ratio of value adding over payroll expenses. While the first round investment amount measures the initial belief of the VC firms in the company's business plan, the pre-exit cash flow determines the cash generation capacity of - and the quality of income generated by - the company and captures whether there are liquidity problems. Higher first round investment amounts and pre-exit cash flows are therefore expected to result in a higher probability of a successful exit. The descriptive statistics (Table 5.9.) show that, on average, PCs that are successfully exited receive a significantly ($p < .05$) higher amount of financing in the first investment round but there is on average no significant difference between the pre-exit cash flow generation. The total asset variable measures the size of the company which is generally expected to be positively related to safer cash flows, and thus to a lower probability of an unsuccessful exit (Hol, 2007). PCs that are successfully exited are on average significantly ($p < .001$) larger in total assets (Table 5.9.). The value adding over payroll expenses ratio measures the efficiency of a company to create value relative to its personnel costs. Higher efficiencies are expected to increase the probability of a successful exit. The descriptive statistics show, however, no significant differences between the means.

Table 5.8.: Logit learning models

	Model 1		Model 2	
First round investment amount (million €)	-0.314	**	-0.180	**
Holding period	-0.537	**	/	
Cash flow (million €)	0.437	*	0.240	
Total assets (LN)	5.180	***	3.216	***
Value adding / Payroll expenses	-0.379	*	-0.529	**
Long term debt / Total assets	-3.340	**	/	
Sales (million €)	-0.092	*	/	
Sales / Total assets	1.551		/	
Value adding (million €)	/		-0.472	**
Value adding / Total assets	/		2.883	***
Cash (million €)	/		0.363	
First investment year	x		x	
PC industry	x		x	
PC Country	x		x	
Constant	-30.480	***	-22.170	***
N	105		131	
Adj R ²	0.63		0.60	

*** $p < .001$, ** $p < .01$, * $p < .05$, † $p < .10$ (conservative two-tailed tests)

The coefficients of the following dummy variables are not reported due to space considerations: PC industry; first investment year; PC country

Table 5.9.: Descriptive statistics

	Successful Exits		Unsuccessful Exits		Student T test
	N	Mean	N	Mean	
First round investment amount (million €)	75	5.067	137	2.728	*
Holding period	94	5.194	189	5.487	
Cash flow (million €)	73	-1.161	108	-1.128	
Total assets (million €)	78	13.144	128	3.332	***
Value adding / Payroll expenses	72	0.208	96	0.115	
Long term debt / Total assets	72	0.083	109	1.789	
Sales (million €)	77	13.023	138	3.136	***
Sales / Total assets	73	0.712	101	0.723	
Value adding (million €)	73	2.474	102	0.855	*
Value adding / Total assets	73	0.123	102	-0.604	
Cash (million €)	76	3.684	125	0.497	**

*** p < .001, ** p < .01, * p < .05, † p < .10 (conservative two-tailed tests)

Further, not only internal factors but also external factors may influence the probability of exit success, e.g. the state of the economic cycle, industry characteristics and characteristic of the country in which the company operates (Hol, 2007; Chava and Jarrow, 2004). We therefore include dummy variables to control for the first investment year and for the PC's industry and country characteristics.

Model 1 further includes the time between first investment and exit, the pre-exit sales, the long term debt over total assets ratio and the sales over total assets ratio. Longer holding periods are expected to result in a higher probability of an unsuccessful exit, although no statistical differences are found between the averages. Long term debt over total assets ratio measures the financial leverage of the PC, an important determinant of company failure and by extension of the probability of an unsuccessful exit (Chen and Shimerda, 1981; Ohlson, 1980). The descriptive statistics display no statistical differences between the means in the ratio of value adding over payroll expenses of both exit ways (Table 5.9.). While the sales variable captures the company's commercial success, the sales over total assets ratio measures the sales generating ability of the company's assets. Higher sales and sales generating abilities of the assets are expected to increase the probability of a successful exit (Altman, 1968). While PCs that are exited successfully on average generate higher sales ($p < .001$), they do not differ in terms of sales over total asset ratio (Table 5.9.).

Value adding and the value adding over total assets ratio are used as alternatives respectively for the sales variable and the sales to total assets ratio as the sales data are missing for a number of companies. Model 2 includes the PC's pre-exit value adding, amount of cash holdings and its value adding over total assets ratio. We expect higher value adding and value adding generation abilities of the assets to increase the probability of a successful exit. Similarly to the sales variables, PCs that are exited successfully on average have higher value adding ($p < .05$) but they on average do not differ in terms of value adding over total asset ratio (Table 5.9.). Finally, higher amounts of cash, a measure of the company's liquidity, decreases the probability of failure and unsuccessful exit (Chen and Shimerda, 1981). Companies which are successfully exited have on average higher amounts of cash holdings ($p < .01$). The variables used to evaluate a company's failure probability may be

correlated and cause multicollinearity issues (Altman, 1968). The highest variance inflation factor was 3.72 for the sales over total assets ratio in model 1, and 2.96 for the pre exit value adding variable in model 2, which are well below the usual threshold level of 10 (Rao et al., 2001).

