Cross-Border Venture-Capital Investments: The Impact of Foreignness on Returns

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Abstract

Against the background of the growing internationalization of venture capital (VC) investing, this is the first comparison of the returns generated by individual domestic and cross-border deals. Examining investments worldwide during 1971 to 2009, we find that cross-border investments significantly underperform equivalent domestic investments. Returns are negatively affected by geographic distance, cultural disparities and institutional differences between the home and host countries. Returns on both cross-border and domestic deals decline after the late 1990s. International portfolio diversification and saturation of domestic markets may explain why VC investors invest cross-border despite poor expected returns.

JEL classification: G24, G32, G33, G34, G1

Key words: venture capital, cross-border, returns, IRR, PME, foreignness, distance

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1. Introduction

This study examines the returns generated by venture capital (VC) investments in domestic and cross-border deals. Venture capital (VC) firms are specialized financial intermediaries that raise funds from investors and invest them in innovative new businesses, so-called portfolio companies, with a view to realising their investment after around 5-7 years (e.g., Sahlman 1990, Gompers and Lerner 2004, Black and Gilson 1998). In a domestic deal, a VC firm invests in its home country; and in a cross-border deal it invests outside its home country. VC firms are experts at investing in inherently risky and informationally opaque start-up ventures (e.g., Gorman and Sahlman 1989; Gompers 1995; Amit, Brander and Zott 1998). The high information asymmetries involved in such investments give rise to adverse selection prior to investment and agency conflicts post-investment. To limit these problems, VC firms closely screen potential investee companies, conduct careful due diligence, and align entrepreneurs' incentives with firm value through monitoring, governance, contracts and other mechanisms including staged financing (e.g., Sahlman 1990, Admati and Pfleiderer 1994; Wright and Robbie 1998; Manigart and Wright 2013). By resolving information problems and incentive conflicts, and by providing portfolio companies with advice, expertise and access to networks, VC investors are able to add value to their investments (e.g., Gorman and Sahlman 1989; Sapienza 1992; Sapienza, Manigart and Vermeir 1996; Devigne, Vanacker, Manigart and Paeleman 2013).

The effectiveness of these specialized methods, mechanisms and practices is often believed to depend crucially on VC investors' familiarity with local markets, their access to local information, knowledge, and networks, and the proximity between VC investors and their investee (portfolio) companies to maintain close links, frequent interaction and valuable reputational capital (e.g., Cumming and Johan 2007; Chen et al. 2010; Dai et al. 2012; Hain, Johan and Wang 2015; Wuebker, Kraeussl and Schulze 2016). As a result, VC investing has

long been thought to be an inherently local business (Wright and Robbie 1998; Cumming and Dai 2010; Dai et al. 2012).

Apparently defying this view, the two decades prior to the Financial Crisis of 2007 saw a large increase in the number and size of cross-border venture-capital (VC) investments. Aizenman and Kendall (2012) report an increase in worldwide cross-border VC investment deals from 15% in the early 1990s to over 40% of global deal volume in 2007. More recently, cross-border investing by U.S. VC firms has risen sharply with early-stage VC investments increasing from under 10 percent to over 30 percent of VC deals in 2013 (Wuebker, Kraeussl and Schulze 2016). In Asia, more than 70% of VC deals are funded by foreign VCs (Dai, Jo and Kassicieh 2012).

Against this background of increasing VC internationalization, we examine the return performance of cross-border and domestic VC investments. VC investors may require higher or lower returns from cross-border investments than from domestic investments. On one hand, VC firms investing abroad are likely to encounter 'liabilities of foreignness' due to geographical distance, cultural disparity and institutional differences between VC investors and their portfolio companies (Zaheer 1995; Wright, Pruthi and Lockett 2005). As a result, cross-border investing gives rise to higher transaction costs (e.g., Portes and Rey 2005) and greater costs due to more severe information asymmetries and agency conflicts (Wright and Robbie 1998; Wuebker et al. 2016). In this case, VC investors require higher return from cross-border investments to compensate for the additional costs. On the other, cross-border investing facilitates portfolios diversification, and VC investors with portfolios predominantly invested in domestic ventures may require lower returns from cross-border investments (e.g., Poterba and French 1991). High levels of VC funds chasing limited numbers of promising investment opportunities may drive VC investors to resort to cross-border investing even though they expect these to generate relatively low returns (Gompers

and Lerner 2000). Cumming, Fleming and Schwienbacher (2009) find the US investments of Asian-Pacific VC firms generate lower returns than their domestic investments.

Cumming et al. (2009) use hand-collected and largely proprietary data to assess the performance of 468 individual VC investments during 1989-2001 based on their internal rates of return (IRR). Other previous studies of VC performance typically lack sufficiently detailed deal-level data to compute direct measures of performance such as IRR or public market equivalent (PME) for individual investments. Due to data limitations, most previous studies measure performance in terms of the likelihood of successful VC exit (e.g., Hochberg, Ljungqvist and Lu 2007) rather than IRR or PME. Bengtsson and Hsu (2015) explicitly note the use of exit success as a limitation of their analysis.[1] Devigne, Manigart and Wright (2016) highlight that the existing evidence on VC returns at deal level is limited and call for further research on understanding the variation of returns. Our paper contributes to the literature by estimating actual returns using proprietary cash-flow data at the level of individual VC deals for 6,529 domestic and cross-border VC investments made around the world during 1971-2009. To our knowledge, this is the first study to find that the underperformance of cross-border investments relative to equivalent domestic investments is a global and persistent phenomenon. We base this conclusion on our analysis of the returns and other performance measures of a broad global sample of VC investments comprising large numbers of host and destination countries and spanning over three decades.

Our results show that cross-border deals generate lower returns than equivalent domestic deals on return-based performance. We address differences in VC investors' target selection and risk, and conclude that the observed return differentials amount to cross-border

[1] With respect to their analysis of exit as a measure of VC success, Bengtsson and Hsu (2015) point out that an "important caveat for this part of our analysis is that we equate the investment outcome with the company's exit mode *due to data limitations*. This outcome variable is a coarse measure of investment performance, though it is commonly used in the entrepreneurship literature." (p340; italics added).

underperformance. We find that geographical distance, cultural disparity and institutional differences between the home countries of the VC investor and the portfolio company negatively affect cross-border returns. Additional tests show that VC firms benefit from cross-border investing by achieving portfolio diversification and overcoming shortages of domestic investment opportunities in saturated markets. Diversification and saturation of domestic markets may explain why VC investors are attracted to cross-border investing despite the poor return performance of cross-border deals.

Our study helps to resolve conflicting evidence in previous studies examining the effect of geographic distance between VC investor and portfolio company within the US on VC exit performance (Chen, Gompers, Kovner, and Lerner 2010; Cumming and Dai 2010; Bengtsson and Hsu 2015). Chen et al. (2010) report that non-local deals outperform local ones in terms of their probabilities of IPO exit, while Cumming and Dai (2010) find exit outperformance by local deals. Bengtsson and Hsu (2015) focus on the ethnicity of VC investors and founders of entrepreneurial companies and find that while shared ethnicity increases the likelihood of investment, it reduces exit performance. We explore what happens when VC investments cross borders, and examine the impact of geographic distance, cultural disparity and institutional differences similar to Nahata, Hazarika and Tandon (2014) and Dai and Nahata (2016). Like other previous cross-border performance studies, Nahata et al. (2014) and Dai and Nahata (2016) measure performance purely in terms of (IPO) exit probabilities.

Our paper lies at the intersection of literatures across several academic fields including economics, finance, entrepreneurship, management and international business, as outlined in Section 2. Focusing largely on entrepreneurial finance, our paper contributes to the growing literature on the internationalization of VC and private-equity (PE) investment and cross-border VC/PE activity and flows (e.g., Schertler and Tykvová 2011; Tykvová and

Schertler 2011; Schertler and Tykvová 2012; Dai, Jo and Kassicieh 2012; Li and Zahra 2012; Cao, Cumming, Qian and Wang 2015), on the performance of cross-border VC investments in terms of the ability of VC investors to achieve successful exits (e.g., Wang and Wang 2012; Humphery-Jenner and Suchard 2013; Bertoni and Groh 2014; Nahata, Hazarika and Tandon 2014; Cumming, Knill and Syvrud 2016; Dai and Nahata 2016). Within this literature, our paper builds on existing studies of how exit performance is affected by distance, cultural/ethnic disparity and institutional differences between the location of the VC provider and that of the portfolio company within the U.S. (Chen et al. 2010; Cumming and Dai 2010; Bengtsson and Hsu 2015) or internationally (Nahata et al 2014; Dai and Nahata 2016). Our study is also related to the literature on syndication and networks in cross-border investments (Hursti and Maula 2007; Guler and Guillén 2010; Meuleman and Wright 2011; Jääskeläinen and Maula, 2014; Hain, Johan and Wang 2015; Chemmanur, Hull and Krishnan, 2016; Meuleman, Jääskeläinen, Maula and Wright 2017). All previous studies of VC performance lack sufficiently detailed deal level data to compute direct measures of performance such as internal rate of return (IRR) or public market equivalent (PME). Our paper extends the literature by being the first to provide evidence on the return performance of both domestic and cross-border VC deals measured as IRR and PME at the deal level.

The remainder of this paper is organized as follows: Section 2 reviews the literature and develops our hypotheses. Section 3 describes the data and methodology, and Section 4 presents our analysis and results. Section 5 concludes the paper.

2. Literature, Conceptual Framework and Hypotheses

VC firms are experts at bearing risk and dealing with the information and agency problems (adverse selection and moral hazard) that complicate investments in promising, young entrepreneurial businesses characterised by high information asymmetries, high risk

and high potential (e.g., Gorman and Sahlman 1989; Gompers 1995; Amit, Brander and Zott 1998). Such ventures typically have little or no trading record or other information, such as balance-sheet and past cash-flow data, used in traditional valuation methods, and frequently operate in innovative industries with no established benchmark companies. VC firms have developed methods to limit the information and agency problems arising from such investments, including screening, due diligence, contracting, monitoring, governance, staged financing (e.g., Sahlman 1990, Admati and Pfleiderer 1994; Wright and Robbie 1998; Manigart and Wright 2013).

The effectiveness of these specialized methods, mechanisms and practices is often believed to depend crucially on VC investors' familiarity with local markets, their access to local information, knowledge, and networks, and the proximity between VC investors and their investee (portfolio) companies to maintain close links, frequent interaction and valuable reputational capital (e.g., Cumming and Johan 2007; Chen et al. 2010; Dai et al. 2012; Hain, Johan and Wang 2015; Wuebker, Kraeussl and Schulze 2016). Greater distance between VC firms and portfolio companies is likely to increase information asymmetries between investors and investees causing more pronounced adverse selection and moral hazard (e.g., De Prijcker, Manigart, Wright and De Maeseneire 2012; Dai et al. 2012; Hain et al. 2015; Dai and Nahata 2016). Distance may thus increase the costs of identifying and screening suitable investment opportunities to VC firms (Cumming and Dai 2010; Wuebker et al. 2016). VC firms typically conduct due diligence that is more rigorous, and hence more costly for more remote ventures (Nahata et al. 2014). Wright, Lockett and Pruthi (2002) report significant differences in risk assessment and information sources used in target selection between foreign and domestic investors.

Non-local and cross-border investors are at a disadvantage relative to local investors in terms of access to portfolio companies, local information, networks, reputational capital

and resources, and typically incur higher information and transaction costs (Nahata et al. 2014). Higher costs of contracting and monitoring cross-border portfolio companies result in lower firm value and lower value added (Sapienza et al. 1996; Sorensen and Stuart 2001; Dai et al 2012; Wuebker et al 2016). Mäkelä and Maula (2008) confirm that local VC firms are more knowledgeable about portfolio companies' markets than foreign VC firms. VC general partners provide advice and monitoring to portfolio companies during meetings held at the companies' offices, and geographic distance increases the costs and VC partners' time involved (Hain, Johan and Wang 2015). Chemmanur et al (2016) find that lack of (geographic) proximity makes it more difficult for VC firms to move scarce human capital such as skilled VC general partners to the location of the portfolio company. As a result, it is more costly to screen, monitor, advise and support more distant portfolio companies.

This advantage of local investors and investments is the focus of several literatures from a range of academic disciplines including entrepreneurial and corporate finance, economics, and international business. Studies in international business and management, based on the seminal study by Zaheer (1995), refer to the disadvantage of not being local as the 'liability of foreignness'. Studies in asset pricing and corporate finance refer to investors' preferences for more familiar, local over non-local investments as 'home bias' (Poterba and French 1991; Coval and Moskowitz 1999). VC firms investing abroad encounter the 'liability of foreignness' problem (Wright, Pruthi and Lockett 2005; Nahata et al. 2014; Dai and Nahata 2016).

