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ABSTRACT

This paper studies how cross-border venture capital investors as opposed to domestic venture capital investors influence the development of their portfolio companies. For this purpose, we use a longitudinal research design and track sales from the year of initial venture capital investment up to seven years after this investment in 692 European technology-based companies. Findings demonstrate how companies backed by cross-border venture capital investors initially exhibit lower sales growth compared to companies backed by domestic investors. After a couple of years, however, companies backed by cross-border investors exhibit higher sales growth compared to companies backed by domestic investors. Finally, companies that raise finance from a syndicate comprising both domestic and cross-border investors develop into the biggest sales generators. Overall, this study provides a more textured understanding of the role played by venture capital investors as their portfolio companies develop and thereby require different resources or capabilities over time.

Keywords: venture capital, cross-border, international, portfolio company development

JEL codes: D92; G24; G32; G34

1. INTRODUCTION

The venture capital industry has long been a local industry (Cumming and Dai 2010), with geographical proximity to investment targets 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). Nevertheless, the last decade has witnessed a strong growth in the international flows of venture capital worldwide (Alhorr et al. 2008; Meuleman and Wright 2011). Driven by increased competition in a maturing industry, venture capital firms have more intensively searched for investment opportunities outside their home regions. Researchers have started to investigate this phenomenon more closely. So far, scholars have primarily focused on the drivers of the venture capital internationalization process at the macro or industry level (e.g., Alhorr et al. 2008; Madhavan and Iriyama 2009; Mäkelä and Maula 2005) or conditions and strategies deployed by venture capital firms to overcome liabilities of distance and liabilities of foreignness (e.g., Bruton et al. 2005; Cumming and MacIntosh 2001; Fritsch and Schilder 2008; Guler and Guillén 2010; Lu and Hwang 2010; Meuleman and Wright 2011; Pruthi et al. 2003, 2009; Wright et al. 2002).

Despite increasing interest in the venture capital internationalization process, research on the impact of cross-border venture capital investors – defined as investors located in a different country from the country where the portfolio company was founded and with no local branch in the latter country - on the development of their portfolio companies is scarce and evidence is mixed. Cross-border venture capital firms located in a venture's target market may play a positive role by legitimizing the unknown venture in that market (Hursti and Maula 2007; Mäkelä and Maula 2005) or by sharing knowledge pertaining to internationalization and international markets, thereby contributing to a stronger internationalization of the venture (Fernhaber et al. 2009; Lutz and George 2010). Yet, cross-border venture capital investors located in another market than the target market tend to drive internationalization efforts of the venture towards the investor's home market with sometimes detrimental effects (Mäkelä and Maula 2005). Furthermore, cross-border venture capital firms stop active contribution to their portfolio companies much earlier than domestic venture capital firms when the prospects of ventures have fallen (Mäkelä and Maula 2006). More recently, scholars have demonstrated that while the probability of a successful exit is lower when venture capital firms invest in more distant companies, the probability of a successful exit increases when distant venture capital firms syndicate with venture capital firms located close to the portfolio company (Cumming and Dai 2010; Moser 2010). Venture capital firms may prematurely exit their portfolio companies, however, and a successful exit from the perspective of the venture capital firm is not necessarily in line with the perspective of entrepreneurs (Gompers 1996).

The goal of the current paper is to investigate how young technology-based ventures backed by cross-border venture capital firms develop over time and how this relationship is moderated when cross-border venture capital investors syndicate with at least one domestic venture capital investor.

We address the call by Zahra and colleagues (2007) to develop a more textured understanding of the role played by venture capital firms as their portfolio companies develop and draw upon the resource based view of the firm and on stage development theories to build a dynamic model on the impact of cross-border venture capital investors upon the development of their portfolio companies. For this purpose, we focus on young technology ventures that received venture capital from cross-border venture capital investors in the first investment round and compare them to ventures that started with domestic venture capital investors only. Given the liabilities of newness and the lack of resources that young technology ventures 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 the venture capital firm than a company at a later stage (Gupta and Sapienza 1992). We hence hypothesize that ventures backed by domestic venture capital investors will initially exhibit higher growth compared to ventures backed by cross-border venture capital investors only, as value added from domestic investors will benefit them most in this early stage (Lockett et al. 2008). As ventures develop, the international knowledge, networks and reputation of cross-border investors will be beneficial to help them internationalize, enabling a higher growth in the medium term. We further expect that ventures raising venture capital from both domestic and cross-border venture capital investors in a first investment round will exhibit the highest growth rates, as they combine the benefits of both domestic and cross-border venture capital investors.

The research population is comprised of European venture capital -backed technology ventures. The broad-scale economic integration policies in the European Union and the introduction of a single currency in a number of countries have contributed to fastening the internationalization process of the European venture capital industry (Alhorr et al. 2008). Language, legal and cultural heterogeneity in different European countries do, however, still form challenges for new technology ventures which strive to develop beyond national boundaries in an early stage of their development (Lutz and George 2010). This makes it often more difficult for European ventures to build a scalable business model, enhancing the need for external resources and support to overcome the barriers to internationalization (Lutz and George 2010). Venture capital investors are hence uniquely positioned to help their portfolio companies, especially if they may contribute the required resources (Hallen 2008).

We use a sample of 692 technology-based ventures from seven European countries that received initial venture capital between 1994 and 2004, and track sales in these ventures from the year of initial venture capital 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. Specifically, ventures that are backed by cross-border venture capital investors initially grow less compared to ventures backed by domestic venture capital investors. After a couple of years, however, the sales growth of the former is accelerated, which implies that ventures backed by cross-border venture capital investors eventually grow faster compared to companies backed by domestic venture capital investors. The presence of at least one domestic venture capital firm positively moderates the relationship between the presence of cross-border venture capital investors and subsequent growth. We show that companies backed by a syndicate comprising both domestic and cross-border venture capital investors develop into the biggest sales generators. Finally, we provide evidence that our results remain robust when we address the multidimensional nature of growth by using alternative growth measures (Delmar et al. 2003) and address potential endogeneity concerns (Shaver 1998).

Our research contributes to the venture capital and entrepreneurship literature. We argue that resource needs of ventures change over time, and show that different types of venture capital investors may address different resource needs. Domestic venture capital investors are better at supporting a venture in its early development, while the resources of a cross-border venture capital investor are especially valuable in a later phase when international expansion becomes more important. Hence, we provide a dynamic perspective on the resources venture capital investors provide to their portfolio companies. Furthermore, bundling diverse resources from different types of venture capital investors allows overcoming the shortcomings of individual investors.