The outcome of the learning models serves as input to classify PCs for which insufficient information is available to classify their exit as successful or not. There are three types of missing information. First, we were unable to find any exit information for 151 companies. Second, we know that an exit took place, but the exit year is unknown for 146 companies. Third, we know that an exit took place and we know the exit year for 179 companies. We first estimate the exit year for those companies for which the exact exit time was lacking. Thereafter, we estimated the likelihood of the exit being successful based upon pre-exit accounting data and company characteristics.

For the 151 companies for which we have no exit information, we first estimated whether the last know round was the final investment round. For this purpose, the expected date of a new round was calculated by adding 822 days to the last round date, which corresponds with the 75 percentile time between two consecutive rounds in our sample (Guler, 2007). Companies were treated as right censored if the date on which a new round was expected occurred after the end of the data collection period August 2011 (18 companies or 2.37%). For the remaining companies without exit info and for the 146 companies for which the exit year was lacking, we assumed that the exit occurred within 1888 days after the final round of financing. This corresponds to the 75 percentile time to exit of the sample and is consistent with the approach of Guler (2007).

Finally, we calculated the logit scores predicted by the two classification prediction models based upon pre-exit accounting data and company characteristics. Companies with logit scores for both models below 0.25 were classified as having been unsuccessfully exited (74 companies or 9.75%) and companies with logit scores for both models above 0.75 as having been successfully exited (155 companies or 20.42%). Companies with a logit score between 0.25 and 0.75, with contradicting scores on both models or without pre-exit accounting data were not classified and treated as right censored data in our main analyses (229 companies or 30.17%).

The results of the full procedure are shown in Table 5.10. While a total of 249 companies were categorized as having experienced a successful exit, 263 PCs were categorized as having experienced unsuccessful exits. The remaining 247 companies were treated as censored, the majority because accounting data was lacking (200 companies) or because the logit scores of the two models were contradicting or inconclusive (29 companies).

Table 5.10.: Classification of full sample after logit failure prediction model

	Total	No exit data	Buy out	Inactive	Liquidated	M&A	IPO	Buy Back	
Successful	Learning sample	94	0	5	0	0	35	54	0
	Exit year known	78	13	5	0	0	60	0	0
	Exit year imputed	77	74	0	0	0	3	0	0
Unsuccessful	Learning sample	189	0	0	0	147	11	0	31
	Exit year known	30	8	4	0	1	17	0	0
	Exit year imputed	44	44	0	0	0	0	0	0
Unknown	Missing accounting	200	137	4	4	0	55	0	0
	Censored	18	18	0	0	0	0	0	0
	Contradicting logit	29	18	1	0	0	10	0	0
TOTAL	759	312	19	4	148	191	54	31	

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Chapter 6

General conclusions, implications & avenues for future research

In this section I aim to provide some more detailed insights into the key conclusions of this dissertation. Therefore, the contributions of the different studies to literature are examined. I also discuss the limitations and avenues for future research. Finally, the theoretical and practical implications of this dissertation are evaluated.

6.1. Introduction

The three empirical studies in this dissertation each investigate a different aspect of the relation between international venture capital (VC) firms and their portfolio companies (PCs) in a European context. The unique, hand-collected database of VC backed companies allowed to empirically study some of the unanswered research questions in the field of VC internationalization. The first study looks at the differences in the determinants of the matching process between entrepreneurial companies and respectively domestic, cross-border and branch VC firms. The second study focusses on how cross-border as opposed to domestic VC investors are associated with the growth of PCs. Finally, the third study investigates how cross-border, branch and domestic VC firms behave when their PCs do not meet initial expectations.

As such, these studies provide important insights in the process of international VC funding and the effects thereof on PCs, and thereby contribute to the fields of VC internationalization, international business and entrepreneurial finance. In the remainder of this chapter, I first summarize the most important findings of the studies and draw some conclusions. Next, I discuss the contributions to academic literature and the practical implications. Finally, I conclude with the limitations and some promising avenues for future research.

6.2. Main findings and contributions

The goal of this dissertation is to investigate the differences between international and domestic VC firms in three main aspects of the VC investment cycle: the initial matching with investment targets, the post-investment development of PCs and the exit from poorly performing PCs. In the next paragraphs I will list the main findings of the studies.