To compensate for the higher costs of cross-border investing as a result of the liability of foreignness, VC firms are likely to require higher returns from cross-border investments than from equivalent domestic investments. On the other hand, cross-border investing facilitates portfolios diversification, and VC investors with portfolios predominantly invested in domestic ventures may require lower returns from cross-border investments (e.g., Poterba

and French 1991). A lack of promising investment opportunities in their home country or high competition for attractive deals due to excess funds available to VC investors may motivate VC firms to embark on cross-border ventures even if they expect them to generate relatively low returns (Gompers and Lerner 2000). For 53 VC funds based in 12 countries in the Asia-Pacific region, Cumming et al. (2009) find that they achieve lower IRRs on investments in US portfolio companies than in domestic investments. On a global level, whether VC investors require higher or lower returns from cross-border investments than from domestic investments remains a question to be resolved empirically.

In comparing the performance of VC firms' selection criteria and investment behaviour may also differ at home and abroad. Empirical evidence confirms that VC investors select different types of ventures at home and abroad. The results of Dai et al. (2012) suggest that VC investors mitigate the higher information and monitoring costs of investing abroad by investing in later financing rounds and in larger, more mature companies that are more transparent and less costly to screen and monitor. VC investors also self-select into cross-border investing. Cumming and Dai (2010) find that investments in more distant firms tend to be undertaken by more reputable and experienced VC investors acting in syndicates to spread risk. In comparing the returns generated by domestic and cross-border investments, it is therefore essential to control for target selection and VC self-selection, in order to compare equivalent domestic and cross-border investments.

Based on our reasoning above, we formulate our first testable hypothesis:

H1: *All else equal, there is no difference in performance between domestic and cross-border VC investments.*

We measure both absolute returns in terms of the internal rate of return (IRR) and returns relative to a market benchmark in the form of public market equivalent (PME). In

addition to returns, we also examine exit performance. To our knowledge, all previous studies of non-local and cross-border VC investments measure performance in terms of exit success. Following Giot and Schwienbacher (2007), they evaluate performance on the basis of whether and how quickly VC investors successfully exit their investments. Existing evidence on the exit performance of investments by US VC firms in local and non-local US portfolio companies is mixed (Chen, Gompers, Kovner, and Lerner 2010; Cumming and Dai 2010; Bengtsson and Hsu 2015). While Chen et al. (2010) find that non-local deals of US VC outperform local ones in terms of their probabilities of IPO exit, Cumming and Dai (2010) find exit outperformance by local deals. Bengtsson and Hsu (2015) focus on the ethnicity of VC investors and founders of entrepreneurial companies and find that shared ethnicity increases the likelihood of investment but reduces exit performance. Our analysis of VC investments across borders is closely related to Dai et al. (2012), Nahata et al. (2014), Li, Vertinsky and Li (2014) and Dai and Nahata (2016).

It is possible that foreign VC firms are less committed to their portfolio companies than local VC firms and may withdraw more quickly in the light of disappointing portfolio company performance. VC firms' premature exit may damage portfolio companies (Mäkelä and Maula 2006). Alternatively, their lower commitment and local embeddedness may allow foreign VC firm to make more efficient exit decisions (Devigne, Manigart and Wright 2016). The exit decisions may have implications for returns: foreign investors' premature exit may result in reduced returns, while more efficient exit decisions may lead to increased returns of cross-border investments. Longer investment durations in portfolio companies not only cause higher monitoring costs but also liquidity problems for VC backers. If cross-border investments require greater efforts and costs spent on advising and monitoring portfolio companies, the higher costs of carrying cross-border investments relative to domestic

investments may tip the balance in favour of earlier exits from cross-border investments (Cumming and Johan 2010; Espenlaub, Khurshed and Mohamed, 2015).

In the final part of our analysis we explore possible reasons why the returns between domestic and cross-border investments differ. In Hypothesis 1, we focus on a binary definition of foreignness. Now we examine the impacts of geographic, cultural or institutional distance. Previous studies show that geographic, cultural and institutional distance between the home and host countries affect the exit performance of VC cross-border investments (Guler and Guillen 2010; Mäkelä and Maula 2008; Li, Vertinsky and Li 2014; Nahata et al. 2014; Dai and Nahata 2016). Existing evidence suggests a negative impact of geographic and institutional distance while the direction of the impact of cultural distance is mixed. Our study contributes to this literature by examining the impact of distance on returns rather than on exit success.

First, we explore whether there is a difference between investments across a single, shared land border and investments across multiple borders. Investments across a single land border may involve less costly travel. Chemmanur, Hull and Krishnan (2016) find that greater travel time adversely affects the exit success of cross-border VC investments. On the other hand, travel costs may depend more closely on geographic distance, and in the next step, we examine the impact of geographic distance. Previous studies find that mixed results with some reporting that greater geographic distance reduces exit performance (Cumming and Dai 2010), others reporting a positive effect (Chen et al. 2010), or no significant effect after controlling for other measures of distance (Li et al 2014; Dai and Nahata 2016). Consequently, we formulate the following hypothesis:

H2a: *VC firm performance in cross-border deals is unrelated to geographical distance between the home countries of the VC firm and portfolio company (after controlling for other measures of distance).*

Due to colonial linkages, geographically distant countries may share similar languages, cultures and institutions. On the other hand, due to historical accident and conflicts, nearby or neighbouring countries may differ greatly not just in language but also in culture and institutional framework. Consequently, as geographic distance may not adequately capture the liability of foreignness, we also examine cultural disparity and institutional differences following Li et al. (2014), Nahata et al. (2014) and Dai and Nahata (2016). VC investors' lack of awareness of local cultural and social practices in unfamiliar cross-border environments can be a source of conflict between the VC firm and portfolio company, increase agency costs and reduce VC performance (Nahata et al 2014). Cultural disparities and institutional differences can adversely affect levels of trust, reputation, financial contracting, and company performance (Li et al. 2014; Nahata et al. 2014). Cultural distance is commonly measured using the approach of Kogut and Singh (1988) based on the measures of culture (power distance, individualism, masculinity and uncertainty avoidance) developed by Hofstede (1980). This approach is also used, among others, in Li et al. (2014), Nahata et al. (2014), Hain et al. (2015) and Dai and Nahata (2016). Li et al. (2014) find that cultural distance reduces exit success while Nahata et al. (2014) find that greater cultural distance increases exit success. Nahata et al. (2014) argue that greater cultural distance motivates VC investors to engage in closer pre-investment due diligence and screening, and this in turn increases exit success. Focusing on the impact of cultural distance on return performance (as opposed to exit success), we test the following hypothesis:

H2b: *VC firm performance in cross-border deals is negatively related to greater cultural distance between the home countries of the VC firm and portfolio company.*

VC investors encounter greater unfamiliarity and liability of foreignness in countries with institutional frameworks more distinct from those in their home country. In more distinct institutional environments, the VC firm's familiar practices are likely to be more at odds with local institutionalized practices with regards to deal selection, contracting, monitoring, and advising (Li et al 2014). E.g., VC firms from countries with strict and well-enforced legal rules and regulations rely on financial and accounting information to evaluate proposals and assess investment risk. By contrast, in countries with weak institutional environments they depend instead on personal contacts to access relevant information and enforce agreements (La Porta, Lopez-de-Silanes, Shleifer and Vishny 1998; Cumming, Fleming and Schwienbacher 2006; Cumming, Schmidt and Walz 2010; Li et al. 2014). VC firms used to effective legal protection of investors and contract enforcement in their home country find they can no longer employ complex, state-contingent contracts in host countries with weak legal institutions (Guler and Guillen 2010). Chemmanur et al. (2016) examine the impact of legal systems on exit success but find no significant impact. Measuring institutional differences using the World Governance Index, Li et al. (2014) find that institutional distance significantly reduces VC exit success. We examine the impact on VC cross-border returns of three dimensions of institutional differences: difference in the legal systems of home and host countries (based on La Porta et al. 1998, similar to Chemmanur et al. 2016), and differences in regulatory quality and political stability (similar to Li et al. 2014). We formulate the following hypothesis:

H2c: *VC firm performance in cross-border deals is negatively related to more pronounced institutional differences between the home countries of the VC firm and portfolio company.*

3. Data and methodology

3.1. Data sources and sample

Our data on individual VC investments are obtained from the Centre of Private Equity Research (CEPRES).[2] CEPRES and its data are described in detail in Franzoni et al. (2012). CEPRES data are used in a number of published studies, including Krohmer, Lauterbach and Calanog (2009), Cumming, Schmidt and Walz (2010), Cumming and Walz (2010), and Franzoni et al. (2012).

Through their special data-collection method (based on the so-called 'Private Equity Analyzer'), CEPRES effectively anonymizes all information relating to investments to meet the confidentiality requirements of the VC and private-equity (PE) firms that provide data to CEPRES. This means that no third parties are able to identify the performance of individual firms, funds or managers. This is important because it eliminates the incentives for VC and PE firms to overstate the results they report to CEPRES. Lack of anonymity in other databases may result in overstating and back-filling of information, amounting to positive self-reporting bias.

Another important advantage of the CEPRES database is the availability of detailed information on cash flows at the level of the individual VC investment. Other databases either lack this information or provide cash flows or IRR only at the fund level.

We start with all 14,224 observations in CEPRES for VC investments made from January 1971 to December 2009. We exclude 2,484 partial exits and non-exits and 5,057 buyout investments.[3] Of the remaining 6,683 observations, we have insufficient cash-flow

[2] CEPRES is a private data provider established in 2001 that offers information on VC deals worldwide.
[3] We focus on fully exited (realized) deals to avoid issues related to the accuracy of the estimated net asset values (NAVs) of unrealized deals or timing issues on when the NAVs are reported. We examine the sensitivity of our results to including partial and non-exits in the robustness section.

data for 154 deals. This leaves us with 6,529 observations on fully realized VC investments exited through IPO, M&A, or liquidation (write-off). We split our sample into four geographical regions by the location of the VC investor: North America, Europe (excluding the UK), the UK and the rest of the world (ROW). Our sample comprises 4,334 observations for North America, 839 for Europe, 363 for the UK and 993 for the ROW.[4] We classify investments as domestic (cross-border) if the VC firm and the portfolio company are located in the same country (different countries).[5]

3.2. Methodology

In this section, we discuss the methodologies used in our analysis. To measure the financial returns to VC investments, we calculate the internal rate of returns (IRR) based on all cash flows to VC investors (both out-flows and in-flows). These cash flows are reported in the CEPRES database. Except for a few studies using proprietary data (e.g., Cumming et al. 2009), most previous studies are limited to observing IRR at the fund level. As we have access to cash-flow data, we are able to calculate IRR based on actual (not proxied) cash flows at the level of the individual VC investment.[6] Cash flows are converted into US dollars following the approach of Franzoni et al. (2012). They are not adjusted for management fees, interest or carried interest. While VC firms commonly use IRR to evaluate their investments in-house, they are often reluctant to disclose IRR figures, and if they do disclose them, they have incentives to overstate the IRR. As a result, reliable data on IRR at the level of the individual VC investment was not previously available to researchers. Some studies are able to calculate IRR but only at the level of the VC fund as a whole (rather than at the level of individual investments held within these funds, as we do here). However, an understanding of

[4] Appendix A provides a breakdown of the distribution of venture capital deals by region during the period 1971 to 2009.
[5] We observe the countries of origin of VC firms and portfolio companies at investment. A limitation of our data is that we do not observe relocations to other countries by either the VC firms or the portfolio companies after the initial investments.

investment level returns is crucial for VC firms to allocate capital efficiently between domestic and cross-border investments and for VC fund investors to select appropriate funds.

For each investment, we observe the stream of cash flows between the start date of the investment and its final liquidation (exit) date and calculate the IRR as the discount rate that equates the present value of net cash flows to zero. The cash flows consist of investments in the portfolio companies and of repayments of dividends and proceeds from exiting the investment.[7]

In addition to IRR, our analysis uses the public market equivalent (PME). IRR is an absolute measure of performance in the sense that it is not measured relative to a benchmark. By contrast, PME is a relative performance measure that compares a venture capital investment to an equivalently timed investment in the relevant public market. It has been interpreted as a market-adjusted multiple of invested capital in that a PME above one means that investors in a given VC deal end up with more wealth than they would have if they had invested in the public markets. We calculate PME as the ratio of discounted cash inflows over discounted cash outflows, where the discount rate is the total return in the corresponding stock market. For investments in US portfolio companies, we use the S&P 500 index to proxy the public market as in Kaplan and Schoar (2005). For investments outside the US, we use the respective local stock-market index. Sorensen and Jagannathan (2015) present rigorous economic underpinnings for PME and show that PME is equivalent to measuring performance using the Rubinstein (1976) dynamic version of the CAPM. They show that under reasonable assumptions about investor utility, PME is robust and valid regardless of the beta of an investment even when beta is time-varying. They conclude that with "PME, investors can evaluate risk-adjusted performance without explicitly calculating any betas or

[6] Note, that the IRRs estimated in our analysis are gross returns as opposed to returns net of fees and the (transaction, search, monitoring) costs incurred by VC firms in undertaking and managing the investment.
[7] In our analyses below we winsorize IRR at 1 percent.

even knowing the risk of the underlying investments" (Sorensen and Jagannathan 2015, p44). Hence, we interpret PME as a risk-adjusted measure of performance.