The rest of the paper is organized as follows. Section 2 provides the theoretical background and develops the hypotheses on the impact of cross-border venture capital investors on portfolio company growth. Section 3 describes the research method, including the sample, measures and method of analysis. Section 4 presents the main research findings. Finally, section 5 concludes by discussing the results from both a theoretical and a practical perspective.

2. THEORY AND HYPOTHESES DEVELOPMENT

The resource based view of the firm (RBV) defines a company as a collection of resources and states that the specific characteristics of the available resources significantly affect the competitive advantage and thereby the development of a company (Barney 1986; Barney 1991; Penrose 1958; Wernerfelt 1984). Companies which posses more valuable, scarce, unique and imperfectly mobile resources are expected to perform better and exhibit higher growth over time (Barney 1991; Chandler and Hanks 1994; Cooper et al. 1994). While high-tech entrepreneurial ventures are often based upon proprietary technological know-how, essential resources such as physical capital resources, human capital resources, financial capital or organizational resources may be missing (Heirman and Clarysse 2004; Clarysse et al. 2007; Lockett et al. 2008).

The main challenge of an entrepreneurial firm 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 entrepreneurial ventures may strongly benefit from the resource base of partner organizations (Lee et al. 2001; De Clercq and Dimov 2008; Lockett et al. 2008).

Venture capital investors are important by not only providing 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 their monitoring and entrepreneurial governance activities, they are active partners in the development of their portfolio companies (Carpenter et al. 2003). Portfolio companies can hence spur their development through access to valuable intangible resources and capabilities provided by venture capital investors. We suggest that not all venture capital investors provide comparable resources, however. Compared with domestic venture capital investors, cross-border venture capital investors provide their portfolio companies with specific resources to grow and to develop internationally (Mäkelä and Maula 2005; 2006). Hence, getting venture capital from cross-border investors may impact portfolio companies differently compared to getting venture capital from domestic investors only. We further discuss the impact of getting resources through cross-border venture capital investors on the growth of their portfolio companies. We hereby take a dynamic point of view, acknowledging that the needs of high technology ventures may change as they develop (Lockett et al. 2008; Vohora et al. 2004; Zahra et al. 2006).

Young technology-based companies face “liabilities of newness” (Stinchcombe 1965), driven by an incomplete resource base, including a lack of intangible resources such as organizational routines, networks and legitimacy in the marketplace, and an inexperienced management team (Stuart et al. 1999; Vohora et al. 2004). Identifying and shaping new opportunities and subsequently

investing in the resource base needed to pursue the opportunity are considered as the "hallmark of entrepreneurial capabilities" (Arthurs and Busenitz 2006: 199). Given their experience and involvement in multiple ventures, venture capital investors are instrumental in developing their portfolio companies by assisting in shaping the opportunity, acquiring essential resources and developing organizational capabilities (Arthurs and Busenitz 2006). We argue that domestic venture capital investors will be more valuable in the early development phase than cross-border venture capital investors and hence that portfolio companies backed by domestic venture capital investors will initially exhibit stronger growth compared to companies backed by cross-border venture capital investors.

First, domestic venture capital investors will facilitate opportunity shaping in their portfolio companies to a larger extent compared to their cross-border counterparts. Challenges of early stage high technology 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 pre-startup phase, have to be continuously tested in the market and redefined depending on feedback received from different parties, including potential customers. Based on newly acquired knowledge, they have to continuously re-assess key strategies (Arthurs and Busenitz 2006; Vohora et al. 2004). For example, early market feedback enables them to evaluate and reassess initial ideas, hereby addressing weaknesses and deficiencies in the initial offering (Vohora et al. 2004). Hence, the early development phase is one of continuous experimentation with the opportunity including product specification, market framing and defining marketing strategies. This entails a continuous feedback searching followed by a repackaging of opportunities, before attaining a sustainable return phase (Vohora et al. 2004). Improvisation and imitation are important in this phase (Zahra et al. 2006).

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 (Zahra et al. 2006; Arthurs and Busenitz 2006; Gupta and Sapienza 1992). These are necessary to pursue the opportunity and implement the value-creating strategy (Arthurs and Busenitz, 2006). Given that their resources are limited at start-up, young high technology companies continuously identify, acquire and integrate resources in their organization and subsequently re-configure those during the early start-up and development phase (Arthurs and Busenitz 2006; Vohora et al. 2004). Critical early resource acquisition activities include purchasing materials, buying or renting facilities and equipment and hiring employees (Newbert 2005).

Spatial proximity of venture capital investors may be especially important in this early phase of opportunity shaping and resource acquisition (Fritsch and Schilder 2008). Venture capital investors are influential in these processes by providing contacts to relevant external parties for soliciting feedback, by critically reassessing initial ideas based on the feedback and hence by helping to shape the new venture's strategy (Gupta and Sapienza 1992). Distance and investing across boundaries creates an information disadvantage and makes it more difficult to monitor ventures closely (Dai, Jo and Kassicieh, 2010). Despite increased difficulties with information gathering and monitoring, cross-border venture capital investors have been found to devote less time to their portfolio companies (Sapienza et al. 1996) due to higher transaction costs (Frisch and Schilder, 2008). Fritsch and Schilder (2008) have furthermore shown that telecommunication technology does not substitute for local presence and face-to-face contacts. Finally, cross-border venture capital investors lose more quickly interest in their portfolio companies if they fail to develop satisfactorily (Mäkelä and Maula 2006). Distance hence makes that venture capital investors are less closely involved with their portfolio companies, which is especially detrimental in the early development stage where their input is likely to be especially beneficial to define the opportunity, acquire early resources and shape organizational routines.

Further, domestic investors will also have a more fine-grained understanding of the legal and institutional environment in which early venture development takes place. As new ventures' interaction with the local environment is especially important to secure important early resources, domestic venture capital investors are expected to be able to provide more valuable and relevant advice to their portfolio companies in their early development phase. In all, young high technology companies will benefit more from domestic venture capital investors compared to cross-border venture capital investors, leading to the first hypothesis:

> **Hypothesis 1:** Portfolio companies that raise initial finance from at least one cross-border venture capital investor will initially exhibit lower growth compared to companies that raise initial finance from domestic venture capital investors.

Once the opportunity has been refined based on market feedback and initial resources have been put in place, high technology ventures enter a new phase in which they strive to attain sustainable returns through market development and revenue generation (Vohora et al. 2004). High-tech ventures often have a narrow product scope based on a technology that may quickly become obsolete and for which the domestic market size is limited. Their specialized product or service base targeted towards niche markets forces them to internationalize rapidly to reach a minimum efficient

scale (Litvak 1990; McDougall et al. 1994; Coviello and Munro 1995; Knight and Cavusgil 2004; Lutz and George 2010). This makes that they need to have an international focus from an early stage (Litvak 1990; McDougall et al. 1994; Coviello and Munro 1995; Knight and Cavusgil 2004). The use of resources and the sale of outputs in multiple countries is hence critical for their development in this stage (Oviatt and McDougall 1994; Lutz and George 2010).