The first study of this dissertation examines the impact of VC firm's geographic and structural heterogeneity on the mutual matching process between investors and companies. Although several previous studies examined the strategies used by the VC investors (i.e. the supply side) to mitigate liabilities of foreignness (LOF), so far few

have taken into account the impact of VC firm's origin on the companies (i.e. the demand side) of this matching process (see Chapter 1 section 1.3.2. for a review of extant literature). Further, to the best of my knowledge, no study to date has examined how the matching is different for international VC firms investing from a local branch office. As such, this study addresses the call to examine how international VC firms use a mix of strategies in order to deal with information asymmetry problems linked to foreign investing (Fritsch and Schilder, 2008; Mäkelä and Maula, 2008; Meuleman and Wright, 2011; Pruthi et al., 2003). Our hypotheses are tested on a sample of 1770 VC investments in young technology based companies, of which 20% by cross-border VC firms and 7% by local branches. Multinomial logistic regressions are used to examine the drivers of the mutual matching process between companies and respectively domestic, cross-border and branch VC firms.

From the supply perspective, the LOF theory is used to explain different investment strategies used by the geographically diverse VC investors (Wright et al., 2005). Consistent with VC firms' behaviour in emerging economies (Dai et al., 2012), our results show that cross-border VC firms have a lower probability of matching with informationally opaque companies in the Europe, despite the fact that the European economies are more integrated than emerging economies and hence lower LOF are expected. Interestingly, this effect disappears when controlling for co-investor characteristics. We hereby show that VC investors rely on their network partners to mitigate their own LOF. While previous research took a PC perspective to highlight how local investors may help to raise foreign VC (Mäkelä and Maula, 2008; Vanacker et al., 2013), our research shows how the network of investors present in a PC impacts the investment decisions from an investor's perspective. We thereby contribute to the recently recognized role of networks in financial markets for overcoming problems created by distance (Jääskeläinen and Maula, 2013).

More specifically, cross-border VC firms have a higher probability to invest with local investors, with larger investment syndicates and with more experienced investors. We further demonstrate that cross-border VC firms are more strict when assessing their co-investors when evaluating seed stage companies compared to non-seed stage companies. While the size of the investment syndicate does not impact the cross-border VC firm's probability to match with seed stage companies, the potential contribution of co-investors to the company - measured as their experience and local presence increases the probability of a cross-border VC firm to match with seed stage companies. Finally, investing through a local branch as opposed to from a foreign head office allows foreign VC firms to exhibit the same investment behaviour as domestic VC firms.

From a demand perspective, we draw upon the resource-based view of the firm to build a life cycle model on the association between PCs' resource needs and VC investors' geographic origin. Less developed companies with higher resource needs have a higher probability to match with domestic VC firms or branches of foreign VC firms, as opposed to cross-border VC firms. In particular, seed stage companies in which only cross-border VC firms co-invest have a higher probability to attract a local VC firm (either a domestic VC firm or a local branch). Hence, seed stage companies put more importance to which VC they target given their available resource base. Refining the opportunity and building the early resource base is important in this phase, and local VC investors are better equipped to provide support in these matters.

In the second and third study, I explore the impact of VC investor's heterogeneity on the investment outcome. As a successful outcome for the VC firm is not by definition a successful outcome for the entrepreneur, I investigated both perspectives. The second study examines the differential impact of cross-border and domestic VC, on the growth of PCs across time. While previous studies indicate that cross-border VC is an increasingly important phenomenon, especially for high-tech companies with high growth potential (Mäkelä and Maula, 2008), there is little evidence on the relationship between raising VC from cross-border investors and the growth of PCs. This question is non-trivial as, compared to domestic VC investors, cross-border VC investors might spur as well as constrain the growth of their PCs. I draw upon the resource-based view of the firm to build a life cycle model on the association between the geographic origin of VC investors and PC growth. I argue that the resource needs of companies change over time, and show that different types of VC investors may address different resource needs. A longitudinal research design is used; and sales, total assets and payroll expenses are tracked in 761 European technology companies from the year of initial VC investment up to seven years thereafter. The findings demonstrate that companies initially backed by domestic VC investors exhibit higher growth in the short term compared to companies backed by cross-border investors. In the medium term, companies initially backed by cross-border VC investors exhibit higher growth compared to companies backed by domestic investors. Finally, companies that are initially funded by a syndicate comprising both domestic and cross-border VC investors exhibit the highest growth. Cross-border and domestic VC investors offer complementary resources which are relevant both in the early development stages as in the later stage internationalisation.