In our initial multivariate analysis, we regress VC performance on whether or not the portfolio company is domestic or cross-border. Subsequent analyses relate VC performance to measures of distance between the VC firm and the portfolio company. VC performance (the dependent variable) is measured alternately as IRR or PME. To account for the endogeneity of the cross-border indicator arising from (un)observable difference in VC backers' selection criteria and investment behaviour at home and abroad, we estimate a two-stage Heckman model. In the first stage, we estimate a probit model of the probability of an investment being cross-border with the cross-border indicator (coded one for cross-border investments and zero otherwise) as the dependent variable. The instrument used in the first stage is the capital inflow into the VC industry of the VC provider's home country in the year of the investment.[8] In the second stage, we estimate VC performance including the inverse Mills ratio based on the estimates of the first stage among the control (explanatory) variables. The explanatory variable of interest is the cross-border indicator. As control variables we include deal and VC characteristics, such as VC experience, investment size, fund age, and indicators of syndication, stage of financing, industry of the portfolio company and the year of investment (deal year).[9] We also control for country-specific stock-market liquidity (based on the country of origin of the portfolio company) in the year prior to VC exit. We use bootstrapped standard errors. In addition to the two-stage model, we also estimate mixed-effects models based on Hesketh, Skrondal and Pickles (2005), that control for observable and unobservable heterogeneity, i.e., differences between domestic and cross-border investments.

[8] We expect that aggregate capital inflow into the VC industry of a given country make it more likely that VC firms invest abroad as competition among VC firms for domestic investments becomes more intense. This causes VC firms to search out investment opportunities abroad.

[9] The CEPRES database we use only shows whether an investment is syndicated or not. Unfortunately, we cannot distinguish between domestic and foreign syndication.

In our initial analysis we use a binary indicator capturing whether a portfolio company is domestic or cross-border. In a subsequent analysis, we examine an additional binary indicator (*Cross-border not sharing borders*) to differentiate between neighboring countries and foreign countries without shared borders. In the final part of our analysis, we investigate whether distance between the VC firm and the portfolio company affects performance. We use three different measures of distance relating to geographic, cultural and institutional differences between countries of the VC firms and portfolio companies. Geographic distance between the VC firms and portfolio companies is measured as the physical distance between the capitals of the home countries of the VC firms and portfolio companies. As in Dai and Nahata (2016), we quantify cultural differences between the countries of VCs and portfolio companies using the four cultural dimensions of Hofstede et al. (2010) following the approach of Kogut and Singh (1988). The four dimensions relate to power distance, individualism, masculinity and uncertainty avoidance. The Hofstede framework is the most widely used and recognized framework for measuring cultural disparities in different disciplines including international business and management research (Kirkman et al., 2006; Sivakumar & Nakata, 2001). We obtain data from Geert Hofstede's website (www.geerthofstede.nl) and use the Cartesian distance measure to calculate culture disparity (see Appendix B for details of this measure). We use three measures of institutional differences between the home countries of the VC firms and portfolio companies: differences in the regulatory quality, political stability, and the legal system. Appendix B provides details on data source and definition of the variables. All variables are from CEPRES except for market liquidity and differences in regulatory quality and political stability, which are collected from the World Bank online database, and differences in legal system is based on data collected from Rafael La Porta's website.

To examine the effect of explanatory variables on the time from VC investment to VC exit, or more accurately, on the exit hazard rate defined as the inverse of the time to exit, we estimate the Cox proportional hazard model. The hazard function measures the likelihood of a VC firm to exit its investment within a small time interval conditional on VC and market characteristics. The interesting feature of the Cox proportional hazard model is that it does not require any distributional assumptions about the exit rate. The coefficients of the Cox Model are estimated through maximum likelihood estimation. A positive coefficient suggests that a unit increase in the covariate accelerates the exit, while a negative coefficient decelerates the exit. Specifically, we estimate a Frailty Cox model that is similar to a fixed-effects model in a linear regression. Our model controls for 'fixed effects' in terms of heterogeneity across VC firms. The model estimates an additional parameter theta, which indicates the presence of such heterogeneity.

4. RESULTS

4.1. Univariate analysis

Devigne et al. (2016) highlight the need for further research on the variation of VC deal-level returns across different exit routes. Panel A of Table 1 reports the annual rate of return earned by VC firms from fully exited investments as measured by the internal rate of return (IRR). The figures are broken down by regions (North America, the UK, Continental Europe and the rest of the world) and exit routes (IPO and M&A). In almost all regions and for all exit routes, cross-border investments generate lower IRR than domestic deals (except for investments exited through IPOs by VC firms in the rest of the world). [10]

[10]Median IRRs for the rest of the world (ROW) also show that domestic investments outperform cross-border ones. The average and median returns on domestic investments by ROW VC firms are comparable to those reported for Asia-Pacific VC firms during 1989-2001 in Cumming et al. (2009).

Next, we examine the public market equivalent (PME), which we interpret as a measure of relative and risk-adjusted performance as outlined in Section 3 above. Panel B of Table 1 shows that the mean PMEs for domestic investments range from 2.02 to 2.86 depending on region. PMEs above 2 suggest that the wealth generated by VC investments in domestic portfolio companies is more than twice the wealth generated by investments in public markets. By contrast the mean PMEs for cross-border investments range from just 1.4 to 1.7. We find statistically significantly higher PMEs for domestic investments in almost all regions except for the 'rest of the world' (ROW). In North America, the mean domestic PME is twice that of cross-border investments. The difference between domestic and cross-border PMEs is particularly pronounced for investments that were exited through IPO with the domestic PME in North America being almost three times the cross-border PME. We find a similar pattern for median PMEs made by North American VC firms for whom median PMEs are significantly higher for domestic investments than cross-border investments. However, differences in medians are not statistically significant for the other regions. The magnitude of our median PME for domestic North American investments is comparable to that reported by Harris, Jenkinson and Kaplan (2014).

[TABLE 1 HERE]

We examine whether VC investors select deals abroad that are systematically different from their domestic deals and whether certain types of VC backers self-select into cross-border investments. Our univariate analysis below tests for differences in the characteristics of cross border investments with those of domestic investments. Table 2 breaks down the figures by regions. For VC firms from all four regions, we find that those firms engaging in cross-border investments are on average, significantly older (more experienced) than those involved in domestic investments. The average (mean) difference

in age between firms backing cross-border portfolio companies compared to those investing in domestic companies is broadly similar at approximately 2.5-2.7 years for VC firms in all regions except in North America.[11] Among North American VC firms, the age difference is much more pronounced, at between seven and nine years (based on medians and means, respectively). This clearly shows that cross-border investment is a game played by seasoned VC players consistent with the findings for the US reported in Cumming and Dai (2010).

We find a similar but weaker effect in terms of the age of the VC fund (rather than the VC firm). Across all regions, it appears that cross-border deals are carried out by older funds. However, this difference between domestic and cross-border deals is marginally significant (at 10%) based on the means of fund age (based on medians, the difference is insignificant). Perhaps the fund-age difference reflects a tendency of funds to first invest in domestic deals perceived to be less risky and to delay 'gambling' on potentially more risky cross-border investments until the fund has matured. Once earlier domestic deals show signs of success, VC firms are safe in the knowledge that they can offset the potential risks of cross-border deals against their existing domestic successes.

On average, cross-border deals are larger in size than domestic deals except for European (ex. UK) VC firms, whose cross-border deals are smaller than domestic deals. This may be due to European VC firms investing in cross-border regions with relatively under-developed institutions and capital markets.

In each of the four regions, cross-border investments are exited more quickly than domestic investments. This is consistent with the higher costs of screening, monitoring and

[11] Based on median age, the results are broadly the same with the exception of the rest of the world, where the difference in medians is only half a year.

fostering cross-border investments causing VC backers to exit cross-border investments more quickly than domestic investments. This result may also be driven by the propensity of VC firms to invest in cross-border investments only later in the life of the VC fund, leaving less time to realize investments before the fund is wound up.

Liquidity is defined as the level of stock-market activity that VC firms face in the country of origin of the portfolio company. Table 2 shows average liquidity across the four regions. Liquidity is higher for North American VCs investing in domestic companies than the liquidity these North American VC firms face when investing abroad. These results are clearly not surprising, given the highly developed North American capital markets. Focusing on VC firms in other regions, we find that European and UK VC investors face more liquidity in their domestic markets than in their cross-border destinations. VC firms in the 'rest of the world', by contrast, seem to come from countries with markets that are on average less liquid than the markets in their cross-border destinations. In sum, most VC firms find lower liquidity in their cross-border destinations than in their domestic markets.

In terms of syndication, our results show significant differences between domestic and cross-border VC deals, with cross-border deals being more likely to be syndicated in all regions except in the 'rest of the world'. North American and UK VC firms, in particular, syndicate cross-border deals more frequently than domestic deals. UK VC firms are more than twice as likely to syndicate cross-border deals than domestic deals, and among North American VC firms, the frequency of syndicating cross-border deals is 54% higher than for domestic deals. We observe the opposite among VC firms in the 'rest of the world': these firms more frequently syndicate domestic deals, with approximately 70% of their domestic deals being syndicated compared to just 40% of their cross-border deals. Among Continental European VC firms, the proportion of syndicated deals is very similar for all (domestic and

cross-border) deals. As a high proportion of syndication may reflect VC investors' demand for risk (or loss) sharing (e.g., Lerner 1994), our results may suggest that North American and UK VC firms perceive cross-border deals to be risky. By contrast, it is domestic deals that are seen to be more risky by VC firms in the rest of the world.

In terms of the breakdown of financing stages, we find a consistent pattern among all cross-border deals, with approximately two-thirds of investments in the early stage, one-fifth in the expansion stage and the rest (approximately 13-16%) in the later stage. This pattern is similar to the breakdown across financing stages of domestic deals by VC firms in the rest of the world. This may suggest a degree of convergence to a global investment pattern. The breakdown in the three other regions is broadly similar, although there are some differences. Notably, there is a higher tendency among North American VCs to invest in early stages domestically rather than abroad. This may reflect their aversion to the higher risks of cross-border early-stage investments compared to domestic early-stage deals. European and UK VC firms differ from the global pattern in their domestic deals, with a greater preference for expansion-stage investments over other stages in domestic deals.

In terms of industry sector, there is evidence of investment clustering: North American and ROW VC firms are more likely to invest in the IT sector, while European and UK VC firms are more likely to invest in Industrials. In contrast to these regional variations, there is little difference between domestic and cross-border deals in each region (except for the biotech industry).[12]

In conclusion, compared to domestic investments, cross-border deals are conducted by older VC firms and later in the life of a VC fund. Cross-border deals are larger (based on Investment Size) and more likely to be syndicated in later financing stages and in the bio-

[12] Panel B of Table 2 shows the natural logarithms of VC age, Fund age and Investments size that are used in our multivariate analysis.

technology sector. In terms of performance, we find that cross-border investments are exited more quickly but at the expense of returns and with lower frequencies of IPOs. Both the lower IRR and the shorter holding periods may be due to systematic differences between domestic and cross-border investments. This could be because VC firms target mature companies and later stage financing when crossing borders. Hence, the risk/return profile of these investments may be different compared to domestic VC investments. Using PME as a risk-adjusted measure of performance, we nevertheless find domestic investments outperform cross-border investments in almost all regions. In the next section we examine the performance of domestic and cross-border investments in the context of a multivariate analysis.

[TABLE 2 HERE]

4.2. Multivariate analysis

To formally test Hypothesis 1 (Cross-border and domestic VC investments generate the same returns), we estimate two-stage Heckman models. The first stage (reported in Panel A of Table 3) estimates the probability of a given deal being a cross-border investment, and the second stage regresses deal-level performance on the *Cross-border* indicator and a range of control variables.[13] Performance is measured alternately as IRR in Panel B and PME in Panel C. We control for risk by including indicators for the stage of financing. Previous studies suggest financing stage as a suitable proxy for deal risk (Sahlman 1990; Ruhnka and Young 1991; Seppa and Laamanen 2001; Cornelli, Kominek and Ljungqvist 2003).

[13] We focus here on the second stage of the two-stage models. The first stage involves a probit model with *Cross border* as the dependent variable and aggregate capital inflows as an instrument, as outlined in Section 3 above. The results of this first stage are discussed in greater detail in the extensions of our baseline analysis in Section 4.5 below.