Compared to operating in domestic markets, expanding internationally entails costs that result from the unfamiliarity faced by companies in 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. 2010). These liabilities of foreignness are especially difficult to overcome for young technology-based ventures, 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. They facilitate gathering, analyzing and interpreting information about opportunities in these markets (Zahra et al. 2007).

It has been shown that cross-border venture capital investors also facilitate international development of their portfolio companies (Dai et al. 2010; Lutz and George 2010). Cross-border venture capital investors may limit liabilities of foreignness experienced by their portfolio companies in multiple ways. First, the presence of cross-border venture capital investors may provide portfolio companies access to complementary knowledge-based resources in the country of origin of the venture capital investor; these would typically be unavailable to companies that raise finance from domestic venture capital investors. For instance, cross-border venture capital investors may be particularly able to provide companies with knowledge about foreign legal and business issues (Mäkelä and Maula 2005).

Second, cross-border venture capital investors may provide portfolio companies access to their international network, allowing companies to make contacts with relevant foreign suppliers, customers, financiers and other potential stakeholders (Mäkelä and Maula 2005). These relationships are likely to foster the international growth of portfolio companies (Yli-Renko et al. 2002). Networks in foreign markets may also increase the ability of portfolio companies 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 venture capital firm as investor may provide benefits in the form of endorsement (Stuart et al. 1999; Mäkelä and Maula 2005). More specifically, cross-border venture capital investors are likely to legitimate their portfolio companies in foreign markets, which is expected to benefit portfolio companies when they need to mobilize resources from these markets (Hursti and Maula 2007). The arguments above lead to the second hypothesis:

> **Hypothesis 2:** Portfolio companies that raise initial finance from at least one cross-border venture capital investor will exhibit higher growth in a later stage compared to companies that raise initial finance from domestic venture capital investors.

We further propose that combining domestic with cross-border venture capital investors leads to strongest portfolio company development. We expect that portfolio companies financed through a syndicate comprising both domestic and cross-border investors will exhibit higher growth rates than portfolio companies that are financed through either a domestic syndicate or a stand-alone investor.

Partnerships between cross-border and domestic venture capital investors offer the opportunity to make their complementary knowledge available to the portfolio companies (Brander et al. 2002; Dai et al. 2010; Fritsch and Schilder 2008). Domestic venture capital 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 portfolio companies (Fritsch and Schilder 2008). Conversely, cross-border venture capital investors provide knowledge, networks and legitimacy that are particularly applicable in their foreign market. They may provide knowledge about foreign and legal issues (Dai et al. 2010), help in opening doors to foreign customers, suppliers, business partners and financiers (Lutz and George 2010; Mäkelä and Maula 2005), endorse the portfolio company 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 venture capital investors thus provide complementary resources, increasing the resources, skills and information available for the development, monitoring and decision making of the portfolio companies (Jääskeläinen 2009).

We therefore expect that portfolio companies, in which cross-border and domestic venture capital investors form a syndicate, outperform those in which only domestic or only cross-border venture capital investors invest. This leads to the third hypothesis:

Hypothesis 3: The presence of at least one domestic venture capital investor besides cross-border venture capital investors will positively moderate the relationship between cross-border venture capital and portfolio company growth.

3. METHOD

3.1. Sample and Data

Data was collected through the VICO project, which is a multi-country project on the financing of entrepreneurial companies in Europe. We use part of the VICO database that contains longitudinal data on 761 venture capital -backed companies founded in one of seven European countries, including Belgium, Finland, France, Germany, Italy, Spain and the UK. The sample covers companies that received initial venture capital financing between 1994 and 2004. This ensures that a variety of investment periods were included in the sample (Gulati and Higgins 2003; Hallen 2008). All companies were independent at start-up (i.e., other organizations may have been minority shareholders, but companies were not controlled by other business organizations) and maximum 10 years old at the time of the initial venture capital investment. Furthermore, all companies had to be active in high-tech industries, including aerospace, biotech, energy, ICT manufacturing, internet, nanotech, pharmaceutical, robotics, software, telecom, web publishing and other R&D. The dataset includes companies that eventually fail and hence results are not subject to survivorship bias, which is an important shortcoming characterising most prior research in entrepreneurial finance (Cassar 2004).

For each venture capital -backed company, we collected detailed yearly financial statement data and this from the year of investment up until seven years after the initial venture capital investment. Financial statement data were collected through Amadeus and country specific databases. We recorded key items from the financial accounts, including sales, tangible assets, intangible assets, total assets, cash, equity and financial debt among others. For some companies no sales data were available, which reduces our sample to 692 venture capital -backed companies. Besides detailed yearly financial statement data, we collected data on the financing rounds in each company. In order to obtain data on venture capital investors that provide financing we combined multiple data sources, including Thomson ONE, Zephyr (a database similar to Thomson ONE, but with a stronger European focus), country specific databases, press releases, press clippings and websites. The data for each venture capital investment include investment year, investment amount, venture

capital firm type and venture capital firm age among others. Table 1 (Panel A) provides an overview of the companies in the sample by company founding period, investment year, country and industry.

3.2. Variable definitions

3.2.1. Dependent variable

We track changes in sales (measured in thousands of Euros) from the year of venture capital investment up to seven years after the investment (whenever data is available). The timeframe of our study covers the typical lifespan of venture capital investments which is between three and seven years. We prefer to study changes in sales for at least two reasons. First, sales is often viewed as the most appropriate measure of firm growth, since it applies to most firms and it is rather insensitive to capital intensity and degree of integration (Delmar et al. 2003). Second, in practice sales often plays a critical role in companies. Indeed, planning systems generally begin with sales targets and companies must use a wide variety of goals, including sales growth, to effectively reach their financial objectives (Barkham et al. 1996; Brush et al. 2000), become break-even and eventually reach profitability. We refrain from using accounting-based indicators of profitability, which are inappropriate for young technology-based companies, because most of these companies do not generate any profit during their first years of operations (Shane and Stuart 2002).