Finally, in the third study I draw upon an escalation of commitment framework to investigate how differences between domestic, cross-border and branch VC investors in access to information, social and structural factors affect their decision to terminate unsuccessful investments. Previous studies have mainly focused on either the rationale for international investments or on explaining successful investments. In contrast, this study contributes to the understanding of behavioural differences between domestic and cross-border VC firms (Mäkelä and Maula, 2006; Wright et al., 2005). The exit outcome of 1060 VC investments in 684 European technology companies is tracked and event-history analysis is used to dynamically estimate the investment and exit process through the distributions of the hazards of successful and unsuccessful exits (Guler, 2007). The results show that domestic investors have a high tendency to escalate their commitment to a failing course of action. In contrast, cross-border investors terminate their investments efficiently, even when investing through a local branch. This is explained by multiple determinants which lower cross-border VC firms' probability to escalate commitment as opposed to domestic VC firms. First, cross-border VC firms' access to lower amounts and mainly hard information decreases their overconfidence and decision's equivocality. Second, a lower social involvement with the project and a lower embeddedness in the local economic and social environment due to the large geographical and cultural distance faced, makes cross-border VC firms less prone to social and emotional pressures from stakeholders surrounding the PC. Local branches of cross-border investors are further shielded from escalation of commitment through structural safeguards. This is one of the few studies that shows how structural safeguards may mitigate escalation of commitment.

6.3. Academic contributions

This dissertation contributes to academic literature in multiple ways. In the next paragraphs, I will elaborate on the main implications for the resource-based view, escalation of commitment theory, international VC literature, international business literature and entrepreneurial finance literature.

6.3.1. Implications for the resource-based view

The first two studies contribute to the resource-based view, more specifically to the dynamic resource-based view. While the resource-based view of the firm defines a company as a collection of resources and states that the characteristics of the available resources affect the competitive advantage of a company, the dynamic resource-based view introduces the idea that the type of resources and capabilities needed by a company changes over time. The dynamic resource-based view hence takes into account the adaptation and change of a company's resources and capabilities through building, integrating, or reconfiguring internal and external resources and capabilities in order to address rapidly changing environments (Helfat and Peteraf, 2003). In order to explain competitive advantage, the resource based view must hence take into account the evolution over time of the resources and capabilities that form the basis of competitive advantage. Given the substantial development which young, entrepreneurial companies undergo and the significant differences in the resources and capabilities international and domestic VC firms can provide, our research setting is highly relevant to examine the dynamic nature of resources and their impact on the company's growth.

One of the central research questions in this dissertation is "when do companies benefit from local as opposed to international investors". There are currently contradicting arguments on the benefits of international as opposed to local investors. Compared to domestic investors, international investors might spur as well as constrain the growth of their PCs. International investors may contribute to the internationalization and hence to a stronger growth of their PCs by sharing their knowledge pertaining to internationalization and international markets (Fernhaber et al., 2009; Lutz and George, 2012) and by legitimizing the unknown company in their home market (Mäkelä and Maula, 2005; Hursti and Maula, 2007). Nevertheless, international investors may also constrain company growth. First, they may drive internationalization efforts of the company towards the investor's home market, which is not always the company's target market (Mäkelä and Maula, 2005). Second, as we show in our third study, they stop active contribution to their PCs much earlier than domestic investors when the prospects of companies have fallen.

Based on a setting of international VC investing, the studies in this dissertation provide strong support for the argumentation of the dynamic resource-based view. A life cycle model emerges as companies' resource needs change over time and different types of investors may address different resource needs. More specifically, we show that while early stage companies require local resources from local investors, later stage companies benefit more from foreign investor's resources in order to exhibit sustainable growth. Local investors are important for early stage companies as they are able to provide local contacts and to set up the initial resource base. Once the company reaches a more developed stage, the local investors are important to attract international investors

through their network and by signalling their PC's quality. Additionally, we show that foreign investor's resources and capabilities which are beneficial for later stage companies can be detrimental for companies in earlier stages of the company's life cycle as international investors may terminate investments which do not meet initial expectation much earlier than domestic investors. This dissertation hence provides a more fine-grained view of the dynamic resource-based view in entrepreneurial companies.