The results are shown in Table 3.[14] Panel A of the table shows the results for IRR. We find a statistically significant negative coefficient of the *Cross-border* indicator in each of the four regressions (Models I-IV). This is consistent with our univariate analysis reported in Table 1. Our multivariate analysis confirms this cross-border effect in terms of lower IRR even after controlling for risk and other potential determinants of performance. The magnitude of this *Cross-border* coefficient ranges from -0.27 for the UK to -0.156 (for the rest of the world). This suggests that cross-border investments have statistically and economically significantly lower IRR on average than comparable domestic investments for VC firms based in any of the four regions. The *Cross-border* coefficient in North America (Model 1) is -0.192 indicating that, all else equal, cross-border investments by North American VC firms underperform equivalent domestic investments by 19 percent in terms of IRR. For VC firms in other regions, the cross-border underperformance ranges from 16 for VC investors in the rest of the world to 27 percent for the UK.

In Panel B of Table 3, the dependent variable is the risk-adjusted measure of performance (PME). Consistent with the IRR results in Panel A and with the univariate analysis (Table 1), we find that the PME for cross-border investments is lower than the PME for domestic investments. This confirms that domestic investments out-perform cross-border investments, and that this performance difference persists after controlling for risk and other known performance determinants.

Next, we examine whether this cross-border effect is a long-term feature of the VC industry, or whether it is concentrated in the early years of the internationalization of VC investments. Past literature finds that the period prior to the late 1990s is characterized by high returns on VC investments in North America while the subsequent period experienced

[14] There is no evidence of multi-collinearity among the variables used in our study. Appendix C provides a correlation matrix for the variables used in the analysis.

significantly lower VC fund returns and large capital inflows resulting in the saturation of the VC industry (Harris et al. 2014). We examine whether this performance decline occurred equally among both cross-border and domestic investments. A priori, we may expect that high capital inflows into a saturated industry lead to a decline in the performance of both domestic and cross-border investments. However, some of this decline may be offset by positive learning effects in cross-border investments. Therefore, we might expect less of a performance decline among cross-border investments initiated in late 1990s. Harris et al (2014) show that the decline of the VC performance started in the late 1990s. Past literature (e.g., Aizenmann and Kendall 2012) also suggests that cross-border VC investing took off during the 1990s due to shortages in profitable domestic investment opportunities. We use 1997 as the cut-off point to divide our sample and include a binary indicator (*Post-1997*) defined as zero for investments made up to 1997, and one thereafter. We include *Post-1997* in our multivariate analyses both on its own (un-interacted) and interacted with the cross-border indicator.[15]

Table 3 reports a significant negative coefficient on the un-interacted *Post-1997* variable suggesting performance declined for all investments, i.e., for both domestic and cross-border deals, after the late 1990s. The coefficients of the interaction term of *Cross-border* and *Post-1997* are positive, and in some cases as large (in absolute terms) as the cross-border coefficient. However, as these coefficients are not different from zero at conventional levels of statistical significance, it appears that the performance differential between cross-border and domestic investments remains unchanged post-1997. This leads us to conclude that the cross-border effect is a permanent feature.

[15] We also use 1998 and 1999 as cut off points and our results remain unchanged.

We consider several further moderating factors.[16] We report our results in Table 3 separately for four broad regions. This regional breakdown is based on the origin of the VC investor. We observe underperformance of cross-border investments in all four regions despite the differences between these regions in terms of the institutional and cultural environments in which VC firms operate. We further explore whether our results depend on the *destination* (as opposed to the origin) of cross-border deals. To this end, we separate the cross-border indicator used in our multivariate analysis reported in Table 3 into three binary variables depending on deal destination. Focusing on the investments by North American VC firms, we find that cross-border deals to the rest of the world (ROW) underperform domestic deals most, by over 10 percent (the coefficient of cross-border deals to ROW is -0.11). Investments to the UK underperform least (2.5 percent) with the underperformance of deals to Europe at 6 percent.

Next, we examine whether our results differ for subsets of VC firms, specifically whether more experienced VC investors show less cross-border underperformance. Measuring experience as VC firm age, we extend the models reported in Table 3 by including as an additional variable the cross-border indicator interacted with a binary variable coded one for the most experienced quartile of VC firms (and zero otherwise). We find the coefficient on this interaction term statistically not different from zero in all regions except ROW (where it is positive but statistically significant at only 10 percent). We conclude that there is no evidence of a differential effect of cross-border investing for top-tier VC investors.

All our multivariate analyses control for a range of statistically significant determinants of performance. Specifically, the control variables include *VC Age*, *Investment Size* and *Duration*, *Fund Age*, *Liquidity*, *Syndication*, *Financing Stage*, *Investment Year*, and

[16] The results of the additional analyses including deal destination and VC experience as moderating factors are not tabulated here but available from the authors on request. We are grateful to an anonymous referee for suggesting this analysis of moderating factors.

Industry. Except for *Fund Age* and *Syndication*, we find all these control variables have a statistically significant impact on VC performance. VC age increases IRR and PME in all regions, suggesting that more experienced VC backers are better at selecting, nurturing and exiting investments. Large investments are associated with lower IRR and PME in all regions. This suggests that VC providers require higher returns for smaller investments to compensate them for higher (business) risk. We find investment duration (i.e., holding period, or time to exit, of the VC backers) to have a significantly positive impact on IRR and PME in all regions. It appears that VC backers require higher returns to compensate them for longer holding periods. Investments that are held for a longer period are likely to be early stage investments for which VC backers require higher average returns to compensate for (liquidity, etc.) risk. Another possible reason for this positive impact of investment duration on IRR could be the tendency of VC investors to hold promising (and ultimately profitable) investments longer to maximize the future gains from a successful exit.

Next, we examine the impact of market liquidity on IRR and PME. Cumming, Fleming and Schwienbacher (2005) focus on variations in the liquidity of exit markets in terms of 'liquidity risk'. They find that when the liquidity of exit markets is high, VC firms tend to invest more in later stage investments than in early stage rounds. Cochrane (2005) documents that early stage returns are higher than later stage returns. Based on these studies, one might expect that the returns to VC firms are likely to be low when market liquidity is high. This reasoning might suggest that *Liquidity* has a negative coefficient in our models. However, as we control for financing stage, we should not expect to find an incremental negative impact of market liquidity on IRR and PME.[17] Nevertheless, we find statistically significant negative coefficients of *Liquidity* in all models. Our results suggest that over and above the impact of liquidity on VC investment decisions (specifically the choice of

[17] We thank an anonymous referee for helping to clarify our interpretation.

financing stage), more liquid markets motivate VC firms to 'rush to exit' at the expense of lower returns.

The coefficient of the inverse Mills ratio (*Lambda*) is statistically significant at 10% level in only some of the regions, specifically in the models for North America and Europe in Panel A, and only in Europe in Panel B. This suggests that adjusting for selection bias and endogeneity is only important in some of the regions. This confirms that the cross-border effect we document is not the result of differential deal selection by VC backers. Instead our results show that cross-border deals underperform *equivalent* domestic deals. In the Robustness Section below, we discuss alternative modelling approaches including mixed-effects models and propensity-score matching, and conclude that our finding of cross-border underperformance is robust.[18]

In conclusion, our results show that cross-border investments have significantly lower returns (in terms of IRR and PME) than domestic investments controlling for risk, proxied by financing stage, and a range of other potential determinants of performance. On the basis of our results, we do not find support for Hypothesis 1.

[TABLE 3 HERE]

[18] The propensity-score matching results are discussed in the robustness section below. The unreported mixed-effects models are as those presented in Table 7, but without the measures of distance. The results of the unreported analyses are available from the authors on request.

4.3 Alternative measures of performance

We test differences between cross-border and domestic investments in terms of exit routes and time to exit. In the absence of detailed cash-flow data, previous studies focus on exit success as a proxy measure of VC performance. Our analysis below examines the robustness of this approach in the context of examining cross-border investments.

Some exit routes benefit VC investors more than others. IPO exits and exits through a merger or acquisition (M&A), such as a trade sale or a secondary buyout, generate positive financial returns (IRR, as reported by Cumming 2008), while a write off (liquidation) typically results in the loss of the VC investment (Cummings 2008; Dai. et al. 2012). 'Successful' exits also enhance venture capitalists' reputations and provide opportunities to raise additional funds from limited partners (LPs). Our first measure of exit performance is the so-called 'success ratio', which reflects the frequency of 'successful' exits from portfolio companies. A narrow measure of the success ratio defines only IPO exits as successes and is defined as the ratio of IPO exits relative to all exits. A broader version of the success ratio that considers both IPO and M&A exits as successes is defined as the ratio of IPO and M&A exits relative to all exits. Previous studies have examined the success ratio as an indicator of VC performance (e.g., Hochberg, Ljungqvist and Lu 2007, Chen et al. 2010; Cumming and Dai 2010; Wang and Wang 2012; Nahata et al. 2014; Dai and Nahata 2016).

Our second measure of performance is the length of VC backers' holding periods in terms of the time from first VC investment in a given portfolio company to the exit of the VC backer. Previous evidence suggests that VC backers realize their investments, on average, after 7 years, with the time to exit ranging from 6.5 years to more than 8 years, depending on the exit route (Giot and Schwienbacher 2007).

Panel A of Table 4 shows that the M&A route is the most common type of successful exit, followed by IPOs. Focusing on IPO exits, we find no significant difference between cross-border and domestic investments in the proportion of IPO exits in all regions except North America. For North American VC firms, we find that IPO exits are less likely for cross-border investments, with only 6% of cross-border deals resulting in an IPO exit. On the basis of this success ratio, cross-border investments are less successful than domestic deals for North American VC firms. Perhaps IPO frequency is not an appropriate indicator of success given that an M&A exit can also be attractive in terms of returns. Defining the success ratio more broadly in terms of the combined proportion of IPO and M&A exits relative to all exits, we find no significant difference between domestic and cross-border deals.

Panel B of Table 4 reports the investment holding period (time to exit) by region and exit route. The results of the full sample show that irrespective of the location of the VC firms, cross-border investments are exited more quickly than domestic investments. This is consistent with the higher costs of screening, monitoring and fostering cross-border investments, tipping the balance towards quicker exits from cross-border than domestic investments. This result may also be driven by the propensity of VC firms to invest in cross-border investments only later in the life of the VC fund, leaving less time to realize investments before the fund is wound up (see Table 2). Examining the results separately by region and exit route, we find the same type of cross-border effect (shorter cross-border holding period) for all the investments by North American VC firms irrespective of exit route. We also find the effect for all IPO exits irrespective of region. However, outside North America, VC firms have longer holding periods in cross-border investments that are exited through M&A than for their corresponding domestic investments. Judging the performance of

VC investments in terms of time to exit, it appears that cross-border investments are more successful than domestic investments, at least for North American VCs.

Given the conflicting evidence on the exit success of cross-border investments by North American VC firms in Panels A and B, we suspect that exit behavior is driven primarily by country-specific and other macro factors and does not reflect the selection and value adding behavior of North American VC backers.

[TABLE 4 HERE]

To examine whether cross-border deals are exited more quickly even after controlling for VC and deal characteristics and macro factors we estimate a multivariate Cox hazard model. Table 5 shows the results of this model with the holding period (time to exit) as the dependent variable and an indicator for cross-border deals controlling for *VC Age* and *Fund Age*, *Investment Size*, market liquidity (*Liquidity*), *Syndication*, *Financing stage*, *Investment year* and *Industry* of the portfolio company. We find, all else equal, VC firms exit cross-border investments significantly more quickly than domestic investments. This effect is observed in all four regions and is strongest in the UK and weakest in North America.

Next, we examine whether the exit behavior of VC firms and the cross-border effect on exit differ before and after the late 1990. Speedier exits in the latter period might be due to a learning effect whereby VC firms get better over time at achieving quicker exits. Since VC cross-border investing is a more recent activity than domestic investments, we may expect this learning effect to particularly impact cross-border deals. To this end, we define a time indicator that takes the value of zero for all investments in the years up to 1997, and one thereafter.

In the models shown in Table 5, we include the *Post-1997* indicator and interact it with the *Cross-border* indicator. The coefficient of *Post-1997* is positive and significant for Europe and the UK showing increasing exit rates since the late 1990s in these regions possibly due to a learning effect. The coefficient of *Post-1997* interacted with *Cross-border* is also positive and significant in all regions suggesting that the increase in exit speed has been particularly pronounced in the case of cross-border investments.

Consistent with Giot and Schwienbacher (2007) we find that larger deals are exited more quickly. Deal size may increase the VC backers' marginal costs of continuing with an investment (in terms of monitoring and advising costs) relative to marginal benefits tipping the balance in favor of earlier exit. A priori, we might expect the impact of investment size to be even stronger for cross-border deals given their higher transaction costs compared to domestic deals. We test this by including an interaction term of *Cross-border* and *Investment Size*, and we find evidence in support of our conjecture: the impact of deal size is indeed greater in cross-border investments than in domestic investments.