3.2.2. Independent variables

We construct a dummy variable equal to one when companies raise initial venture capital finance from at least one *cross-border venture capital (CBVC)* investor and zero otherwise. We define cross-border venture capital investors as those investors that are located in a country different from the country where a portfolio company was founded. Moreover, in order to be defined as cross-border venture capital investors, investors should have no local office in the country where a portfolio company was founded. The cross-border venture capital investor dummy variable allows us to compare the growth pattern of companies that start with only domestic venture capital investors versus companies that start with at least one cross-border venture capital investor.

We also include a variable that captures whether the first investment round was syndicated and the syndicate included at least one domestic venture capital investor. We construct a *syndication (SYND)* dummy variable, which equals one when companies raise initial venture capital from a syndicate including at least one domestic investor and zero otherwise. We further calculate the interaction between the syndication dummy and the cross-border venture capital dummy. The interaction term allows us to compare the growth pattern of companies that start with syndicates which include only domestic venture capital investors versus companies that start with syndicates including cross-border investors and at least one domestic venture capital investor.[1]

We focus on the initial providers of venture capital financing for a number of reasons. First, it is difficult to separate the influence of first-round and later-round investors (Sorensen 2007). For example, although later-round cross-border venture capital investors may influence subsequent portfolio company growth, the ability of the portfolio company to attract later round cross-border investors may also reflect the influence of the initial domestic investor. Second, the composition and identity of the initial venture capital investors is likely to have a significant impact on the identity of the venture capital investors that provide follow-on financing (Hallen 2008). Finally, although changes may occur in the composition of a syndicate over time and our approach may hence introduce some noise into the data, we see no way in which this additional noise biases the results in favour of our hypotheses.

Table 1 (Panel B) provides an overview of our sample, where we distinguish between companies that raise financing from a standalone domestic investor, a cross-border investor (or multiple cross-border investors), a syndicate of domestic investors or a syndicate with at least one cross-border and one domestic investor. Two particular observations are worth noting.

Insert Table 1 About Here

First, cross-border venture capital investors have been active over the entire timeframe of our study, although most cross-border investments are concentrated during the dot-com bubble, the subsequent crash and the following normalization of the venture investment market. Second, while previous studies have stressed the importance of domestic investors in order for portfolio companies to raise cross-border venture capital (Mäkelä and Maula 2008), we find that cross-border investors

[1] Results remain robust when using the natural logarithm of the number of cross-border investors that provide initial financing, and the natural logarithm of the number of domestic investors in a syndicate. The use of dummy variables, however, fits better with the theoretical framework we have developed above. For instance, it may be sufficient to have one domestic venture capital firm investing together with a cross-border venture capital firms to diminish the information asymmetry problems experienced by the latter. This is why we subsequently report our results by using the dummy variables.

also invest on their own without domestic investors and this even in the initial venture capital financing round.

Table 2 shows the origin of the cross-border investors in our sample. Most cross-border investors (42%) come from another Continental European country, while approximately an equal number come from the U.K. and Ireland on the one hand and the U.S. on the other hand. Very few cross- border investors originate from other countries. U.K. and Irish venture capital investors invest relatively more frequently without local investors compared to U.S. investors and investors from other Continental European countries.

Insert Table 2 About here

3.2.3. Control variables

We control for venture capital firm characteristics, industry effects, year effects, country effects and portfolio company characteristics. Table 3 gives an overview of the control variables. For venture capital firm characteristics, we include *VC firm age*, measured as the difference between the investment year and founding year of the lead venture capital firm providing initial financing. This measure partially controls for the fact that older venture capital firms may have more experience and may have established a broader network in the venture capital community (Sorenson and Stuart 2001).

Insert Table 3 About Here

The average lead venture capital investment firm is 14 years (median: 4 years) when investing in a portfolio company; cross-border investors are older (average: 24 years; median: 7 years). We further control for the type of venture capital firm involved. Venture capital firms are often affiliated with other organizations and these affiliations may shape their strategies and objectives, and, by extension, the growth patterns of their portfolio companies. For instance, bank-related venture capital firms may invest in companies for which they can then provide further financial services, including debt finance (Hellmann et al. 2008). We include four dummy variables, which are equal to one when the venture capital firm that provides initial financing is respectively a *bank-related investor (17.92% of portfolio companies), corporate investor (14.31%), university-related investor (5.06%), government-related investor (24.57%)*, and zero otherwise. *Independent (62.72%)* venture capital firms serve as the reference category.

For portfolio company characteristics, we include *portfolio company age*, measured as the difference between the year of the initial venture capital investment and company founding year, since it is well-established in the organizational growth literature that age effects cause differences in growth patterns. Companies are on average 2.2 years (median: 1 year) when receiving a first venture capital investment. Portfolio companies raising venture capital from cross-border investors only are slightly younger (average age: 1.82 years; median 1 year). We also control for the *initial amount of finance* raised by the portfolio companies. 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). The mean venture capital amount invested is €3,324,000 (median: €910,000). Cross-border investors invest higher amounts (average: €8,944,000), while the highest amounts are invested by syndicates comprised of domestic and cross-border investors (average: €9,820,000). 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). The average (median) firm in the sample has 24% (8%) of intangible assets compared to total assets, with the highest intangible assets ratio occurring in firms which are financed by stand-alone domestic investors (average: 30%; median: 9%). This suggests that domestic venture capital investors invest in companies with higher growth potential, or with higher information asymmetries.

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. Table 1 shows that the most important industry is the software industry (35%), followed by the biotech industry (17%), the ICT industry (16%) and the internet industry (13%). We also include *year dummies* for the wide variety of investment periods included in our sample, including the development of the venture investment market, dot-com bubble, the subsequent crash, and the following normalization of the venture investment market (Gulati and Higgins 2003; Hallen 2008). Such controls are important since companies may exhibit different growth patterns depending upon the investment period when they received their initial venture capital investment. We further include *country dummies* to control for potential country effects, since previous research has shown that the institutions and norms that structure venture capital investing exhibit significant commonalities as well as significant variations across countries (Sapienza et al. 1996).

Close to 20% of all sample firms come from the U.K. and 19% from Germany; 16% come from France and 14% from Italy. Spanish firms represent 11% of the sample, while Belgian and Finnish companies represent slightly less than 10% of all firms in the sample (see Table 1).

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 can potentially 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).