6.3.2. Implications for the escalation of commitment theory

The third paper contributes to the escalation of commitment theory. While most studies of escalation have focused on individual decision makers, organizations as a whole can also escalate commitment. The third study in this dissertation contributes to research on escalation of commitment by answering recent calls to study the impact of structural determinants on escalation behaviour (Sleesman et al., 2012). This study is one of the first to show structural characteristics reduce escalation of commitment. First, operating across borders decreases the risk of escalation of commitment through having more limited access to soft information, a lower social involvement with the project and a lower embeddedness in the local economic and social environment. Second, when investing close by, escalation of commitment can be mitigated by involving professionals that are located farther away in the decision making process. This is not only relevant in a VC context, but also in any professional environment at risk of escalation of commitment in its decision making.

6.3.3. Implications for the international venture capital literature

The three studies primarily contribute to the international VC literature. The first study shows that cross-border VC firms adapt their investment strategies driven by LOF. This finding is non-trivial as, compared to emerging markets, LOF are expected to be much lower in developed and more economically integrated markets such as Europe. Moreover, by demonstrating that cross-border VC firm's lower probability to invest in informationally opaque firms disappears when controlling for co-investor characteristics, we show that cross-border VC firms can mitigate their LOF and expand investment options through their syndicate partners. More specifically, cross-border VC investment is facilitated by local, more or more resourceful co-investors. Local syndication mitigates information and value adding problems as it allows the cross-border VC firm to outsource the monitoring and value adding functions to local co-investors (Mäkelä and Maula, 2008; Chemmanur et al., 2012), which are not hindered by geographical, cultural or institutional distance. Additionally, by co-investing with more or more resourceful partners, international VC firms may generate additional value through the combination of skill sets, experience and networks of a diversity of VC firms. Finally, these co-investors may endorse the PC and signal its quality to the cross-border VC investors. This dissertation hence advances international VC literature by providing a more fine grained understanding on the antecedents and the investment strategies to mitigate LOF in a developed market and on the role of network partners in mitigating LOF.

The second study contributes by showing that the companies follow a life cycle model, the resource needs of companies change over time and different types of VC investors may address different resource needs. More

specifically, while domestic VC firms are essential for early growth, international VC firms' resources help to achieve sustainable growth.

Although organizational decision makers have been shown to escalate their commitment towards a failing course of action (Guler, 2007), extant research has neglected the differential impact which VC firms' origin may have on the probability to exhibit this decision bias (Birmingham et al., 2003; Guler, 2007). The third study, in contrast, differentiates between domestic, cross-border and branch VC firms and acknowledges that escalation behaviour is determined by project, psychological, social and structural factors (Sleesman et al., 2012). The findings are of direct relevance for future research on escalation behaviour as organizations investing domestically or across borders exhibit different probabilities to escalate commitment. Organizational origin should hence be included in future research on decision making behaviour and more specifically in escalation of commitment research. Moreover, the study also adds to the few studies that examine unsuccessful exits by VC firms (Cumming and Dai, 2010).

By investigating the impact of the VC firms' modes of internationalization (i.e. setting up a local branch versus investing from headquarters) on the VC firm's investment strategy and investment commitment, respectively the first and third study of this dissertation answer a call made by multiple recent studies (Guler and Guillén, 2010a; Pruthi et al., 2003; Wright et al., 2002). More specifically, the first study contributes to literature by showing that the establishment of a local branch allows VC firms to expand internationally while limiting LOF. A local branch combines the benefits of both domestic and cross-border VC firms. While from a supply point of view, investing through a local branch efficiently lowers LOF, from a demand point of view, branches are able to provide both local resources through their proximity and employment of local investment managers and international resources by leveraging their head office resource base. Moreover, cross-border VC firms consider branch VC firms as equally appealing to overcome LOF, as the effects of syndicating with at least one domestic VC firm or branch VC firm are the equally positive. The third study adds to literature by showing that organizational structural safeguards, such as the establishment of a local branch, are powerful factors inhibiting the risk of escalation behaviour. Although the employment of local investment managers and proximity to their PCs is expected to make branch VC firms behave similarly to domestic VC firm, branch VC firms' investment committees including both local and head office executives prevents escalation of commitment.

6.3.4. Implications for the international business literature

This dissertation also advances international business literature by providing a richer understanding of the benefits of international investors both for the investors as for the investees. The latter has typically been neglected in the international business literature.

Multiple studies underline that LOF only has detrimental effects on the foreign investor and increases their probability of an unsuccessful exit. These studies, however, do not consider escalation of commitment in investments that fail to meet expectations and their results may, as we show in the third study, hence be driven by this decision bias. Our findings suggest that operating in an international environment does not only entail

LOF, but can induce more rational decision making and as a result maximize value creation. This is important for foreign investors as they may be reluctant to invest abroad due to LOF while these liabilities may increase their rational behaviour. Understanding how foreign investors as opposed to domestic investors behave when facing underperforming investments is hence important. As a result, we contribute to the international business literature by enhancing understanding of how international firms behave when cross-border activities fail to meet expectations (Benito, 2005).

