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Cross-border Venture Capital Investment: Is there still a place for geography

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Abstract

Cross-border Venture Capital Investment: Is there still a place for geography? Katja Bringmann, University of Antwerp, June 2012 (PhD start date), December 2016 (expected final date), katja.bringmann@uantwerpen.be State-of-the-art and theoretical arguments The importance of venture capital [VC] as source of finance for young and innovative businesses is widely acknowledged. Besides providing entrepreneurs with money, venture capitalists take an active stance in their portfolio firms and also add non-financial resources in form of managerial expertise and social capital. It has been stressed that for the effective coaching and monitoring of the new venture, frequent personal contact between the investor and the entrepreneur is important and enhances economic performance. Given the general homophily of social interactions in space, leading to escalating information costs and asymmetries with increasing distance, prior studies found a preference of VC investors for investments in portfolio companies located in vicinity. However, in opposition to the long observed spatial restrictiveness of domestic VC investments, the past decade has seen an acceleration in the number of international VC transactions. Nowadays, about 40 per cent of VC deals denote the participation of a cross-border investor. Research Gap The growing trend towards VC investments across national borders suggests a re-evaluation of the geographic fundamentals of VC. Deviations from the parochial bias of VC investments have so far solely been addressed for single countries or specific regions such as Silicon Valley. In this study we extent these contributions by adding insights on the spatial patterns of VC investments that transcend domestic borders. We systematically test if in an increasingly globalizing financial system the significance of physical distance is mitigated with respect to VC activity. Data and Method For analyzing the impact of physical distance on cross-border VC investment allocation, we collect data on gross bilateral VC investment flows between 191 industrial and developing market economies for the period 1990-2010 using Thomson Reuters' VentureXpert database. Of a total of 762.090 possible bilateral investment dyads between 36.290 different country pairs over a period of 21 years, we identified VC activity between 5.619 dyads (0.0074%). Besides geographic distance, investment flows are likely to be influenced by institutional and macroeconomic developments and cultural distance. We therefore include as control variables the annual GDP volume of source and destination country and, at the dyad level, the existence of a common currency, common visa policies, common language and historical ties. The data is obtained from both the World Bank and the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). With respect to trade flows in goods between

countries, the gravity equation is widely applied in international economics to explain spatial trade patterns. Apart from the trade literature, the model has also been successfully empirically tested for financial transactions such as FDI and cross-border equity. The model estimates bilateral trade flows as a function of the economic mass of two countries and their bilateral distance while taking into account several trade barriers and facilitators. Using count data models, we systematically assess the persistence of spatial consideration in global VC transactions for different geographical areas: a comprehensive sample of market economies including and excluding the US as largest net exporter of VC and a more granulated European centered data set. Results We find a statistically significant distance decay effect with respect to cross-border VC investments. In that, also global VC activity is characterized by an enduring "home bias" effect emphasized in case of domestic VC activity. In contrast, the size of the destination country's economy, cultural proximity as well as increased economic integration facilitates the influx of foreign investors. The distance decay effect is more prominent in the sample of European countries compared to the global cross section, which mainly has to do with the role of the US as largest exporter of VC and its relatively secluded geographic position. By letting the distance variable vary over a range of intervals, we forward that the effect of distance in its logged form on VC investment flows is not a continuum. Rather, we observe different thresholds where the impact of distance changes. Consequently, we suggest that the functional form of physical distance is better approach by a splined model. Summing up, the article makes two distinct contributions to the growing literature on cross-border VC and international entrepreneurship. By stressing the continuing influence of geography on international capital markets, we intend to reintroduce a more spatially-informed discourse to the field. Secondly, we provide empirical support that the gravity model, commonly applied in the international trade literature on goods, is similarly well suited to explain bilateral financial flows in form of VC. Finally, our insights into the aggregated investment behavior of VC firms are useful for policy makers dealing with the uneven spatial development of VC investments.

Cross-border Venture Capital Investment: Is there still a place for geography?

Katja Bringmann (University of Antwerp)

1. Introduction

For young and innovative firms venture capital [VC] is an important financing vehicle. Given the early development stage of those firms coupled with a high risk profile and information asymmetries, VC activity is often portrayed as a local business. The strong emphasis on geographical proximity between investors and target firms in the venture capital literature, which gets reflected in concepts such as the "One-hour driving rule" of investing[1] (Cumming & Dai, 2010), is however in stark contrast to the globally growing number of transnational VC deals.