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 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 (Bliese and Ployhart 2002; Hausknecht et al. 2008; 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. This assumption seems reasonable for many applications in organizational studies. Individual profile plots (not presented) confirm significant heterogeneity in initial sales and the evolution of sales over time. 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:

$$sales_{ij} = \beta_{1i} + \beta_{2i}\, t_{ij} + e_i \qquad (1)$$

where $sales_{ij}$ is the ith company's sales at the jth time point. t_{ij} is a simple count measure representing the successive years after the initial venture capital investment (0, 1, 2, ..., 7) which is used to fit a linear trend to the ith company's data across time. β_{1i} and β_{2i} are the company specific intercept and linear coefficient respectively. The values of the βs 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):

$$sales_{ij} = \beta_{1i} + \beta_{2i}\, t_{ij} + \beta_{3i}\, t_{ij}^2 + e_{ij} \qquad (2)$$

The second level in the hierarchy are the group-level models. 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 equation (2) quadratic individual change model, the group level equations are:

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

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

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

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, 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.

An extension of the unconditional RCM discussed above is to incorporate predictors of change. The key predictors of change in this paper are the cross-border venture capital variable, the syndication variable and their interaction. 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 venture capital involvement, syndication and their interaction. These predictors of change are static covariates which are incorporated in the group-level equations. Consider the individual-level quadratic change model (2) above. The group level equations studying change conditional on syndication, cross-border venture capital involvement and their interaction then become:

$$\beta_{1i} = \beta_1 + \beta_4 CBVC_i + \beta_5 SYND_i + \beta_6 CBVC_i \times SYND_i + b_{1i} \quad (6)$$

$$\beta_{2i} = \beta_2 + \beta_7 CBVC_i + \beta_8 SYND_i + \beta_9 CBVC_i \times SYND_i + b_{2i} \quad (7)$$

$$\beta_{3i} = \beta_3 + \beta_{10} CBVC_i + \beta_{11} SYND_i + \beta_{12} CBVC_i \times SYND_i + b_{3i} \quad (8)$$

where $CBVC_i$ indicates whether cross-border venture capital was raised, $SYND_i$ indicates whether the first investment was syndicated with at least one domestic investor, and $SYND_i$*$CBVC_i$ is the interaction term measured at the time of the initial venture capital investment for the i-th company. β_4 is the relationship between cross-border venture capital and intercept or initial sales, β_7 is the relationship between cross-border venture capital and linear change in sales and β_{10} is the relationship between cross-border venture capital and quadratic change in sales. β_4 is the cross-border venture capital by intercept interaction and shows how the mean initial sales of companies is dependent upon the receipt of cross-border venture capital. β_7 is the cross-border venture capital by linear trend interaction and indicates how the mean linear trend in sales is dependent upon the receipt of cross-border venture capital. β_{10} is the cross-border venture capital by quadratic trend interaction and indicates how curvature is dependent upon the receipt of cross-border venture capital. Similar interpretations hold for coefficients relating to the syndication dummy and the interaction term.

4. RESULTS

4.1. Descriptive Statistics

Table 4 reports descriptive statistics on sales from the year of investment up to seven years after the initial venture capital investment. It confirms that the average venture capital -backed company in our sample demonstrates significant sales growth over time. The large difference between mean and median sales indicates the distribution of sales is skewed towards the higher sales values. We use the natural logarithm of sales 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).

Insert Table 4 About here

Table 4 further indicates the sample size for sales at various points in time. Traditional longitudinal techniques require either complete data or assume data are missing completely at random (MCAR). MCAR implies that an unconditional random process, like a random number generator, is responsible for the missing data. A major advantage of the RCM framework is that under the assumption of missing at random (MAR), missing data can be accommodated (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 venture capital. For instance, when a company received initial venture capital in 2004, accounting 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.[2]

[2] We also have missing data because companies failed. Failed companies were those that ceased to operate over the timeframe of the study. We decided not to eliminate data of these failed companies altogether, since this would introduce survivorship bias (Cassar 2004). Rather, we used as much of the data that is available on failed companies and include observations for the years failed companies operated. As a robustness check, we included the failed companies with zero sales for each year in which they could have had sales if they had lived (see Eisenhardt and Schoonhoven 1990). This procedure provided similar results compared to those described below.

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 venture capital 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 are shown in Table 5. Model 1 reports the means model or no change model, which will serve as the baseline model in other to determine whether more complex growth models are needed.

Insert Table 5 About Here

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 using the -2 log-likelihood statistic (-2LL) based on the chi-square distribution (Bliese and Ployhart 2002). The -2LL value associated with the more complex model is subtracted from the -2LL value associated with the more parsimonious model and the difference is tested for statistical significance using a chi-square test. When comparing the means model (model 1) with the linear model (model 2) the difference is distributed as chi-squared with $df = 3$. Since $\chi^2(3, \alpha = 0.05) = 7.815$ and the difference in -2LL equals 1118 (=12348-11230), we find that the linear models fit the data significantly better compared to the constant models. When comparing the linear model (model 2) with the quadratic model (model 3) the difference is distributed as chi-squared with $df = 4$. Since $\chi^2(4, \alpha = 0.05) = 9.488$. The difference in -2LL equals 165 (=11230-11065), implying that the quadratic models have a significantly better fit compared to the linear models. Hence, the quadratic change models provide the best fit, and we discuss this model in more detail below.

The quadratic change model allows the modelling of curvilinear change in sales. The fixed effects estimate initial sales, instantaneous rate of change in sales and curvature, a parameter that describes a changing growth rate of sales over time. Model 3 indicates, unsurprisingly, that the average venture capital-backed company has positive non-zero sales (5.5369; $p < .001$) in the year of the initial venture capital investment. Because the instantaneous rate of change is positive, sales grow by .5906 ($p < .001$) in the first year after venture capital investment. But the negative curvature (-.0525; $p < .001$) 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 and syndication with domestic investors on sales growth in venture capital-backed companies. This allows testing the hypotheses.

4.3. Hypothesis Tests

Table 6 evaluates the controlled effect of receiving first round venture capital financing from cross-border venture capital investors and from syndicates with at least one domestic investor on the growth pattern of venture capital -backed companies.

Insert Table 6 About Here

In Model 4 we control for the age of the lead venture capital firm at the time of investment, venture capital firm types involved in the initial investment, industry effects, country effects, year effects and portfolio company age. In Model 5 an additional control is included for the investment amount provided by the first round investors. In Model 6 we further include the relative amount of intangible assets at time of the first investment to control for difference in growth potential between companies. Note that adding these additional controls to our models reduces the sample size due to data unavailability. The results of the three conditional RCM models are qualitatively similar. We therefore focus our subsequent discussion on the most complete model (Model 6).

The growth pattern of sales is summarized in three parameters, more specifically initial size, instantaneous rate of change (linear growth) and curvature (quadratic growth). We fail to find an effect of cross-border venture capital, syndication with domestic investors and their interaction on the initial sales level in venture capital-backed companies. This suggests that the initial size of the portfolio company is not related to the probability of being funded by either cross-border or domestic investors.