Moreover, the second study shows that foreign investors may positively impact their company's growth. While companies invested by local investors are more likely to exhibit high growth early-on, companies backed by foreign investors have more sustainable growth rates in the long run. This is especially the case when local investors co-invest with foreign investors.

6.3.5. Implications for the entrepreneurial finance literature

In addition, this dissertation advances the entrepreneurial finance literature. By considering the demand perspective in the first study, we address the call by Pruthi and colleagues (2003) to investigate what factors influence the PCs decision to obtain finance from an international rather than a domestic VC firm. Thereby, we contribute to the knowledge on the paradox of the increasing internationalization in the VC market. The increasing number of international VC investments contrasts with the benefits of geographical proximity of domestic VC firms to add value and monitor PCs. The results from the first study contribute by displaying that entrepreneurs dynamically assess their companies' resource gaps and consequently target VC investors with specific geographic origins based upon the required resources. Moreover, the second study shows that PCs benefit from international VC firm's resources to achieve long term growth. A life cycle model emerges from these results: a young PC benefits from tight monitoring and close interaction with its investors to shape its opportunity and to develop early organizational resources and routines. This study hence contributes to the entrepreneurial finance literature by showing that domestic VC investors are better at supporting a company in its early growth, while the resources of a cross-border VC investor are especially valuable in a later phase when international expansion becomes more important. The study thus provides a life cycle perspective on the resources VC investors may offer to their PCs. The study further shows that bundling the diverse resources from different types of VC investors allows overcoming the shortcomings of one particular type of investor. Overall, this study provides a more fine-grained understanding of the role that domestic and cross-border VC investors can play as their PCs grow and thereby require different resources or capabilities over time.

These findings are important, as few studies have disentangled the effects of domestic and cross-border VC investors on the growth of their PCs. Most studies on the effects of VC have studied performance at the VC investor or fund level, focusing on PC exit and/or survival, or focusing on post-IPO performance (limiting these studies to the most successful PCs). This study, in contrast, is one of the first to focus on the growth of the PC from the initial VC investment throughout the typical lifespan of a VC investment. This is important for entrepreneurs, as the goals of investors and entrepreneurs are not always aligned. Understanding how PCs grow

after having received VC, and how different types of investors contribute differently to company growth, is hence relevant.

6.4. Limitations and avenues for future research

In this dissertation I have examined different aspects of the relation between international VC firms and their PCs in a European context. While the results of the empirical studies provide new insights to resource-based view and escalation of commitment theory and new insights in the fields of VC internationalization, international business and entrepreneurial finance, the studies are not without limitations. In the next paragraphs, I will elaborate on main limitations of the dissertation and discuss some avenues for future research.

6.4.1. Methodological limitations: Sample, variables and method of analysis

6.4.1.1. Sample: discussion of internal validity and external validity

Although the studies in this dissertation use a unique and very valuable dataset, there are some inherent limitations associated with it.

A first potential limitation relates to the *internal validity* of the studies, i.e. the degree in which confounding variables are successfully eliminated within the study. The internal validity of the studies potentially suffers from the presence of various countries and industries in the sample and from year effects. This heterogeneity may impact some of the central themes in the different studies: the PC's growth potential and growth pattern, the probability of both successful and unsuccessful exits, the level of information asymmetry and LOF. In the next paragraph, I will hence examine the potential limitations relating to the internal validity.

In the first study, the internal validity may suffer from various levels of LOF due to differences in the PC country's culture and institutional setting, information costs and difficulties to monitor or add value. This potentially affects the investment strategy used by the cross-border VC. In order to address this issue, we included PC country dummies in the main models. Moreover, as these drivers of LOF may change over time and over industries, time and industry dummies were also included in the main models. With respect to the second study, the growth potential and growth pattern may vary given the size of the PCs' and the VC firms' home markets, the PCs' industry and the specific year under investigation. In order to address these issues, we included several control variables in the main models. Moreover, robustness analyses were ran substituting the cross-border VC dummy with a dummy that captures whether the cross-border investor originated from an Anglo-Saxon country. The results are broadly consistent with those of the main models and the dynamics are often even stronger. This is in line with our theory as in this analysis we focus on Continental European PCs and Anglo-Saxon investors, for whom the geographical, cultural and legal distance are higher than between PCs and investors operating in different countries within Continental Europe (Mäkelä and Maula, 2006). In the third study, the inclusion of different first investment years, PC countries and industries may affect the probabilities of a successful or an unsuccessful exit. This is addressed by inclusion of several control variables.