In opposition to the long observed spatial restrictiveness of domestic VC investments, the past decade has seen an accelerating number of cross-border VC transactions. Cross-border VC is hereby defined as financial participation of an investor from country A in a portfolio company located in country B. In Europe, about half of all investments directed towards a country's domestic firms exhibit a cross-border dimension (see Table 1). The large share of VC investments across national borders appears diametrical to the long observed parochial bias and suggests the re-evaluation of the geographic fundamentals of VC with a focus on global transaction patterns. In this paper, we assess the spatial dispersion of international VC activity on the global and the European level. In particular, we analyze whether international VC flows are to some degree still limited by geography or if they indeed have become frictionless as often stated by the popular press recurrently announcing the "death of distance".

Not only in the case of venture capital investments, but also for a number of other financial activities a local bias has been forwarded, despite the omnipresence of modern communication technologies and the "weightless" nature of financial assets. Skewed spatial patterns are observed in case of corporate bonds (Portes, Rey, & Oh, 2001), international equity flows (Portes & Rey, 2005), mutual funds' selection of stocks (Coval & Moskowitz, 2001) and in case of investment portfolio allocations (Tesar & Werner, 1995). Even with respect to mergers and acquisitions a preference for geographically proximate firms has been detected (Uysal, Kedia, & Panchapagesan, 2008).

In the VC business, physical proximity between investor and target has long been regarded as important, because venture capitalists take an active stance in their portfolio companies and also add non-financial resources in form of managerial expertise and social capital. For the effective coaching and monitoring of the new venture, frequent personal contact between the investor and the entrepreneur is important and enhances economic performance (Chen et al., 2010, Cumming & Dai, 2010). Geographical heterogeneity largely deters social interaction between actors important for the exchange of information (Sorenson, Rivkin, & Fleming, 2006). In line with the general homophily of social interactions in space, leading to escalating information costs and asymmetries with increasing distance, prior studies found a preference of VC investors for investments located in vicinity (Gupta & Sapienza, 1992). Informational frictions and related principal-agent problems that amplify with physical distance are in this way reduced.

Deviation from the parochial bias of VC investments have so far solely been addressed for single countries (M. Fritsch & D. Schilder, 2008; O. Sorenson & T. E. Stuart, 2001) or specific regions

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

such as Silicon Valley (Terri L Griffith, Patrick J Yam, & Suresh Subramaniam, 2007). In this study we extend these contributions by adding insights concerning the spatial patterns of VC – target firm relations that transcend domestic borders. We systematically test if in an increasingly globalizing financial system the significance of physical distance is mitigated with respect to VC activity. Using count data models, we assess the persistence of spatial consideration in global VC transactions for different geographical areas: a comprehensive sample of market economies including and excluding the US as largest net exporter of VC and a more granulated European centered data set. We demonstrate that physical distance continues to play a role in international VC transactions.

The gravity equation is widely applied for the estimation of trade flows in goods between countries. The gravity model calculates bilateral trade flows as a function of the economic mass of two countries and their bilateral distance. Commonly, it is also accounted for trade barriers and trade facilitators such as customs unions as well as linguistic and historical ties. Apart from the trade literature, the model has also been successfully tested for financial transactions such as FDI (Blonigen, Davies, Waddell, & Naughton, 2007) and cross-border equity (Portes & Rey, 2005). We provide empirical support that the gravity model is similarly well suited to explain 'weightless' bilateral financial flows in form of VC.

The findings do not only add to the growing academic literature on cross-border VC and international entrepreneurship. Also from a public policy perspective, in the light of recent policy efforts by the European Commission to improve conditions for cross-border VC activity (European Commission, 2013), a better understanding of the determinants of the direction of international VC transactions is imperative. Even more though, given the uneven spatial development of VC, large variations in the liquidity of VC markets and divergence in the ability of countries to attract foreign investors. Given the important role of VC as access to finance for small and medium-sized young firms in innovative industries, unequal pattern of VC may impact the longer-term innovative development and competitiveness of regions and countries. Finally, by stressing the continuing influence of geography in international capital markets, we intend to reinforce a more spatially-informed discourse to the field of international finance.