Receiving initial finance from at least one cross-border venture capital investor significantly affects the sales growth trajectories of portfolio companies. Specifically, companies backed by cross-border venture capital investors exhibit a significantly lower instantaneous growth rate (-.4968; $p < .01$) compared to portfolio companies backed by domestic venture capital investors. This provides support for our first hypothesis: companies backed by cross-border venture capital investors initially exhibit lower sales growth compared to companies that raise initial finance from domestic venture capital investors.

Although companies backed by cross-border venture capital investors have a lower instantaneous growth rate, curvature is significantly higher and positive (.0754; $p < .01$). This indicates that although sales initially increase at a higher rate in companies backed by domestic investors, sales growth diminishes more quickly over time in companies backed by domestic investors 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 exceed the growth rate of companies backed by domestic investors. This provides support for our second hypothesis: companies backed by cross-border venture capital investors exhibit higher growth in later stages compared to companies that raise initial finance from domestic venture capital investors. A further analysis of the evolution of sales in companies backed by a standalone domestic investor and companies backed by a cross-border investor (or a syndicate comprising only cross-border investors) shows that the shift in growth rates between these two groups of companies is located within the timeframe of our study. Specifically, while the growth rate of the average company backed by a standalone domestic investor equals .87 one year after the investment, it equals .24 four years after the investment. The growth rate of the average company backed by one or multiple cross-border investors equals .23 one year after the investment, while it equals .28 four year after the investment. Differences between growth rates of the average companies backed by standalone domestic or cross-border investors become even more pronounced in subsequent years. This provides additional supporting evidence for our second hypothesis. Figure 1 summarises these distinct effects graphically[3]. It shows that the mean company, backed by cross-border venture capital investors, develops initially more slowly after investment than the mean company, backed by domestic venture capital investors. At the end of the observation period, sales of companies backed by cross-border venture capital investors fully catch up with those of companies backed by domestic venture capital investors. Interestingly, the sales growth of companies backed by cross-border venture capital investors is still significantly positive seven years after investment (which corresponds with the end of the observation period), while it is significantly negative for companies backed by domestic venture capital investors. This suggests that cross-border investors are more beneficial in the long run compared to domestic investors, even if the initial development of their portfolio companies is slower in the early years after the investment.

[3] Note that we do not graph the evolution of the natural logarithm of sales, but prefer to graph the evolution of sales, for ease of interpretation.

The interaction term between the presence of cross-border investors and syndication with domestic investors demonstrates that portfolio companies initially backed by syndicates including both cross-border and domestic venture capital investors show a significantly higher instantaneous rate of change (.5234; $p < .05$). We find evidence that syndication with domestic investors benefits the growth of companies backed by cross-border investors compared to companies that are only backed by cross-border venture capital investors. Nevertheless, curvature is negative in companies backed by cross-border investors and at least one domestic investors (-.0689; $p < .05$), which entails that curvature is similar between companies backed by cross-border investors and at least one domestic investors and companies that raise finance from domestic investors only.

Figure 1 demonstrates that although companies backed by a syndicate comprising cross-border and domestic investors have similar sales compared to other venture capital backed companies, they develop into the biggest sales generators by the end of the timeframe of our study. It provides support for hypothesis 3: a syndicate comprising domestic and cross-border venture capital investors positively moderates the relationship between the presence of cross-border venture capital investors and sales growth. Sales of companies, backed by a syndicate comprised of domestic and cross-border venture capital investors are higher than those of other companies during the whole observation period.

Insert Figure 1 About Here

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 two specific concerns. First, although sales is typically considered to be the most appropriate growth measure and sales is the preferred growth measure by entrepreneurs themselves, growth is considered to be multidimensional in nature (Delmar et al. 2003). Second, it is important to consider potential endogeneity concerns. Indeed, our results may be attributable to matching on the basis of unobservable characteristics (Shaver 1998). More specifically, cross-border (domestic) venture capital firms may select companies with different growth potential, or alternatively companies with different growth potential may select cross-border (domestic) venture capital firms (Eckhardt et al. 2006).[4]

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

We address the multidimensional nature of company growth by studying change in alternative growth measures. First, we reran all models with the natural logarithm of total assets as our dependent variable. Results are qualitatively similar, and even stronger, when using the natural logarithm of total assets as the dependent variable. Specifically, companies backed by cross-border investors exhibit lower instantaneous growth rates in total assets compared to companies backed by domestic investors. But companies backed by cross-border investors have higher curvature compared to companies backed by domestic investors. When domestic investors and cross-border investors provide initial finance, instantaneous growth rates are higher compared to cases where only cross-border investors provide initial finance. Different from the models with the natural logarithm of sales as the dependent variable is that curvature is similar between companies backed by only cross-border investors or a syndicate comprising cross-border and domestic investors. This implies that for both groups curvature is significantly higher compared to companies backed by only domestic investors. Using total assets as an alternative growth measure hence provides strong support for our three hypotheses.

Second, we reran all models with the natural logarithm of wages paid as our dependent variable. This measure reflects both the number of employees and quality of employees, when assuming that employees with more human capital will be more expensive (Medoff and Abraham 1980). Results remain qualitatively similar. We find support for our first two hypotheses. When companies initially raise finance from cross-border investors instantaneous growth rates are lower, but curvature is higher. We find only weak evidence for our third hypothesis, however. Overall, our results are largely robust when using different growth measure, but call for more research on the complex interaction between different growth measures.

We also performed three tests in an effort to assess potential endogeneity concerns empirically. First, we included an additional control for differences in the growth potential between companies in our main results presented in Table 6. When including the ratio of intangible assets on total assets in Model 6 results remained remarkably stable compared to the other models, despite a significant reduction in sample size. Moreover, all models fail to find an association between the initial level of sales and the receipt of cross-border venture capital. Differences between companies backed by cross-border investors and domestic investors only emerge in the years following the initial investment.

Second, we collected data on a subsample of companies for which we have data available from two to one year before the initial venture capital investment was made. We split our sample in companies backed by a standalone domestic investor, a standalone cross-border investor (or a syndicate comprising only cross-border investors), a syndicate of domestic investors and a syndicate

comprising cross-border and domestic investors. We did not find systematic differences in growth rates from two to one year before the venture capital investment between companies in the different groups. This implies that cross-border (domestic) venture capital investors do not necessarily select companies with higher growth rates pre-investment.