A second potential limitation related to the use of a specific sample is the *external validity*, i.e. the extent to which the results of a study can be generalized to the population or to other situations. More specifically, the geographical, industry and time period coverage of the studies may reduce the generalization of the findings. I will hence discuss the potential limitations relating to the external validity in the next paragraph.

The focus on European PCs in the sample may limit the generalizability of the results. LOF faced by cross-border VC firms may differ between developed and emerging VC markets (Chemmanur et al., 2012). Moreover, companies established in countries with large internal markets such as the U.S. may not need to internationalize in order to grow. This may seriously reduce the PCs' need for international VC's resources. Although we cannot control for these issues, there are several reasons to assume that the findings of our studies are generalizable towards companies outside of Europe. First, investing in developed markets is expected to involve less LOF. As a result, the fact that we are able to find an impact of LOF on the investment strategies of international VC firms in these circumstances makes us confident that the results will hold in less developed markets. Second, high-tech companies often have a narrow product scope based on a technology that may quickly become obsolete and for which the domestic market size is limited (Litvak, 1990; McDougall et al., 1994; Coviello and Munro, 1995; Knight and Cavusgil, 2004; Sapienza et al., 2006; Lutz and George, 2012). This forces high-tech companies to internationalize as soon as possible. Moreover, although larger domestic markets may enable the PCs to delay their internationalization, we expect that high-tech companies will want to internationalize as soon as possible in order to exploit the first mover advantage.

A second threat to external validity concerns the generalization to other industries. We acknowledge the potential limitations in the generalizability towards non-high-tech industries. This is due to the particularities of high-tech as opposed to non-high-tech industries. First, LOF are particularly severe when investing in high-tech companies as these are based upon company specific proprietary technological know-how which is especially difficult to assess for distant "outside investors". Second, thin markets for information arise both because high-tech companies are secretive in order to protect their competitive position, and because there may be few trusted third parties for information dissemination (Hsu, 2004). Moreover, the challenges of high-tech companies are further compounded by the fact that they often operate in complex and highly volatile environments (Stuart et al., 1999). A third and final potential thread to the external validity is the specific timeframe of the sample. Although there might be a generalization problem due to the timeframe of our studies, the study accounts for different macro-economic climates by the inclusion of a pre-bubble, bubble and post-bubble period.

6.4.1.2. Variables

There are some limitations related to the variables available in our sample and to measurement of the variables used in the studies.

First, our large scale study prevents to provide a more fine grained insight in the matching processes used by VC firms to mitigate LOF or by entrepreneurs to obtain the required resources. For example, understanding the interaction between cross-border VC firms and their co-investors provides an interesting avenue for future

research. Additionally, analysing a representative sample containing companies that have tried but failed to raise domestic, cross-border or branch VC would help to more accurately understand the matching process.

Second, we acknowledge that understanding how cross-border investors influence internationalization of their PCs, for instance by analysing exports or international acquisitions, would be interesting. Such data is however not available in the current database.

Finally, although we provide clear evidence that domestic VC firms are more prone to escalate commitment compared to cross-border VC firms and branch VC firms and discuss the multiple determinants theoretically, we are unable to assess the relative impact of each determinant separately. The relative importance of each determinant is another research question which warrants further more qualitative study. Moreover, we acknowledge that a classification of the exits based upon the actual returns of the VC firm would provide an even better categorization. Such data is however unavailable in the current database.

6.4.1.3 Method of analysis

Although we estimate separate models for the supply and the demand perspective in the first study, the realization of a match is always the result of both the investor's and the entrepreneur's preferences. We are hence unable to fully disentangle the divers of both perspectives.

6.5. Practical implications

6.5.1. Implications for entrepreneurs

Given the difficulty to raise finance from outside investors, high-tech entrepreneurs are under pressure to accept finance when and where they can find it. We provide evidence that entrepreneurs in their search for finance should carefully evaluate the potential investors and target investors that match their own and the investors' needs.

First, having highly experienced, well networked and reputable local investors is crucial for PCs that need to obtain cross-border VC as the local investors can play a particularly important brokerage role. They may help the PC to become investment ready for the cross-border VC firms by providing essential early resources, signalling the PC's quality to cross-border VC firms and lower the LOF of more distant cross-border VC firms. As a result, local investors have a major impact on the probability to attract foreign investments thereby expanding the resource base of the PC. PCs should hence target well established, professional and highly reputed local investors (either domestic or branch VC investors) with a broad international network who are able to endorse them by providing a trustworthy signal.