The paper proceeds as follows. In Section 2 we outline the evolution of cross-border VC transactions. In Section 3 we focus on theoretical arguments regarding the interaction of geography and VC. Section 4 describes the data, specifies variables and elaborates on the gravity model. The main empirical findings are presented in Section 5. A detailed discussion of the results is then provided in Section 6, whereas Section 7 offers a conclusion and lays out avenues for prospective research.

2. A Brief History of Cross-Border Venture Capital Investment

Section still to be developed. Here I will outline the evolution of cross-border investment activities over time and give an overview of the major net receiver and net supplying VC markets.

Table 1. Cross-border and domestic VC investments in Europe (1990-2010)

Year	Domestic venture capital transactions (Europe)	Cross-border venture capital transactions (intra-European)	Inflowing Cross-border VC as share of total VC transactions (intra-European)	Inflowing global cross-border VC in Europe (count)	Inflowing Cross-border VC as share of domestic market (global)
1990	70	30	30%	94	57%
1991	83	30	27%	87	51%
1992	96	30	24%	105	52%
1993	100	53	35%	136	58%
1994	157	82	34%	193	55%
1995	211	76	26%	206	49%
1996	368	160	30%	438	54%
1997	361	133	27%	411	53%
1998	724	215	23%	746	51%
1999	1378	469	25%	1436	51%
2000	3296	1011	23%	3243	50%
2001	3027	766	20%	2374	44%
2002	1643	447	21%	1613	50%
2003	3426	743	18%	2024	37%
2004	4214	1125	21%	2356	36%
2005	3372	925	22%	2744	45%
2006	3063	681	18%	3434	53%
2007	2777	693	20%	2685	49%
2008	2633	687	21%	2571	49%
2009	1941	406	17%	1678	46%
2010	2451	435	15%	1929	44%
Total	35391	9197	21%	30503	46%

Data Source: Thomson Reuters (2011)

3. Venture Capital and Geography

3.1. The Importance of Spatial Proximity in the VC Investment process

VC activity appears to be unevenly distributed and geographically concentrated in only a few high tech clusters and financial centers around the globe (Chen, Gompers, Kovner, & Lerner, 2010; R. L. Florida & M. Kenney, 1988; Lindgaard Christensen, 2007; Martin, Sunley, & Turner, 2002; Mason & Harrison, 2002; Powell, Koput, Bowie, & Smith-Doerr, 2002; Zook, 2002). In the literature mainly two motives are cited to explain the parochial bias of VC: (1) the existence of information asymmetries with respect to deal selection and (2) the importance of monitoring and knowledge transfer following deal closure. In the remainder of this section, both rationales will be discussed in further detail.

VC investors enter firms at an early development stage when the young firm does not yet dispose over an elaborate public track record. To curtail information asymmetries at the deal selection stage, venture capitalists often refer to their broad social network to learn about promising new investment opportunities (Fried & Hisrich, 1994; Hochberg, Ljungqvist, & Lu, 2007). Investment bankers, entrepreneurs, consultants, but also other venture capital firms with whom the investor has worked in the past, often belong to this referral network.

Reliable information exchange involves trusted relations. The establishment of trust, in turn, is facilitated by frequent face-to-face contact. Venture capitalists' networks, like social linkages in general, are consequently predominantly local in scope. Thus, one reason forwarded to explain the spatial clustering of VC investors and their target firms is the spatial bias of investors' social ties. This causes investors to be better informed about deals involving local firms than more, in geographic terms, remote investment opportunities.

However not only the spatially restricted scope of their social networks explains the co-location of investor and target firms, shorter travel time between them also facilitates the due diligence process in that less time is needed for transit. A reduction in travel time between investor and investee increases the likelihood that a business gets selected for funding (Lutz, Bender, Achleitner, & Kaserer, 2013). Investors are found to prefer to invest in companies that are located in their direct neighborhood, no further than one hour driving distance from their office (Zook, 2002). The tendency towards back yard investments leads to a geographic bias already at the opportunity identification and due diligence stage (Mason, 2007).

In contrast to most financial instruments such as bank loans, venture capitalists' involvement does not slacken after money has been granted. Rather, most investors obtain a seat in the Board of Directors and become actively involved in the development and management of their target companies (De Clercq & Manigart, 2007; Gorman & Sahlman, 1989; Sapienza, 1992; Sapienza, Manigart, & Vermeir, 1996). In view of the high investment risk that is inherent to many venture capital deals, the direct involvement of an investor curtails financial and business hazards, diminishes principal – agent related problems as well as offers the possibility to actively steer the development of the young firm.