A priori, we might also expect that the experience of the VC firm is more valuable in cross-border investments than in the domestic deals, as greater expertise and better networks help VC firms exit more quickly, particularly from cross-border investments. We include an interaction term of *Cross-border* with *VC Age*, but we find no statistically significant marginal impact of VC Age on the cross-border effect. We also expect VC Age to have a direct effect on exit rates. Testing this, we find that VC Age is significant only in North America and Europe. In North America, older VC firms exit more slowly than younger firms, possibly due to grandstanding by inexperienced US VC firms, as documented by Gompers (1996). In Europe, by contrast, it is older VC firms that are associated with higher exit rates.

Fund age at the time of the VC investment is also a significant determinant of exit rates. Investments by funds that are more mature at the time of investments have higher exit rates than investments by younger funds. In some regions, the effect of fund age is particularly strong for the oldest quartile of funds (as shown by Fund age x top25th).

Finally, we examine the impact of the liquidity in the stock market in the investment region (that is, the region of the portfolio company's country of origin). Based on the findings of Black and Gilson (1998), Cumming et al. (2006) and Wang and Wang (2010), we expect more liquid capital markets to facilitate speedier exit and higher exit rates. Consistent with this conjecture, we find that *Liquidity* has a strongly significant positive impact on exit rates in all four regions.

As a final control variable, we include in Table 5 an indicator of syndicated investments. Consistent with Giot and Schwienbacher (2007) we find that syndicated investments have higher exit rates than other investments. This suggests that by combining expertise and networks, syndicates are able to facilitate speedier exit.

Our results show that cross-border investments are exited more quickly than domestic investments after controlling for a number of factors. However, if we were to conclude from this that cross-border investments are more successful than domestic investments, this would be at odds with our analysis of return performance in Table 3. Our results suggest that VC investors may choose to invest abroad to benefit from shorter holding periods, but they do so *at the expense of returns*. Our results highlight that alternate measures of performance may result in fundamentally different assessments of success.

[TABLE 5 HERE]

4.4 The Effect of Distance

So far our analysis examines the difference between domestic and cross-border investing using a simple binary indicator. Our results suggest that foreignness (as captured) by our *Cross-border* indicator, is a liability. In this section, we try to unpack what aspects of foreignness drive our result. In our earlier analysis we treat investments by US VC firms in Canada the same as a US firm investing in China. Clearly, the latter is significantly more costly to an investing US VC firm than the former due to the greater geographical distances involved as well as cultural and regulatory differences and differences in political risk.

In Panel B of Table 6, our analysis breaks down cross-border investing into investments in neighboring countries (that share a land border) and non-neighboring countries.[19] In addition to *Cross-border* (which continues to be defined as one if the VC firm invests in a foreign country, and zero otherwise) we now also include the binary variable *Cross-border (not sharing)* to pick up the effect of investments in non-neighboring countries. *Cross-border (not sharing)* is defined as one if the deal is located in a non-neighboring, foreign country, and zero otherwise.

Panel B of Table 6 reports the results of a mixed-effects model of IRR for North America and Europe.[20] In both regions we find the coefficient of *Cross-border (not sharing)* to be significant and negative, with a coefficient that is almost three times as large in absolute terms than that on the *Cross-border* indicator. The latter coefficient is slightly smaller than in our earlier analysis reported in Table 3 (Models I and II of Panel A) but still statistically

[19] Panel A of Table 6 reports descriptive statistics for the additional variables used in the analyses presented in Panels B and C of Table 6.

[20]The mixed-effects analyses in Panels B and C of Table 6 model *Investment year* and *Industry* of the portfolio company as fixed effects and *Financing stage* as random effects. Our choice between fixed and random effects is based on likelihood ratio tests. Following common practice in the relevant literature (e.g.,Chemmanur et al. 2016; Degeorge, Martin and Phalippou 2016), industry fixed-effects are included to control for unobserved time-invariant industry characteristics. Our results may be biased if the unobserved industry characteristics are time variant. We thank an anonymous referee for noting this issue.

significant and negative. The difference between the *Cross-border* and *Cross-border (not sharing)* coefficients is statistically significant, suggesting that cross-border investments involving countries that do not share a land border underperform domestic investments significantly more than cross-border investments in neighboring countries. We conclude that there is a significant negative 'cross-cross-border effect'.[21]

Next, we examine whether the cross-border effect is driven by geographic distance or differences in culture or institutional framework between the VC investor and the portfolio company. Previous studies report mixed evidence on the impact of geographic distance and cultural and institutional differences between VC firm and portfolio company on the likelihood of a successful exit, typically an IPO exit (Chen et al. 2010; Cumming and Dai 2010; Chemmanur et al 2016; Dai and Nahata 2016; Nahata et al 2014). Consistent with past evidence (Li et al. 2014; Nahata et al 2014; Dai and Nahata 2016) we predict that geographic distance has no significant effect after controlling for other distance measures (see Hypothesis 2a). However, we expect that more cultural or institutional differences reduce exit performance, as predicted by Hypotheses 2b and 2c (see Section 2).

Unlike all previous studies of cross-border performance, our analysis measures performance based on deal-level returns (IRR) rather than proxy performance using exit success (Hochberg et al. 2007). We use five different measures of distance and differences: the logarithm of geographic distance (in miles); cultural differences between the countries of VC firms and portfolio companies calculated as differences between countries in terms of the Hofstede et al. (2010) four cultural dimensions (power distance, individualism, masculinity, uncertainty avoidance); and three measures of institutional differences between the home countries of the VC firms and portfolio companies (differences in regulatory quality, in

[21] We thank an anonymous referee for suggesting this term and the associated analysis.

political stability, and in the legal system). See Section 2 and Appendix B for details of variables and data sources.

Consistent with Hypotheses 2b and H2c (see Section 2), but contrary to the null hypothesis H2a, our results in Panel C of Table 6 show that all five measures capturing geographic distance, culture disparity and difference in the institutional setting have significant negative impacts on VC-deal return performance. In addition, the *Cross-border* indicator remains significant at the 10% level (except in Model IV for the rest of the world). This suggests that there remains a residual negative impact of foreignness over and above the negative impacts of geographic distance, cultural and institutional differences. In the next section, we examine further possible explanations for this cross-border effect.

[TABLE 6 HERE]

4.5 Extensions

For our conclusion that cross-border investments underperform domestic investments to be valid, we need to demonstrate that the differences in returns are not merely due to differences in risk. This part of our analysis examines the relative risk of cross-border and domestic deals. Note that there is no generally accepted measure of risk in the context of private equity investments. This is due to the fact that one cannot observe a time-series of market valuations for non-traded assets (such as private equity stakes), which makes standard methods to assess risk used for standard traded assets infeasible. As a result, there are no standard approaches to correct for risk in private equity research. Following Degeorge, Martin and Phalippou (2016), we approximate investment risk in several ways. First, we examine the VC providers' risk of wealth loss based on the investment multiples of domestic and cross-border investments in each of the four regions. Column 1 of Table 7 shows the

proportions of domestic and cross-border VC investments with investment multiples of zero, i.e. deals that result in bankruptcy (write-off) and thus a complete loss of wealth for VC providers. The second column (entitled 'capital loss') shows the proportions of deals with investment multiples of less than one, which result in (at least) a partial loss of wealth for VC providers. Using tests of differences in proportions, we conclude that there are no statistically (or economically) significant differences between domestic and cross-border investments in both these measures of risk. Next, we measure the systematic risk of VC investments in terms of their betas, that is the sensitivity of the IRRs of VC investments relative to returns on the stock-market index for the home country of the portfolio company. Following Axelson, Strömberg and Sorensen (2013) and Degeorge, Martin and Phalippou (2016), we estimate beta as the slope in a regression of IRR on the corresponding stock-market return. We find no statistically significant differences between the betas of domestic and cross-border investments in any of the four regions.

The final part of the analysis reported in Table 7 addresses the question whether cross-border investing helps VC firms to diversify fund risk. Column (3) of Table 7 shows the betas of cross-border investments relative to the stock-market of VC providers' home countries. We compare the resulting 'home betas' in Column (3) to the 'host betas', shown in Column (2), that are calculated relative to the stock-market in the portfolio company's countries. If VC providers are able to diversify their portfolios by investing abroad, we expect IRRs of cross-border deals to be less sensitive to the VC firms' domestic stock index than to the stock index of the portfolio-company country. In other words, we expect to find the home betas to be lower than the host betas. Our results confirm that the home betas are statistically significantly lower than the host betas. While the host betas range between 2.5-2.8, the home betas range between 1.2-1.4 for all regions except in the 'rest of the world'. Our results suggest that VC firms from North America, Europe and the UK significantly reduce their

exposure to (home) market risk by investing abroad. Consequently, they should expect lower returns from cross-border than from domestic investments.

[TABLE 7 HERE]

Our final analysis examines another possible motive for VC firms to invest in cross-border deals (besides diversification). Past evidence suggests that higher capital inflows into the domestic VC industry lead to more competition among VC firms for promising deals. Gompers and Lerner (2000) refer to this as "Money chasing deals". In a saturated domestic VC market characterized by an excess of funds and a shortage of investment opportunities, VC firms might seek investment opportunities abroad (Schertler and Tykvova 2011). We estimate a Probit model to investigate the likelihood of a VC firm investing in cross-border deals. This is the first stage of the Heckman model reported in Panel A of Table 3 above. Our explanatory variable of interest measures aggregate capital inflows into the domestic VC market (*Ln Capital Inflow*). If cross-border investments are driven by limited domestic investment opportunities and saturation of the domestic VC market, we expect a positive coefficient of *Ln Capital Inflows* in the probit model. The results of the Probit model show a significant positive coefficient of *Ln Capital Inflows* consistent with the saturation argument.

Overall, the results of our extended analysis show that VC firms benefit from cross-border investing by achieving portfolio diversification and overcoming shortages of domestic investment opportunities in saturated markets. Together with diversification, these benefits may explain the attraction of cross-border investing to VC investors despite the poor return performance of cross-border deals relative to domestic investments.

4.6 Robustness

We explore whether our models are subject to bias due to the non-randomness of the VC exit decision using an approach similar to Cumming et al. (2009). In the sample used for our baseline analyses above, we include only fully exited investments. As a robustness check, we start with a sample including all (fully, partially and unexited) investments. We estimate a Heckman model for IRR similar to that reported in Table 3. In addition to the Probit model of the VC firm's decision to invest cross-border (as in Table 3), this extended Heckman model includes a second Probit model of the VC firm's decision to fully exit their investment.[22] We find no evidence of significant bias and our results are qualitatively unchanged in all regions. The coefficients on our variable of interest, the cross-border indicator, for the four regions remain broadly in line with those reported in our baseline analysis in Table 3 above (see Appendix D).

Our baseline analysis controls for deal syndication, but not for possible endogeneity of the syndication choice. To check robustness to such possible endogeneity, we estimate a Heckman model for IRR with a Probit stage modelling the syndication decision following Tian (2012).[23] The results of this Heckman model remain qualitatively unchanged with the coefficient of interest, on the cross-border indicator, broadly the same as in our baseline analysis in Table 3 (see Appendix D).

While our baseline analysis includes standard control variables for VC firms and funds, we examine whether omitting certain other VC control variables biases our results. Specifically, we control for the 'busyness' of VC fund managers following the literature on the tradeoff

[22] Full exits are coded one, while partial exits and no-exits are coded zero. Explanatory variables are investment duration and economic conditions at exit, as in Cumming et al. (2009). The estimated coefficient of the lambda of this full-exit Probit model is statistically insignificant.

[23] Syndication is modelled as a function of the logarithms of capital inflows, VC Age, Fund Age and Investment Size. Unfortunately, the database we use does not allow us to differentiate between domestic and foreign syndication.

between VC fund size and investment monitoring quality (Kanniainen and Keuschnigg 2003; Cumming 2006; Cumming and Walz 2010). *Busyness* is defined as portfolio (fund) size per fund manager and is intended to measure the impact of lower amounts of managerial time and resources available for any one investment in larger funds. Adding *Busyness* to the second stage of the Heckman-model of IRR reported in Table 3, we find *Busyness* has a statistically significant (at 5 percent), negative coefficient that ranges between -0.07 for ROW and -0.12 in North America. However, comparing the cross-border coefficients of our baseline model with those of the extended model, we find that our key result, the cross-border effect, remains virtually unchanged in all regions (see Appendix D).