Second, early finance decisions may have a long-lasting impact on subsequent company growth. While PCs of local investors are more likely to exhibit high growth early-on, companies backed by cross-border VC investors have higher growth rates in the long run, especially when local VC investors co-invest with cross-border VC investors.

However, entrepreneurs should also understand that having cross-border or branch VC firms as investors may lead to a lower commitment of the investors, especially if the PCs do not meet initial expectations. While cross-border VC or branch VC may be especially beneficial for PCs when they perform well, they also terminate investments more easily when PCs do not meet expectations. Entrepreneurs should therefore carefully evaluate if and when to target domestic or cross-border VC investors.

Overall, our findings suggest that it might be worthwhile for entrepreneurs to extend their search for finance and target a broad and diverse investor base, or local investors with a strong international network and reputation.

6.5.2. Implications for international venture capital investors

Our research is relevant for VC practitioners as it shows that different geographical focuses may have a significant impact on investment strategy. Cross-border VC firms should recognize the important role which local VC investors can play and know in which situations they are most valuable. Moreover, cross-border VC firms need to build and maintain solid relationships with local VC firms as this will increase their deal-flow. If the focal country is a part of the long term strategy of an international VC, they should consider establishing a local branch. A local branch's geographical proximity and local embeddedness allows international VC firms to limit their LOF and to invest without domestic VC firms.

When investing without local syndicate partners, cross-border VC firms should carefully assess the development stage of their PCs prior to investing. Given the liabilities of newness and the lack of resources that young technology companies face (Vohora et al., 2004), a young company in the early phases of its technical and organizational development is more likely to require a higher level of involvement by a VC investor than a company at a later stage (Gupta and Sapienza, 1992). As companies age, the international knowledge, networks and reputation of cross-border VC investors can assist their internationalization, enabling a higher later stage growth. It is hence recommended that cross-border VC firms only target companies which they perceive as mature enough to start internationalizing unless local VC investors co-invest as PCs will then benefit from the complementary benefits of "localness" and of "foreignness".

We further show that while LOF may make foreign investors reluctant to invest across borders, being foreign may also have positive effects as it reduces the probability to escalate commitment. As domestic VC firms are more prone to escalation of commitment, international VC firms should be careful not to be peer pressured by domestic VC firms into re-investing in PCs that do not meet their expectations.

6.5.3. Implications for local venture capital investors

Local VC firms play a crucial role within the international VC setting. They facilitate cross-border investing by lowering the LOF of more distant cross-border VC firms. From the viewpoint of the PC, local VC firms are better equipped to provide support in refining a company's opportunities and building the early resource base. Local investors are particularly valuable in helping their PCs to make contacts in their local environment, including customers, law firms, suppliers and key employees (Newbert, 2005). These are necessary to pursue

the opportunity and implement a value-creating strategy (Arthurs and Busenitz, 2006). Once a PC is ready to expand internationally, local VC firms can signal the PC's quality and thereby endorse the PCs to cross-border VC firms.

Local investors should thus recognize that although their investment targets need a good local investor, most will benefit from having a cross-border investor in order to help them achieve higher growth in the middle and long term. Local VC firms should hence carefully assess the development of their PCs and attract cross-border VC firms when their PCs are ready for it. As a result, local VC investors need to maintain a well-developed network of potential international VC investors.

Domestic VC firms on the other hand should be careful when evaluating follow-on investment rounds in their PCs. They are prone to escalate commitment to a failing course of action and should hence further improve their decision making process in order to avoid this irrational behaviour. Moreover, the finding that branch VC firms do not escalate commitment - despite the employment of local investment managers and the geographical proximity to the PCs - indicates that their structural safeguards provided by investment committees consisting of both local and head office executives prevents them to escalate commitment to a failing course of action. Domestic VC firms may hence implement this organizational safeguard by including distant executives in their investment committees. Further, when international co-investors stop investing in a PC, domestic VC investors should carefully consider whether to continue to invest. As international VC investors are less prone to escalate their commitment to a failing course of action, the signal provided by international VC investors may be valuable to domestic VC investors to terminate the investment, despite potential local pressures.

6.5.4. Implications for policy makers

This study also has important implications for public policy makers. Public policy programs that aim to develop a strong local VC industry in order to foster the growth of local entrepreneurial companies should recognize that stimulating cross-border investments and the establishment of local branches by foreign VC firms is beneficial. Stimulating international VC investments not only increases the financial capital available to entrepreneurial companies, but also provides them with complementary resources that help them to develop and grow more strongly. In addition, enabling domestic VC firms to grow internationally will further strengthen the local VC industry.

6.6. References

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“This is not the end, this is not even the beginning of the end, this is just perhaps the end of the beginning.”

Sir Winston S. Churchill