With respect to the generation of these beneficial synergies, physical proximity between the venture capital firm and the portfolio company is crucial (R. Florida & M. Kenney, 1988). The spatial concentration of investors and investees facilitates regular face-to-face encounters, which particularly ease the tapping of 'nonmonetary' resources such as the investors' social capital (Mäkelä & Maula, 2006; R. Martin, Berndt, Klagge, & Sunley, 2005; C. M. Mason & Harrison, 1995; Powell et al., 2002; Zook, 2004). Zook (2002) asserts the importance of vicinity for the occurrence of knowledge spillovers including the easier and cheaper transfer of tacit knowledge: "Getting the most from a venture capitalist or 'smart money' [...] is constrained by geography [...] Firms located near sources of VC have better access to the funding, networks, and advice of venture capitalists" (pp. 163).

There are also circumstances that moderate the impact of distance on venture capital investments: Syndication, the degree of investment participation and investor's experience. Geographical proximity seems to matters less in syndicated investment deals (Fritsch & D. Schilder, 2008). Venture capitalists are more willing to invest in a distant target company when they syndicate with a local partner. Generally it is then the local partner that takes on a leading role in the investment and closely monitors the entrepreneur. Secondly, older, more experienced venture capital firms are more inclined to finance target firms located further apart (Terri L. Griffith, Patrick J. Yam, & Suresh Subramaniam, 2007; Powell et al., 2002). Experience often comes with a larger network of contacts and investors that capture a central position in domestic syndication networks are found to have a broader investment radius than their more peripheral counterparts (O. Sorenson & T. E. Stuart, 2001).

3.2. Cross-border Venture Capital

The VC business has been predominantly local in scope, however since the late 1990s we see an increasing number and volume of longer distance, cross-border investments. US investors were the first to venture overseas, but during the past years also European investors have begun to cross regional and national borders to search for promising funding opportunities. Here outflows are especially denoted in, in relative terms, smaller countries and markets like Sweden, Finland and The Netherlands (Hall & Tu, 2003). The two predominant rationales commonly cited to explain investor's renunciation of the local sphere are portfolio diversification and, on the supply side, a larger pool of investment opportunities.

The literature on VC has so far only paid limited attention to the acceleration of international transactions (see Wright, Pruthi, & Lockett, 2005). The few existing studies on international VC flows concentrate on filtering host country conditions that attract funding (see Schertler & Tykvová, 2011) and home country factors and investor inherent characteristics that broaden the investment radius (Hall & Tu, 2003). Underdeveloped is research dealing with the spatial patterns of international VC flows and their evolution. This is especially surprising given the

broad understanding of the importance of geography in the VC investment process at the domestic level.

Generally deals are classified in the literature as either being domestic or cross-border. No further decomposition is made according to the actual geographic location of the host country or investor in case of cross-border investments. Aizenman and Kendall (2012) are the first to detail the geographic patterns of international VC flows by introducing a variable measuring the geodesic distance of investment dyads. Like the majority of studies they nevertheless address VC internationalization from a US centered perspective, only taking into account US deals involving international partners and international deals with the participation of a US investor. Given the size and maturity of the US market and its exposed geographical position separated by an ocean from most other noteworthy VC markets, those results may however be unrepresentative with regard to European investors.

The distance between creditor and borrowers has been growing also in other financial sectors like small business lending (Petersen & Rajan, 2002). Modern communication technologies facilitate the sourcing of information over longer distances. The differences between small business lending and VC is however that the former involves more mature firms and bases decisions on "hard", codified and public available information which are more easily transferrable over greater distances. Nevertheless, we expect that *the importance of physical proximity has diminished over time also for VC as IT and highly advanced communication tools allow for the execution of due diligence as well as advising and monitoring tasks over further distances and across borders.*

Summing up, VC distinguishes itself from other investment vehicles (portfolio investments, bank loans etc.) by the large hands-on involvement on behalf of the investor. Coupled with high information asymmetries, which however reduce with physical proximity, the literature has stressed for long the local nature of VC activity. The localization of VC activity is thereby in sharp contrast to an ever more globalizing financial system. The increasing number of long distance, cross-border VC deals suggests that during the past years also VC activity has in parts become less local. Nevertheless, few studies so far focus their attention on activities beyond the regional level and consider VC internationalization processes. In what follows we analyze whether there is the need for a paradigm change in the VC literature towards a less space-based view by reviewing the importance of different proximity concepts (physical, institutional and cultural) for VC internationalization.