Third, we collected data on the exits realized in the group of companies backed by a standalone domestic investor, a standalone cross-border investor (or a syndicate comprising only cross-border investors), a syndicate of domestic investors and a syndicate comprising cross-border and domestic investors. The proportion of failures in each group is relatively similar, with failure rates somewhat higher in the companies backed by cross-border venture capital investors. This indicates that cross-border venture capital investors (whether they invest alone or in a syndicate with a domestic investor) do not necessarily have access to the best entrepreneurial companies. Overall, these additional tests together indicate that it is unlikely that selection is entirely driving our results.

5. DISCUSSION AND CONCLUSION

While it has been widely acknowledged that venture capital investors have on average a positive contribution on the development of their portfolio companies, evidence is increasing that not all venture capital is the same. This paper contributes to this stream of research by differentiating between portfolio companies backed by domestic and cross-border venture capital investors. While previous studies indicate that cross-border venture capital is an increasingly important phenomenon, especially for high-tech companies with high growth potential (Mäkelä and Maula 2008), there is little evidence on the impact of cross-border investments on the economic development of the portfolio companies. Based upon a sample of 692 young high technology companies from seven European countries and using a longitudinal research strategy, we have shown that companies backed by cross-border venture capital investors grow initially at a lower rate than companies backed by domestic venture capital investors. In later years, companies backed by cross-border venture capital investors exhibit higher growth rates, however. Companies backed by a syndicate comprised of domestic and cross-border venture capital investors develop more strongly, both in the short and in the long run, than other venture capital backed companies.

Our findings suggest that proximity and knowledge of the local institutional and legal environmental are important for venture capital investors investing in early phases of company development. Domestic venture capital investors are better equipped than cross-border investors to overcome information asymmetries and to provide the resources relevant in the early development phase. Refining the opportunity and building the early resource base is important in this phase, and

domestic venture capital investors are better equipped to provide support in these matters. Cross-border investors, on the other hand, have a better knowledge of external markets and are able to provide legitimacy to the entrepreneurial firm in international markets. These resources are especially beneficial for more developed firms. 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. Portfolio companies exhibit 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 resources that investors may bring to a heterogeneous venture capital syndicate (Dai et al. 2010).

The finding that companies, backed by heterogeneous syndicates comprised of both domestic and cross-border investors, is interesting. It shows that both types of partners play a complementary role from an early stage onwards. While the internationalization resources provided by cross-border investors constrain early company growth when no domestic investors are present, these resources enhance company growth when complemented by those provided by domestic investors. This might reflect that portfolio companies implement internationalization routines in an early development phase, which may be further exploited in a later stage when internationalization becomes important. This is consistent with the imprinting view, suggesting that early routines have a long-lasting effect on company development. Combining the complementary resources of domestic and cross-border investors is hence relevant from an initial development stage.

Our study is important, as few studies have disentangled the effects of domestic and cross-border venture capital investors on their portfolio companies. Most studies on the effects of venture capital have studied performance at the venture capital firm or fund level, focusing on portfolio company exit and/or survival, or focusing on post-IPO performance (limiting these studies to the most successful portfolio companies). Our study, in contrast, is one of the first to focus on the development of the portfolio company. This is important for entrepreneurs, as the goals of investors and entrepreneurs are not always aligned. Understanding how portfolio companies develop after having received venture capital, and how different types of investors contribute differently to firm development, is hence relevant.

The longitudinal 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 development in-between (and outside) 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, studies focusing on the short-term would have a tendency to conclude that cross-border venture capital is associated with lower growth as the instantaneous growth rate in sales is lower in companies backed by only cross-border investors. Yet, long-term studies would have a tendency to conclude that cross-border venture capital is associated with higher growth as the growth rates of companies backed by at least one cross-border investor increases more strongly over time. This study provides a further call for research that takes advantage of recent developments in longitudinal data analysis to study the dynamic nature of growth over time.

As with all research, this study also has limitations. First, we differentiate companies based on the first investment round venture capital investor characteristics, ignoring investors that may invest in a later investment round. This provides important avenues for future research. For instance, is there a different impact of syndication composition in a first round of finance versus subsequent rounds of finance? Second, cross-border investors may differ from domestic investors in both their selection behavior and their involvement in portfolio companies 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 portfolio companies on the basis of unobservable characteristics (Dai et al. 2010). However, the main purpose of this study was to gain an insight into how the presence of a cross-border investor influences the growth of portfolio companies. Whether these differences are due to selection or value adding is another question which warrants further study.

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 portfolio companies of domestic investors are more likely to exhibit high growth early-on, companies backed by cross-border venture capital investors have more sustainable growth rates in the long run, and especially so if domestic venture capital firms co-invest with cross-border venture capital firms. 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 has also important implications for public policy makers. Public policy programs that aim to develop a strong local venture capital industry in order to

foster the development of local entrepreneurial companies should recognize that stimulating cross-border investments is a beneficial strategy. This not only increases the pool of financial capital available for entrepreneurial companies, but also provides complementary resources that help them to develop and grow more strongly.

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TABLE 1: DESCRIPTION OF THE SAMPLE

	PANEL A		PANEL B							
	Total sample		Domestic standalone		Domestic syndicated		CBVC		CBVC- Domestic syndicated	
	Number	%	Number	%	Number	%	Number	%	Number	%
Foundation period										
1984-1989	21	3.0	19	4.3	1	0.7	0	0.0	1	1.4
1990-1994	87	12.6	61	13.9	15	10.2	4	12.1	7	9.7
1995-1999	313	45.2	195	44.3	69	46.9	14	42.4	35	48.6
2000-2004	271	39.2	165	37.5	62	42.2	15	45.5	29	40.3
Year first investment										
1994	11	1.6	10	2.3	0	0.0	1	3.0	0	0.0
1995	16	2.3	15	3.4	1	0.7	0	0.0	0	0.0
1996	27	3.9	21	4.8	2	1.4	2	6.1	2	2.8
1997	47	6.8	42	9.5	3	2.0	2	6.1	0	0.0
1998	48	6.9	33	7.5	9	6.1	2	6.1	4	5.6
1999	68	9.8	38	8.6	21	14.3	3	9.1	6	8.3
2000	177	25.6	104	23.6	37	25.2	9	27.3	27	37.5
2001	114	16.5	65	14.8	25	17.0	9	27.3	15	20.8
2002	67	9.7	41	9.3	16	10.9	4	12.1	6	8.3
2003	59	8.5	38	8.6	16	10.9	0	0.0	5	6.9
2004	58	8.4	33	7.5	17	11.6	1	3.0	7	9.7
Country										
Belgium	65	9.4	42	9.5	14	9.5	1	3.0	8	11.1
Finland	68	9.8	59	13.4	4	2.7	0	0.0	5	6.9
France	109	15.8	40	9.1	60	40.8	0	0.0	9	12.5
Germany	134	19.4	81	18.4	18	12.2	14	42.4	21	29.2
Italy	97	14.0	71	16.1	10	6.8	11	33.3	5	6.9
Spain	82	11.8	72	16.4	9	6.1	0	0.0	1	1.4
UK	137	19.8	75	17.0	32	21.8	7	21.2	23	31.9
Industry										
Biotech	115	16.6	69	15.7	26	17.7	4	12.1	16	22.2
Energy	2	0.3	0	0.0	2	1.4	0	0.0	0	0.0
ICT	110	15.9	71	16.1	29	19.7	2	6.1	8	11.1
Internet	93	13.4	59	13.4	11	7.5	10	30.3	13	18.1
Other R&D	22	3.2	17	3.9	4	2.7	0	0.0	1	1.4
Pharmaceutical	24	3.5	16	3.6	5	3.4	1	3.0	2	2.8
Robotics	15	2.2	13	3.0	2	1.4	0	0.0	0	0.0
Software	239	34.5	152	34.5	51	34.7	12	36.4	24	33.3
TLC	40	5.8	21	4.8	11	7.5	4	12.1	4	5.6
Web publishing	32	4.6	22	5.0	6	4.1	0	0.0	4	5.6
Total	**692**	**100.0**	**440**	**100.0**	**147**	**100.0**	**33**	**100.0**	**72**	**100.0**