Our baseline model in Table 3 includes year dummies for investment year and controls for market conditions (in terms of market liquidity) at the time of exit. Next, we examine whether further controls for changes in market conditions during the investment holding period (i.e., from investment to exit) affect our results. To this end, we measure the average return of the Morgan Stanley Capital International (MSCI) index and the average global risk-free return between the date of investment to the date of exit. Including these additional control variables does not qualitatively affect our main results of interest, i.e., our estimates of the coefficient of the cross-border indicator (see Appendix D).

Finally, we examine the robustness of our results using propensity-score matching. We match each cross-border deal with an equivalent domestic deal based on the propensity score estimated using VC age, investment size, fund age, investment holding period, liquidity, syndication and financing stages. Using caliper radius matching, we classify a domestic investment as a match for a cross-border investment when the propensity scores for both investments vary by no more than 1 percent (following e.g., Dehejia and Wahba 2002). We use t-tests and Wilcoxon tests to confirm that the cross-border and matched domestic investments are not significantly different in terms of their mean and median characteristics.

Using the sample of matched observations, we estimate a mixed-effects model (similar to the models reported in Table 3) and consistent with our previous results in Table 3, we find Cross-border coefficient to be lower than in our earlier analyses but still both statistically and economically significant (see Appendix D).[24]

Overall, our results on the underperformance of cross-border investments remain robust. For North America, we find *Cross-border* coefficients ranging from -0.119 to -0.196, from which we conclude that all else equal, the cross-border investments of North American VC firms underperform their domestic investments by between 12 and 20 percent in terms of IRR. Globally, our results are similarly robust indicating underperformance of cross-border investments of between 22-25 percent for European VC investors, 25-28% for UK VC investors, and comparatively lower underperformance of between 15-17 percent in the rest of the world.

5. Conclusion

Against the background of increasing cross-border financial flows, we examine the return performance of cross-border VC investments. Due to data limitations, previous literature analyses cross-border performance in terms of the likelihood of successful VC exit, and reports conflicting results. The main contribution of our paper is that we are able to estimate actual returns using detailed cash-flow data unavailable to previous studies. We calculate internal rate of return (IRR) and public market equivalent (PME) for 6,529 deals conducted by VC firms in North America, the UK, Europe and the rest of the world during 1971-2008. We show that cross-border deals underperform domestic deals in terms of IRR by 12 to 28% depending on regions and research design. ADD RESULT ON PME. Comparing

[24] As propensity score matching is based on observable characteristics only, it only addresses concerns of selection bias and endogeneity due to observable differences between the treatment and control groups (e.g., Dehejia and Wahba 2002). By contrast, the two-stage Heckman models in Table 3 allow for endogeneity due to unobservable differences and omitted variables.

deals before and after the late 1990s, performance is lower for all investments in the latter period but the performance differential between domestic and cross-border investments remains unchanged.

Geographical distance, cultural disparity and institutional differences between the home countries of the VC investor and the portfolio company negatively affect cross-border returns but do not fully explain the cross-border underperformance. Our analysis confirms that differences of risk are unlikely to explain the variation in returns between cross-border and domestic investments. Further analysis shows that VC firms benefit from cross-border investing by achieving portfolio diversification and overcoming shortages of domestic investment opportunities in saturated markets. Together with diversification, these benefits may explain the attraction of cross-border investing to VC investors despite the poor return performance of cross-border deals relative to domestic investments. While VC firms may choose to invest abroad for many reasons, our results suggest that they should not expect to achieve higher deal-level returns when they do so.

Our results are of clear relevance to VC fund managers (general partners) in guiding their portfolio decisions including considerations of relocating portfolio companies (Cumming et al. 2009). They should also prove useful to investors (limited partners) in VC funds who need to understand the relative performance of cross-border and domestic investments in order to make sound fund-selection decisions and influence the investment patterns of VC funds. The negative impact of institutional differences on VC returns that we observe will be of interest to policy makers and regulators.

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Table 1: Return and PME on exit.

This table shows the mean and median Internal Rates of Return (IRRs) and Public Market Equivalent (PME) by exit route and region of VC firms. We show the results for the full sample and for IPOs and M&A exits separately. Panel A shows IRRs and Panel B shows PMEs. We use statistical tests to assess whether the performance of cross-border investments is significantly different from domestic deals. The t-test for the mean is based on an unequal sample and unequal variance. The test for differences in medians is the Wilcoxon test. ***, ** ,* indicate significance at 1%, 5% and 10%, respectively.

Panel A: IRR	North America		Europe (Ex. UK)		UK		ROW	
	Dom	Cross-border	Dom	Cross-border	Dom	Cross-border	Dom	Cross-border
Full sample								
Mean	46.69	28.73**	43.02	24.47***	34.16	18.90**	27.54	41.69**
Median	24.76	21.45*	17.52	23.68*	19.99	14.99*	27.15	24.32*
No of obs	***3945***	***389***	***553***	***286***	***258***	***105***	***794***	***199***
IPO								
Mean	125.33	114.62*	112.86	101.91*	117.69	103.76*	85.88	118.09***
Median	42.63	39.32	30.42	40.72*	27.52	18.013*	45.69	41.67
No of obs	***861***	***25***	***82***	***41***	***69***	***28***	***95***	***23***
M&A								
Mean	77.58	49.99**	78.11	40.73**	54.47	37.94**	98.87	66.83**
Median	11.30	12.30	12.18	11.27	13.79	10.57	12.19	11.47
No of obs	***1575***	***195***	***342***	***139***	***136***	***58***	***542***	***118***
Panel B: PME								
Full sample								
Mean	2.86	1.40**	2.02	1.49*	2.04	1.74*	1.30	5.10**
Median	1.20	0.89*	1.05	1.03	1.40	1.12	1.02	2.05*
No of obs	***3945***	***389***	***553***	***286***	***258***	***105***	***794***	***199***
IPO								
Mean	7.96	2.79***	2.52	1.86**	2.58	1.95*	2.05	6.66
Median	3.92	1.12**	1.54	1.00	1.06	0.88	1.98	1.08*
No of obs	***861***	***25***	***82***	***41***	***69***	***28***	***95***	***23***
M&A								
Mean	4.12	2.19**	2.20	1.71*	2.21	1.48*	1.92	4.48***
Median	2.45	0.98*	1.47	1.06	1.33	1.11	1.06	2.08**
No of obs	***1575***	***195***	***342***	***139***	***136***	***58***	***542***	***118***

Table 2: Descriptive statistics of deals characteristics

This table provides descriptive statistics for domestic and cross-border deals by regions. *VC Age* is the age (years in business) of the venture capital firm at the time of initial investment in the portfolio company. *Fund Age* is the fund age measured from the date of fund initiation to the date of investment. *Investment Size* is the total amount invested by the VC firm in a portfolio company. *Investment duration* is the time between the initial VC investment and the VC exit date (in years). *Liquidity* is the stock market liquidity of the country of the portfolio company measured as the total value of shares traded on the stock exchange(s) divided by country GDP. *Syndication* is a binary variable equal to one for syndicated deals and 0 otherwise. We show figures for each of three *Financing stages* (*Early*, *Expansion* and *Later stage* investments). Panel B shows natural logarithmic transformations of *VC Age*, *Fund Age* and *Investment Size*. We use statistical test to assess whether cross-border characteristics are significantly different from domestic. The t-tests for the means are based on unequal samples and unequal variances. Differences in medians are tested using the Wilcoxon test. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Panel A	**North America**		**Europe (Ex. UK)**		**UK**		**ROW**	
Variables	**Dom**	**Cross-border**	**Dom**	**Cross-border**	**Dom**	**Cross-border**	**Dom**	**Cross-border**
VC Age (years)								
Mean	4.64	13.65**	8.36	11.12*	10.56	13.05*	5.17	7.66*
Median	4.00	11.00**	7.50	10.00*	8.92	10.75*	4.54	5.00
Fund Age (years)								
Mean	2.35	3.94*	1.72	2.09*	1.88	2.89*	2.31	3.61*
Median	2.08	2.25	1.15	1.13	1.25	1.10	1.50	2.13
Investment Size (million USD)								
Mean	4.69	6.28**	4.39	2.16**	3.01	4.93*	5.15	7.13*
Median	1.15	2.15**	2.02	1.51**	1.86	2.00*	2.30	2.54
Investment duration (years)								
Mean (years)	4.74	3.44**	3.88	3.20*	3.98	3.15*	3.90	3.10**
Median (years)	4.00	3.14*	3.32	3.11*	3.50	3.01*	3.42	3.08*
Liquidity								
Mean	1.46	0.91***	1.10	0.84**	1.29	1.01*	0.56	1.20**
Median	1.24	0.75***	1.01	0.81*	1.15	0.86*	0.55	0.94**
Syndication (binary)								
Yes	36.70	56.98**	48.56	49.43	32.97	72.97**	68.93	40.07**
No	63.30	43.09**	51.44	50.57	67.03	27.03**	31.07	59.94**
Financing Stages (binary)								
Early	72.26	67.23***	59.47	67.84	53.06	66.06	67.56	61.52
Expansion	23.81	19.79***	38.85	18.92***	37.51	18.04**	19.61	21.73
Later	3.94	12.98***	1.68	13.23***	9.44	15.90*	12.83	16.75
Industry (binary)								
Biotechnology	2.58	7.26**	6.89	12.95**	6.71	9.68**	7.191	2.91***
Consumer Goods and Services	16.77	11.33*	11.20	15.59	10.95	13.32	11.403	20.00***
Financials	2.38	2.26	2.22	4.54**	2.02	2.61	2.29	3.20
Industrials	16.42	19.53*	58.20	51.30	58.76	53.05	1.50	21.43
Information Technology	60.34	57.11	19.12	15.10	18.17	20.04	59.13	52.38*
Others	1.51	2.51*	2.37	0.52*	3.39	1.29*	0.48	0.09**
No of deals	***3945***	***389***	***553***	***286***	***258***	***105***	***794***	***199***

Table 2 continues

Panel B: Logarithm transformations								
VC Age (years)								
Mean	1.63	2.47	2.44	2.37	2.33	2.63	1.81	2.19
Median	1.55	2.32	2.38	2.27	2.26	2.47	1.66	1.69
Fund Age (years)								
Mean	0.94	1.49	0.75	0.81	0.82	1.09	0.87	1.39
Median	0.92	0.88	0.21	0.14	0.38	0.11	0.55	0.81
Investment Size (million USD)								
Mean	1.77	1.87	1.05	1.01	1.22	1.74	1.79	2.04
Median	0.38	0.84	1.01	0.74	0.78	0.88	0.88	1.02

Table 3: Multivariate analysis (Two-stage Model)

The table shows the results of a two stage Heckman model of VC performance. Stage 1 in Panel A shows the probability of investing in cross-border deals using probit models. The dependent variable is equal to 1 if the investment is a cross-border deal and zero otherwise. In Stage II, the dependent variable is IRR measured as annualized internal rates of return in Panel B; alternately the dependent variable is public market equivalent (PME) i+n Panel C. *Capital inflow* is the logarithm of the total amount of funds into VC industry. *Cross-border* is 1 for cross-border investments and zero otherwise. We include a binary indicator *Post-1997* equal to zero for investments up to 1997 and one thereafter. *Cross-border x Post-1997* is *Cross-border* interacted with *Post-1997. Ln VC Age* is the natural logarithm of age (years in business) of the venture capital firm at the time of initial investment in the portfolio company. *Ln Fund Age* is the natural logarithm of fund age measured from the date of fund initiation to the date of investment. *Ln Investment Size* is the natural logarithm of the total amount invested by the VC firm in a portfolio company. *Investment Duration* is the number of years from initial VC investment to VC exit. *Ln Fund Age* Top25th is the natural logarithm of fund age for funds above the 75th age percentile, and 0 otherwise. *Liquidity* is the stock market liquidity of the country of the portfolio company measured as the total value of shares traded on the stock exchange(s) divided by country *GDP*. *Syndication* is a binary variable equal to one for syndicated deals and zero otherwise. [a]We include two binary *Financing Stage* indicators for Expansion and Later stage investments (with Early stage as the base). We also include dummies for portfolio-company *Industry* and (investment) *Year*. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Panel A	Model I: North America		Model II: Europe (Ex.UK)		Model III: UK		Model IV: ROW	
Variables	*Coeff*	*Pvalue*	*Coeff*	*Pvalue*	*Coeff*	*Pvalue*	*Coeff*	*Pvalue*
Ln Capital inflow	0.013***	(0.000)	0.027**	(0.016)	0.012**	(0.036)	0.003	(0.115)
Ln VC Age	0.002**	(0.039)	0.001**	(0.002)	0.011***	(0.000)	0.004	(0.234)
Ln Fund Age	0.014*	(0.091)	0.097*	(0.074)	0.104**	(0.017)	0.072*	(0.092)
Ln Investment Size	0.041**	(0.041)	0.068***	(0.005)	0.020**	(0.037)	0.020**	(0.041)
Liquidity	0.023***	(0.000)	0.002*	(0.096)	0.027**	(0.022)	0.012*	(0.064)
Syndication	0.016**	(0.029)	0.003*	(0.087)	0.009*	(0.052)	0.006	(0.184)
Industry[a]	*Present*		*Present*		*Present*		*Present*	
Financing Stage[a]	*Present*		*Present*		*Present*		*Present*	
Investment Year [a]	*Present*		*Present*		*Present*		*Present*	
Pseudo R-square	0.166		0.131		0.089		0.111	
No of obs	***4334***		***839***		***363***		***993***	