4. Data

We aggregate annual data on cross-border VC transactions from a set of 191 industrial and developing market economies for the period 1990-2010 using Thomson Reuters' VentureXpert database. The database contains information on VC deals, private equity backed companies, initial public offerings, and limited partners and is widely used in VC research. The global sample covers 762.090 possible bilateral investment dyads between 191 times 190 country pairs over a period of two decades. Effectively, we identified VC activity between 5.619 dyads (0.0074%). In case of the European sample, 30 countries are considered (EU 28, Norway and Switzerland) resulting in 18.270 bilateral investment dyads whereby 8.92 per cent of the dyads denote VC activity.

The longitudinal nature of our data over two decades allows for tracing the long-term development and capturing the dynamics of the VC internationalization process over time. Existing studies on transnational VC activity generally still lack such long-time approach (Wright et al., 2005).

Although Thomson Reuters reports VC activity from the 1960s onwards, data before 1980 is collected in a non-systematic way based solely on the retrospective self-reporting of selected industry participants and thus it is prone to severe selection bias. In addition, another reason for

limiting the starting date of the sample to 1990 is the geopolitical division of countries as consequence of the "Iron Curtain" which caused a severe structural distortion of bilateral trade flows. Taking 1990 as starting year, we ensure that states in Europe, next to the US the largest VC market, are consistent in their geographic area over time.

4.1 Dependent Variable

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

4.2 Independent Variables

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

- $d_{ij} = \log(R \times [\arccos[\sin(lat\ i) \times \sin(lat\ j) + \cos(lat\ i) \times \cos(lat\ j) \times \cos(i-j)]])$

4.3 Control Variables

Besides geographic distance, investment flows are influenced by institutional and macroeconomic developments and cultural distance. We therefore include as control variables the annual GDP volume of source and destination country and, at the dyad level, the existence of a common currency, common visa policies, common language and historical ties. The data is obtained from both the World Bank and the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

Market size: we control for the market size of source country *i* and destination country *j* by using the log of their respective GDP (*lnGDP_i and lnGDP_j*) expressed in constant 2005 US dollars (WDI, 2015).

In addition to bilateral distance, we include the dummy variable *Common Border* that equals one when the country dyad shares a border and zero otherwise

Cultural distance: *Common Language_{ij}* is a dummy variable that takes on the value of 1 if country *i* and country *j* share a common language, and zero otherwise. To account for historical ties in form of a common colonial past, we introduce the dummy variable *Historical Ties_{ij}*. Both variables are regarded as standard specifications in trade-related gravity equations. Previous studies forward that cultural proximity between financial markets facilitates communication and trust and consequently increases the likelihood of bilateral investments (Jaaskelainen, 2014).

Year dummies capture macroeconomic effects such as global shocks that apply to all countries in a given years. Source and destination country fixed effects proxy stationary country specific characteristics such as differences in entrepreneurial culture.

5. Methodology

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

2004). The mass of the bodies is hereby often converted into the GDP of country i and, respectively, country j.

Despite its long disputed theoretical foundation, the gravity model has not only become an empirical work horse in the trade literature, but has also proven to be of similar explanatory power regarding international financial flows (Portes & Rey, 2005). The gravity equation has been applied to a wide range of cross border asset transactions including bonds, equity and banking assets (Coeurdacier & Martin, 2009), and foreign direct investments [FDI] (Alcacer & Ingram, 2013; Brenton, Di Mauro, & Lücke, 1999).