TABLE 2: ORIGIN OF CROSS-BORDER VENTURE CAPITAL INVESTORS

	Total sample		Standalone CBVC (or syndicate of CBVC)		CBVC- Domestic syndicated	
	Number	**%**	**Number**	**%**	**Number**	**%**
CBVC from North	34	27.64	7	19.44	27	31.40
CBVC from UK and	32	26.02	13	36.11	19	22.09
CBVC from Continental	52	42.28	14	38.89	37	43.02
CBVC from other	5	4.07	2	5.56	3	3.49
Total	**123**	**100.00**	**36**	**100.00**	**86**	**100.00**

TABLE 3: DESCRIPTIVE STATISTICS OF CONTROL VARIABLES

		Venture capital firm age	*Portfolio company age*	*Initial amount of finance (x €1.OOO)*	*Intangible asset ratio*
Total sample	Mean	13.77	2.29	3324.05	24.26%
	Median	4.00	1.00	910.00	8.26%
	SD	49.91	2.70	8748.40	139.71%
	N	692	692	531	496
Domestic standalone	Mean	13.82	2.34	1442.90	29.99%
	Median	4.00	1.00	475.50	8.75%
	SD	60.90	2.77	2590.70	172.84%
	N	440	440	328	322
Domestic syndicated	Mean	10.74	2.32	4272.00	15.39%
	Median	5.00	1.00	2030.99	10.09%
	SD	14.57	2.62	8951.19	16.58%
	N	147	147	123	111
CBVC	Mean	23.67	1.82	8944.38	10.27%
	Median	6.00	1.00	3250.00	4.61%
	SD	30.62	2.47	17176.27	13.00%
	N	33	33	22	18
CBVC - Domestic syndicated	Mean	15.05	2.15	9820.11	10.67%
	Median	7.00	1.00	4023.12	6.09%
	SD	19.61	2.53	17762.70	13.95%
	N	72	72	58	45

TABLE 4: DESCRIPTIVE STATISTICS FOR SALES (IN 000 EUR)[A]

Time	0	1	2	3	4	5	6	7
Mean	2161.1	2685.9	3314.4	4680.29	5695.20	7440.91	9629.89	11746.9
Median	421.00	699.49	875.50	1123.63	1597.50	1853.16	2297.50	2513.00
Std.	8094.2	7457.8	8248.7	12628.7	14282.5	18719.6	30794.0	42455.7
N	429	505	524	482	448	365	312	226

[a] Time is a simple count measure representing successive years where zero equals the year of the initial venture capital investment.

TABLE 5: UNCONDITIONAL RCM WITH THE NATURAL LOGARITHM OF SALES AS THE DEPENDENT VARIABLE

	Model 1	Model 2	Model 3
Initial Size	6.6071 ***	5.8573 ***	5.5369 ***
	(0.0741)	(0.0811)	(0.0849)
Instantanious rate of		0.2647 ***	0.5906 ***
		(0.0168)	(0.0299)
Curvature			-0.0525 ***
			(0.0040)
-2LL	12348	11230	11065
Number of observations	3291	3291	3291

Where † p < 0.10, * p < 0.05, ** p < 0.01 and *** p < 0.001 (Conservative two-tailed tests).

TABLE 6: CONDITIONAL RCM WITH THE NATURAL LOGARITHM OF SALES AS DEPENDENT VARIABLE

		Model 4 [a]	Model 5 [b]	Model 6 [c]
Initial Size	Intercept	4.7145 **	1.7116 **	2.0463 **
		(0.294	(0.521	(0.578
	Cross-Border VC	0.5069	-	-
		(0.355	(0.439	(0.526
	Syndication	0.1702	-	-
		(0.223	(0.252	(0.271
	Cross-Border VC x	0.1443	0.0548	0.2514
		(0.452	(0.527	(0.628
Instantaneous rate of	Intercept	0.7627 **	0.8331 **	0.8681 **
		(0.118	(0.205	(0.220
	Cross-Border VC	- **	- **	- **
		(0.137	(0.167	(0.188
	Syndication	-	-	-
		(0.090	(0.103	(0.109
	Cross-Border VC x	0.2794	0.5124 *	0.5234 *
		(0.180	(0.210	(0.236
Curvature	Intercept	- **	- †	- †
		(0.015	(0,026	(0,028
	Cross-Border VC	0.0601 **	0.0730 **	0.0754 **
		(0.018	(0.022	(0.024
	Syndication	0.0109	0.0215	0.0213
		(0.012	(0.014	(0.015
	Cross-Border VC x	- †	- *	- *
		(0.024	(0.028	(0.031
	-2LL	10595.	8543.6	7683.1
	Number of observations	3291	2639	2379

[a] Includes the following control variables (not presented due to space considerations): industry dummies, country dummies ,year dummies, lead venture capital firm age, venture capital firm type and portfolio company age.

[b] Includes the following control variables (not presented due to space considerations): control variables of Model 4 and initial investment size.

[c] Includes the following control variables (not presented due to space considerations): control variables of Model 5 and intangible assets ratio.

Where † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$ (Conservative two-tailed tests).

FIGURE 1: PREDICTED GROWTH CURVES FOR PORTFOLIO COMPANY SALES (IN 000 EUR)