Table 3 continues

Panel B	Model I: North America		Model II: Europe (Ex. UK)		Model III: UK		Model IV: ROW	
Variables	*Coeff*	*P-value*	*Coeff*	*P-value*	*Coeff*	*P-value*	*Coeff*	*P-value*
Cross-border	-0.192**	(0.033)	-0.232**	(0.017)	-0.270**	(0.023)	-0.156**	(0.017)
Post-1997 X Cross-border	0.047	(0.130)	0.173	(0.207)	0.036	(0.193)	0.250	(0.135)
Post-1997	-0.339**	(0.021)	-0.379**	(0.032)	-0.117	(0.108)	-0.252**	(0.037)
Ln VC age	0.011**	(0.023)	0.015**	(0.030)	0.018**	(0.012)	0.050**	(0.015)
Ln Fund Age	-0.141	(0.309)	-0.126	(0.192)	-0.233	(0.226)	0.264	(0.781)
Ln Investment size	-0.238***	(0.000)	-0.263***	(0.000)	-0.320***	(0.000)	-0.373***	(0.000)
Investment duration	0.065**	(0.030)	0.050**	(0.045)	0.091**	(0.030)	0.055*	(0.088)
Ln Fund Age top25th	0.066	(0.398)	0.057	(0.223)	-0.059	(0.762)	-0.276	(0.652)
Liquidity	-0.188**	(0.024)	-0.273**	(0.011)	-0.178**	(0.026)	-0.422**	(0.050)
Syndication	0.014	(0.743)	0.012	(0.222)	0.104	(0.458)	0.353*	(0.086)
Constant	0.173***	(0.000)	0.037**	(0.044)	0.152**	(0.027)	0.154**	(0.022)
Lambda	0.605*	(0.090)	-0.477*	(0.096)	0.201	(0.244)	-0.117	(0.314)
Industry[a]	*Present*		*Present*		*Present*		*Present*	
Financing Stage[a]	*Present*		*Present*		*Present*		*Present*	
Investment Year [a]	*Present*		*Present*		*Present*		*Present*	
Adj R-square	0.141		0.077		0.044		0.066	
No of obs	***4334***		***839***		***363***		***993***	

Table 3 continues

Panel C	Model I: North America		Model II: Europe (Ex. UK)		Model III: UK		Model IV: ROW	
Variables	*Coeff*	*P-value*	*Coeff*	*P-value*	*Coeff*	*P-value*	*Coeff*	*P-value*
Cross-border	-0.018**	(0.020)	-0.020**	(0.016)	-0.023**	(0.042)	-0.016**	(0.035)
Post-1997 X Cross-border	0.002	(0.477)	0.004	(0.356)	0.007	(0.381)	0.041	(0.270)
Post-1997	-0.019*	(0.078)	-0.024*	(0.053)	-0.021*	(0.092)	-0.061*	(0.083)
Ln VC age	0.001**	(0.032)	0.007**	(0.040)	0.001**	(0.012)	0.002**	(0.017)
Ln Fund Age	-0.006	(0.306)	-0.011	(0.144)	-0.004	(0.766)	0.022	(0.254)
Ln Investment size	-0.015***	(0.000)	-0.010***	(0.000)	-0.009***	(0.000)	-0.058***	(0.000)
Investment duration	0.003**	(0.021)	0.004**	(0.024)	0.002**	(0.029)	0.006*	(0.056)
Ln Fund Age top25th	0.023	(0.391)	0.008	(0.499)	0.009	(0.756)	-0.036*	(0.065)
Liquidity	-0.034**	(0.040)	-0.032**	(0.033)	-0.017**	(0.023)	-0.029*	(0.075)
Syndication	0.003	(0.219)	0.004	(0.216)	0.005	(0.663)	0.036*	(0.089)
Constant	0.014***	(0.000)	0.018**	(0.031)	0.016**	(0.023)	0.014**	(0.000)
Lambda	0.021	(0.133)	-0.034*	(0.081)	0.010	(0.255)	0.014	(0.261)
Industry	*Present*		*Present*		*Present*		*Present*	
Financing Stage	*Present*		*Present*		*Present*		*Present*	
Investment Year	*Present*		*Present*		*Present*		*Present*	
Adj R-square	0.13		0.084		0.050		0.074	
No of obs	***4334***		***839***		***363***		***993***	

Table 4: Investment types and holding period (Time to exit)

Panel A shows the numbers of exits by exit type and region. Full-sample proportions are relative to total (domestic and cross-border) exits by region. Proportions for each of the exit routes (IPO, M&A and Write-offs) are relative to either domestic or cross-border exits by region. The Z-test for the proportions is based on an unequal sample and unequal variance. Panel B shows the means and medians of investment durations (in years) by the method of exit and the region of VC firms. The t-test for the mean is based on an unequal sample and unequal variance. The t-test for the median is based on the Wilcoxon test. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Panel A	North America		Europe (Ex. UK)		UK		ROW	
	Dom	Cross-border	Dom	Cross-border	Dom	Cross-border	Dom	Cross-border
Full sample								
Proportions	0.910	0.090***	0.659	0.341**	0.711	0.289**	0.800	0.200***
No of obs	***3945***	***389***	***553***	***286***	***258***	***105***	***794***	***199***
IPO								
Proportions	0.218	0.064**	0.148	0.143	0.267	0.266	0.120	0.116
No of obs	***861***	***25***	***82***	***41***	***69***	***28***	***95***	***23***
M&A								
Proportions	0.399	0.501	0.618	0.486*	0.527	0.552	0.683	0.593
No of obs	***1575***	***195***	***342***	***139***	***136***	***58***	***542***	***118***
Write-offs								
Proportions	0.383	0.434	0.233	0.371	0.205	0.181	0.198	0.291
No of obs	***1509***	***169***	***129***	***106***	***53***	***19***	***157***	***58***

Table 4 continues

Panel B	North America		Europe (Ex. UK)		UK		ROW	
	Dom	Cross-border	Dom	Cross-border	Dom	Cross-border	Dom	Cross-border
Full sample								
Mean (years)	4.74	3.44**	3.88	3.20*	3.98	3.15*	3.90	3.10**
Median (years)	4.00	3.14*	3.32	3.11*	3.50	3.01*	3.42	3.08*
No of obs	***3945***	***389***	***553***	***286***	***258***	***105***	***794***	***199***
IPO								
Mean (years)	6.98	4.69**	6.08	4.68**	5.96	4.12**	4.73	3.12**
Median (years)	6.88	4.17**	4.50	4.02*	4.51	4.00*	4.25	3.01**
No of obs	***861***	***25***	***82***	***41***	***69***	***28***	***95***	***23***
M&A								
Mean (years)	4.49	3.10*	4.37	4.83*	3.39	4.03*	3.43	4.82**
Median (years)	3.97	3.09**	3.99	3.09*	3.01	3.83*	3.17	4.35**
No of obs	***1575***	***195***	***342***	***139***	***136***	***58***	***542***	***118***
Write-offs								
Mean (years)	2.13	1.90	2.02	2.02	2.85	2.45	1.83	2.11
Median (years)	1.87	1.71	1.62	1.01	2.09	1.87	1.75	1.57
No of obs	***1509***	***169***	***129***	***106***	***53***	***19***	***157***	***58***

Table 5: Cox proportional hazard model

This table shows a Cox proportional (frailty) model of VC exit rate estimated using maximum likelihood estimation. *Cross-border* equals one for cross-border investments and zero otherwise. We include an interaction term of *Cross-border* with *Post-1997*, another interaction term of *Cross-border* with *Ln VC Age*, and a third with *Ln Investment Size. Ln VC Age* is the natural logarithm of age (years in business) of the venture capital firm at the time of initial investment in the portfolio company. *Ln Fund Age* is the natural logarithm of fund age measured from the date of fund initiation to the date of investment. *Ln Investment Size* is the natural logarithm of the total amount invested by the VC firm in a portfolio company. *Ln Fund Age Top25th* is the natural logarithm of fund age for funds above the 75th age percentile, and 0 otherwise. *Liquidity* is the stock market liquidity of the country of the portfolio company measured as the total value of shares traded on the stock exchange(s) divided by country GDP. *Syndication* is a binary variable equal to one for syndicated deals and 0 otherwise. *Theta* is an indicator of heterogeneity (frailty). [a]We include two binary *Financing Stage* indicators for Expansion and Later stage investments (with Early stage as the base). We also include dummies for portfolio-company *Industry* and (investment) *Year* for years up to 1997. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Variables	Model I: North America		Model II: Europe (Ex.UK)		Model III: UK		Model IV: ROW	
	Coeff	*Hazard ratio*	*Coeff*	*Hazard ratio*	*Coeff*	*Hazard ratio*	*Coeff*	*Hazard ratio*
Cross-border	1.375***	3.955	1.689**	5.417	2.519***	12.411	2.329***	10.267
Cross-border X *Post-1997*	2.324***	10.221	0.248*	1.281	1.185**	3.269	2.522**	12.459
Post-1997	0.276	1.318	0.915**	2.496	0.773*	2.167	0.377	1.458
Ln VC Age	-0.018**	0.982	0.007*	1.007	0.002	1.002	0.002	1.002
Ln Fund Age	0.153**	1.165	0.116*	1.122	0.380**	1.462	0.285*	1.330
Ln Investment Size	0.221**	1.247	0.132**	1.141	0.127**	1.135	0.294**	1.341
Ln Fund Age Top25th	0.030	1.030	0.167**	1.182	0.077	1.080	0.040	1.041
Liquidity	0.258***	1.295	0.853***	2.346	0.806**	2.238	0.205**	1.228
Syndication	0.482***	1.619	0.103*	1.108	0.145*	1.156	0.138	1.148
Theta	*0.799***		*0.208***		*0.163***		*0.998****	
Industry[a]	*Present*		*Present*		*Present*		*Present*	
Financing Stage[a]	*Present*		*Present*		*Present*		*Present*	
Investment Year [a]	*Present*		*Present*		*Present*		*Present*	
Pseudo R-square	0.166		0.141		0.090		0.111	
No of obs	***4334***		***839***		***363***		***993***	
Censored obs	***512***		***316***		***105***		***255***	

Table 6: Multivariate analysis of VC performance

Panel A shows the descriptive statistics for the additional variables used in Panels B and C that measure the absence of a shared land border (*Cross-border not sharing*), geographic distance, cultural disparity and regulatory differences between the VC firm's and the portfolio-company's home countries. Panel B shows the impact of cross-border investing on performance in countries with and without shared land borders. The table shows the results of mixed-effects models of VC performance. The dependent variable is IRR and is measured as annualized internal rate of return. *Cross-border* is 1 for cross-border investments and zero otherwise. *Cross-border (not sharing)* is 1 for cross-border investments in countries without a land border with the VC firm's home country, and zero otherwise. All other variables are defined as in Table 3. Panel C shows the impact of measures of distance and regulatory and institutional differences on performance (IRR). *Geographic distance* is measured as the distance between the capitals of the respective countries of VC firm and portfolio company. *Cultural distance* is the difference in the Hofstede measure of culture (from Geert Hofstede's website) between the home countries of the VC firm and of the portfolio company. *Regulatory quality (Diff)* and *Political Stability (Diff)* are the differences in the average scores of regulatory quality and political stability (as in Kaufmann, Kraay and Mastruzzi 2007, based on data from the World Bank). *Legal system (Diff)* is a binary variable that takes the value 1 if the countries of the VC firm and portfolio company have different legal systems, and zero otherwise (based on data from Rafael La Porta's website). Other control variables are as defined in Table 3. ***,**,* indicate 1%, 5% and 10% conventional levels. [a]The mixed-effects analyses in Panels B and C model *Investment year* and portfolio-company *Industry* as fixed effects and *Financing stage* as random.