The basic standard gravity specification model is represented by:

$$Y_{ij} = \beta_0 X_i^{\beta_1} X_j^{\beta_2} D_{ij}^{\beta_3} X_{ij}^{\beta_4} \eta_{ij},$$

(1)

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

If we rewrite equation (1) in a log linear form, we obtain:

$$\ln(Y_{ij}) = \ln \beta_0 + \beta_1 \ln X_i + \beta_2 \ln X_j + \beta_3 \ln D_{ij} + \beta_4 X_{ij} + \ln \eta_{ij}$$

(2)

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

$$\ln(flows_{ij,t}) = \beta_0 + \beta_1 \ln(GDP_{i,t}) + \beta_2 \ln(GDP_{j,t}) + \beta_3 \ln(distance_{ij}) + \sum \lambda X_{ij}$$
$$+ time\ dummies + \varepsilon_{ij,t}$$

(3)

Silva and Tenreyro (2006) stress the deficiencies of applying Ordinary Least Squares [OLS] estimation methods to the log-linearized gravity equation. The heteroskedastic nature of the error term and the occurrence of dyads denoting zero-investment flows cause inconsistent and biased results when using OLS. Especially the elasticities associated with the distance term get highly inflated using standard OLS estimation techniques. Also the augmented gravity model controlling for fixed effects introduced by Anderson and Van Wincoop (2003) is not prone to Jensens's inequality in the case of OLS. As an alternative way, the authors therefore suggest applying Poisson pseudo-maximum likelihood estimators.

Given the count data nature of the dependent variables, we employ Quasi-Poisson Maximum Likelihood Estimators to estimate the size and effect of the distance variable and other control variables on aggregate bilateral VC flows.

6. Empirical Results & Discussion

Results from the gravity equation are provided in Table 2. In all models *VC flows$_{ij}$* is the dependent variables. Given Quasi-Poisson models use a log link, we interpret the estimated coefficients as multiplicative effects. Thus, with every standard deviation increase in a variable, the coefficient shows the multiplicative effect exp(β) on the mean of VC flows$_{ij}$.

We estimate how geographic distance between the country of the investor and that of the target firm relates to the size of investment flows between the country pair. Thereby we also account for cultural proximity between the countries, the degree of bilateral economic integration and

differences in macroeconomic factors. The results for the global sample including 131 countries are presented in Table 2.

The US is home to the largest and most advanced VC market worldwide. To ensure robustness of the results and eliminate the possibility that they are solely driven by the US, we run separate models excluding the US. In addition, we calculate the model for a European subset. The dominance of the US has also been denoted in previous studies on VC (e.g. Espenlaub, Khurshed, & Mohamed, 2015).

<Table 2: Gravity Estimates – Cross-border Venture Capital Investment Worldwide 1990-2010. To be inserted>

The European integration process has led to the liberalization of trade barriers and a decreasing fragmentation of markets resulting also in a higher conformity in legal practices (e.g. patent application, intellection property protection). Consequently, given a reduction in economic and legal uncertainties across EU member states, European investors may be inclined to venture at larger distance. Thus, we test if our results also hold in case of intra European cross-border transactions. When looking at the time series dimension of our data, a decrease of the distance coefficient over time implies that the location bias is diminishing and that the EU VC market is becoming more integrated. In contrast, if the distance coefficient remains high, this suggests that when going abroad, investor still prefer investments targets close to their home country, in neighboring states.

For this analysis, we construct a sample of 30 European countries (28 EU Member States, Switzerland, Norway) for the period 1990 - 2010. Although they are not EU members, we include two additional countries in the sample, Norway and Switzerland, as they maintain strong economic ties with EU Member States. Table 3 shows the results for the European sample including and excluding the UK based on quasi-Poisson maximum likelihood estimation.

We conclude that the size of a country's economy as well as cultural, political and legal proximity between county pairs and especially their geographic proximity are important determinants of bilateral VC flows. Country fixed effects indicate that cross-border investments in Europe are mainly confined to the more mature VC markets of western and northern Europe including the UK, France, Germany, the Netherlands, Belgium, Sweden and Finland.

The UK is the most mature and largest VC market in European in terms of volume and number of transactions. Nevertheless, estimation results may have been biased given its specific position with respect to the European integration process (the UK is neither a Schengen nor Eurozone member) and its particular geographic position as an island. Indeed, we observe considerable differences between the two samples in all models concerning the coefficient of the "Common border" variable. Excluding the UK leads to a doubling in magnitude of the coefficient. Also the statistically significant and positive effect on bilateral investment flows of sharing a currency is more than twice as pronounced when the UK is left out. Same applies to the effect of a shared visa policy easing the free movement of people.