Panel A: Descriptive Statistics	**Cross-border (All regions)**		
	Mean	***Median***	***STD***
Cross-border (not sharing)	0.793	1.00	0.231
Geographic Distance (Mil)	4651	4255	2610
Cultural Distance (#)	9.87	10.91	5.44
Regulatory quality (Diff)	2.00	4.00	37.00
Political Stability (Diff)	5.00	1.00	41.00
Legal system (Diff)	0.351	0.000	0.403
Logarithmic values			
Geographic Distance	8.755	8.355	1.184
Cultural Distance	2.105	2.187	0.645

Table 6 continues

Panel B: Mixed-effects models of IRR in (non-)neighboring countries	North America		Europe	
	Coeff	*P-value*	*Coeff*	*P-value*
Cross-border	-0.151**	(0.024)	-0.205**	(0.033)
Cross-border not sharing border	-0.417***	(0.001)	-0.588***	(0.000)
Ln VC age	0.020**	(0.011)	0.024**	(0.021)
Ln Fund age	-0.156	(0.254)	-0.121	(0.301)
Ln Investment size	-0.305***	(0.000)	-0.286***	(0.000)
Investment Duration	0.082***	(0.000)	0.074***	(0.000)
Ln Fund Age top 75th	0.085	(0.251)	0.099	(0.351)
Liquidity	-0.267***	(0.000)	-0.302***	(0.000)
Syndication	0.025	(0.254)	0.021	(0.251)
Constant	0.221***	(0.000)	0.042***	(0.000)
Pseudo R-square	***0.131***		***0.110***	
No of Obs	***4334***		***839***	
Industry &Stage & Investment Year[a]	Y		Y	

Table 6 continues

Panel C: Mixed-effects models of IRRs with distance measures	Model I: North America		Model II: Europe (Ex. UK)		Model III: UK		Model IV: ROW	
	Coeff	*P-value*	*Coeff*	*P-value*	*Coeff*	*P-value*	*Coeff*	*P-value*
Cross-border dummy	-0.178*	(0.073)	-0.105*	(0.092)	-0.132*	(0.061)	-0.101	(0.118)
Ln (Geographic distance)	-0.181*	(0.080)	-0.120*	(0.090)	-0.113*	(0.058)	-0.173*	(0.055)
Ln (Cultural distance)	-0.294*	(0.084)	-0.257*	(0.094)	-0.276*	(0.092)	-0.368*	(0.082)
Regulatory quality(Diff)	-0.004***	(0.004)	-0.005**	(0.046)	-0.002**	(0.021)	-0.002*	(0.091)
Political Stability (Diff)	-0.002*	(0.075)	-0.003*	(0.059)	-0.002*	(0.072)	-0.003*	(0.052)
Legal system (Diff)	-0.068	(0.478)	-0.103	(0.329)	-0.050	(0.601)	-0.011	(0.293)
Post-1997	-0.518***	(0.000)	-0.250**	(0.024)	-0.483***	(0.000)	-0.362***	(0.008)
Ln VC age	0.018***	(0.001)	0.030***	(0.000)	0.028***	(0.000)	0.055***	(0.000)
Ln Fund Age	-0.155	(0.254)	-0.215	(0.132)	-0.196	(0.161)	-0.072	(0.688)
Ln Investment size	-0.293***	(0.000)	-0.246****	(0.000)	-0.332***	(0.000)	-0.500***	(0.000)
Investment duration	0.082***	(0.000)	0.082***	(0.000)	0.080***	(0.000)	0.034	(0.168)
Ln Fund Age top25th	0.095	(0.394)	0.075	(0.544)	0.039	(0.727)	0.037	(0.364)
Liquidity	-0.269***	(0.000)	-0.360	(0.308)	-0.267***	(0.000)	-0.263***	(0.005)
Syndication	0.014	(0.291)	0.015	(0.187)	0.011	(0.390)	0.364**	(0.025)
Constant	0.205***	(0.000)	0.166**	(0.041)	0.174***	(0.000)	0.144***	(0.000)
Industry	*Present*		*Present*		*Present*		*Present*	
Financing Stage	*Present*		*Present*		*Present*		*Present*	
Investment Year	*Present*		*Present*		*Present*		*Present*	
Pseudo R-square	0.137		0.120		0.109		0.117	
No of obs	***4334***		***839***		***363***		***993***	

Table 7: Alternative measures of risk (Domestic vs. cross-border deals)

The table shows a comparison of domestic and cross-border deals using alternative measures of risk Bankruptcy is calculated as the fraction of investments where the investment multiple is equal to zero. Capital loss is the fraction of investments where the multiple is less than one. Systematic risk is measured as the sensitivity of IRR to the local market index of the VC firms for domestic deal (1), local market index of portfolio company for cross-border deals (2) or local market index of the VC firms for cross-border deals. ***,**,* indicate 1%, 5% and 10% conventional levels.

	Bankruptcy		**Capital loss**		***Systematic risk***				
Regions	***Domestic***	***Cross-border***	***Domestic***	***Cross-border***	***Domestic Deals (Local index of VC) (1)***	***Cross-border Deals (Local index of Portfolio) (2)***	***Cross-border Deals (Local index of VC) (3)***	***Diff (1)-(2)***	***Diff (2)-(3)***
North America	17%	20%	29%	31%	2.519	2.402	1.343	1.112	2.113**
Europe	15%	18%	25%	32%	2.749	2.661	1.394	1.021	3.022***
UK	18%	19%	22%	24%	2.692	2.511	1.241	1.512	2.590**
ROW	23%	24%	29%	33%	2.681	2.784	2.567	-1.041	1.481

Appendix A: Distribution of venture capital deals by region from 1971-2009

	All deals (#)	North America (NA)			EU (ex. UK)			UK			ROW		
Investment Years		**Domestic deals (#)**	**Cross Border (CB) (#)**	**CB to Total NA (%)**	**Domestic deals (#)**	**Cross Border (CB) (#)**	**CB to Total EU (%)**	**Domestic deals (#)**	**Cross Border (CB) (#)**	**CB to Total UK (%)**	**Domestic deals (#)**	**Cross Border (CB) (#)**	**CB to Total ROW (%)**
1971-1980	35	35	0	0	0	0	-	0	0	-	0	0	-
1981-1990	850	691	50	6.75	39	16	29.09	11	12	52.17	29	2	6.45
1991-2000	4435	2595	194	6.95	424	216	33.75	178	77	30.20	621	130	17.31
2001-2009	1209	624	145	18.86	91	54	37.24	67	17	20.24	145	66	31.28
Total	**6529**	**3945**	**389**	**8.97**	**554**	**286**	**34.05**	**256**	**106**	**29.28**	**795**	**198**	**19.94**

Appendix B: Definitions of Variables

Variable	Definition of variable
Cross-border	A dummy variable taking a value of 1 if the portfolio company and the VC firm are located in different countries, and zero otherwise.
Cross-border not sharing border	A dummy variable taking a value of 1 if the portfolio company is located in a country that does not share a border with the home country of the VC firm, and zero otherwise.
Geographic distance	Measured as the distance between the capitals of the countries of the VC firms and portfolio companies in miles. We obtain the data from the CEPII website (www.cepii.fr/anglaisgraph/bdd/distances.htm).
Cultural distance	As in Dai and Nahata (2016), we follow the approach of Kogut and Singh (1988) and use the Hofstede measures of culture (i.e., Power distance, Individualism, Masculinity and Uncertainty avoidance) to compute the cultural distance between VC firm and Portfolio company. The data are obtained from Geert Hofstede's website (www.geerthofstede.nl). The following Cartesian distance measure is used to calculate cultural disparity: $\text{Hofstede cultural difference} = \frac{\left(\sum_{i=4}^{4}\left(C_{Local,i} - C_{cross-border,i}\right)^2\right)^{\frac{1}{2}}}{4}$ where $C_{local,\,i}$ is the local VC culture based on measure *i* and $C_{cross\text{-}border,\,i}$ is the culture measure of the portfolio company based on measure *i.*
Regulatory distance	Is the difference in the score of regulatory quality between the home countries of the VC firm and the portfolio company. The score value for each country ranges between 0 and 100. The data are obtained from Worldwide Governance Indicator (WGI) of the World Bank website (http://data.worldbank.org/data-catalog/worldwide-governance-indicators)
Political distance	Is the difference in the score of political stability between the home countries of the VC firm and the portfolio company. The score value for each country ranges between 0 and 100. The data are obtained from Worldwide Governance Indicator (WGI) of the World Bank website (http://data.worldbank.org/data-catalog/worldwide-governance-indicators)
Legal system difference	As in Chemmanur et al. (2016, this is a dummy variable coded 1 if the (Common or Civil Law) origins of the legal systems of the home countries of the VC firm and the portfolio company differ, and zero otherwise. The data are obtained from Rafael La Porta's website (http://faculty.tuck.dartmouth.edu/rafael-laporta/research-publications).
Capital inflow	The aggregate amount of capital inflow into the VC industry in the home country of the VC firm in the year of investment. The data are obtained from the Preqin database.
Ln VC Age	Natural logarithm of the age (years in business) of the venture capital firm at the time of initial investment in the portfolio company.
Ln Investment size	Natural logarithm of the total amount invested by the VC firm in a given portfolio company (in USD million).

Appendix B continues

Ln Fund Age	Natural logarithm of fund age measured in years from the date of fund initiation to the date of VC investment in a given portfolio company.
Ln Fund Age Top 25th	Natural logarithm of fund age for older funds, specifically, funds above the 75^{th} age percentile and 0 otherwise.
Investment duration	The time between the initial VC investment and the VC exit date (in years).
Liquidity	Stock market liquidity of the country of origin of the portfolio company measured as the ratio of the value of shares traded on the country's stock exchange(s) divided by the country GDP.
Syndication	A binary variable equal to 1 if the investment is syndicated and 0 otherwise.
IRR	Internal rate of return (IRR) based on detailed information of the investment cash flows, as described in Section 3. IRR is winsorized at 1 percent in all analyses.
PME	Public Market Equivalent, as described in Section 3.
Post-1997	Binary indicator equal to zero for investments up to 1997 and one thereafter.
Year	Set of binary indicator variables for the year of VC investment.
Financing stage	Binary variables for financing stage. We include an indicator for investments in expansion stages (zero otherwise), and another for investments in later stages (zero otherwise). Early stage investments are used as the base.
Industry	A set of binary industry variables for the portfolio company's primary industry focus. We include indicators for biotechnology, consumer goods and services, financials, industrials, and information technology, treating 'Others' as the base.

Appendix C: Correlation matrix.

Variables		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Fund age	**(1)**	1												
VCs age	**(2)**	0.169	1											
Inv-size	**(3)**	-0.115	0.281	1										
IRR	**(4)**	0.025	-0.003	-0.037	1									
PME	**(5)**	-0.006	-0.012	-0.005	0.003	1								
Holding period	**(6)**	0.019	0.208	0.515	-0.032	-0.012	1							
Liquidity	**(7)**	0.011	-0.058	0.032	-0.020	-0.002	0.133	1						
Syndication	**(8)**	-0.092	0.018	0.034	0.020	-0.019	0.119	0.019	1					
IPO	**(9)**	0.020	-0.002	-0.149	0.163	-0.003	-0.250	-0.006	0.022	1				
M&A	**(10)**	0.013	-0.057	-0.033	0.145	-0.008	-0.046	-0.035	-0.039	-0.231	1			
Early	**(11)**	-0.033	0.118	-0.050	-0.039	0.018	0.072	-0.039	0.141	-0.088	-0.020	1		
Expansion	**(12)**	0.034	-0.147	0.033	-0.003	-0.004	-0.135	0.059	-0.144	0.053	-0.022	-0.734	1	
Later	**(13)**	0.005	0.014	0.030	0.059	-0.004	0.065	-0.017	-0.023	0.061	0.057	-0.526	-0.192	1

Appendix D: Robustness

The table shows the coefficients of cross-border indicator for different models by regions. The results are reported by the baseline Heckman model (1), three stage Heckman model (2), instrumental variable for syndication (3), market condition and busyness (4) and propensity score matching (5). The control variables are as reported in the previous tables. . ***, **,* indicate significance at 1%, 5% and 10% respectively.

	Model I: North America		Model II: Europe (Ex.UK)		Model III: UK		Model IV: ROW	
Coefficient of Cross-border Indicator	*Coeff*	*Pvalue*	*Coeff*	*Pvalue*	*Coeff*	*Pvalue*	*Coeff*	*Pvalue*
(1) Baseline Heckman model (from Table 3)	-0.192**	(0.033)	-0.232**	(0.017)	-0.270**	(0.023)	-0.156**	(0.017)
(2) Heckman model with two Probit stages (for exit decision and for cross-border investing)	-0.196**	(0.041)	-0.248**	(0.028)	-0.278**	(0.033)	-0.166**	(0.025)
(3) Heckman-model with instrumental variable for *Syndication*	-0.1843**	(0.045)	-0.2204**	(0.019)	-0.2592**	(0.026)	-0.1498**	(0.019)
(4) Heckman-model with additional Stage II variables (market conditions, busyness)	-0.179**	(0.044)	-0.229**	(0.020)	-0.254**	(0.025)	-0.145**	(0.018)
(5) Mixed-effects model with propensity-score matching	-0.119**	(0.032)	-	-	-	-	-	-