				Dependent variable:				
				Cross-border transactions (count)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln GDP (Origin)	−1.881***	−2.459***	−1.899***	−2.480***	−1.938***	−2.436***	−1.752***	−2.722***
	(0.510)	(0.593)	(0.520)	(0.577)	(0.518)	(0.596)	(0.519)	(0.577)
Ln GDP (Destination)	0.795**	−0.431	0.946**	−0.163	0.749*	−0.431	0.749*	−0.884*
	(0.405)	(0.489)	(0.407)	(0.474)	(0.415)	(0.499)	(0.408)	(0.472)
Common Language	0.658***	0.567***	0.602***	0.497***	0.655***	0.567***	0.639***	0.547***
	(0.087)	(0.095)	(0.087)	(0.090)	(0.088)	(0.096)	(0.089)	(0.095)
Common Border	0.586***	1.051***	0.450***	0.958***	0.585***	1.051***	0.513***	1.029***
	(0.068)	(0.076)	(0.071)	(0.072)	(0.069)	(0.076)	(0.070)	(0.075)
Historical Ties	−0.708***	−0.815***	−0.539***	−0.424***	−0.706***	−0.813***	−0.753***	−0.791***
	(0.122)	(0.117)	(0.122)	(0.111)	(0.123)	(0.118)	(0.126)	(0.116)
Ln Distance (km)	−1.146***	−1.012***	−1.263***	−0.996***	−2.020***	−1.985***	−1.186***	−1.001***
	(0.044)	(0.059)	(0.048)	(0.057)	(0.490)	(0.680)	(0.045)	(0.058)
Common Currency			0.545***	1.298***				
			(0.083)	(0.094)				
Schengen							0.425***	0.703***
							(0.079)	(0.087)
Time x Distance	No	No	No	No	Yes	Yes	No	No
Observations	17,276	16,094	17,276	16,094	17,276	16,094	17,276	16,094

Note: Significance at the 1, 5, and, respectively, 10 per cent level is denoted by *p<0.1; **p<0.05; ***p<0.01. Standard errors are in parentheses. Models (2), (4), (6), and (8) exclude the UK. All models include year dummies from 1990 - 2010 as well as destination and origin country fixed effects. The base country is Austria.

Table 3. Gravity Estimates – Cross border Venture Capital Investment in Europe 1990-2010

7. Conclusion

We find a statistically significant distance decay effect with respect to cross-border VC investments. In contrast to the frictionless market paradigm, which remains the dominating concept in the international finance discourse, the "home bias" effect emphasized in case of domestic VC activity is thus also forwarded for international VC transactions. Despite the omnipresence of modern communication technologies and the "weightless" nature of financial assets, the distance decay effect is enduring and observable over the entire period of observation. Internationalization of VC activity also appears to be relatively restricted to a limited set of countries in the Western hemisphere (US & Western Europe).

The size of the destination country's economy, cultural proximity as well as increased economic integration, in contrast, facilitate the influx of foreign investors. The distance decay effect is more prominent in the sample of European countries compared to the global cross section, which mainly has to do with the role of the US as largest exporter of VC and its relatively secluded geographic position.

The continuing importance of physical, but also institutional and cultural proximity between investor and target is attributed to the high degree of information asymmetries and the important role of direct interpersonal contact during the investment process. The continuing importance of interpersonal ties suggests a more detailed analysis of human networks and how they steer the emergence of international VC activity. There is need for research that investigates the mechanisms of the formation of international investment ties at the micro-level. A good starting point here is the literature on transnational technical communities (Madhavan & Iriyama, 2009; Saxenian, 2002). It also closely relates to studies on the social structure of the VC industry by Sorenson and Stuart (2001) who find that social ties help overcoming local investment biases in case of domestic investors and Tykvová and Schertler (2011) who attribute tie density among local investors to the size and style of cross-border VC flows.

Bibliography

Aizenman, J., & Kendall, J. (2012). The internationalization of venture capital. *Journal of Economic Studies, 39*(5), 488-511.

Alcacer, J., & Ingram, P. (2013). Spanning the Institutional Abyss: The Intergovernmental Network and the Governance of Foreign Direct Investment1. *American journal of sociology, 118*(4), 1055-1098.

Anderson, J. E., & Van Wincoop, E. (2003). Gravity with gravitas: a solution to the border puzzle *The American Economic Review* (Vol. 93, pp. 170-192).

Anderson, J. E., & Van Wincoop, E. (2004). Trade costs: National Bureau of Economic Research.

Blonigen, B. A., Davies, R. B., Waddell, G. R., & Naughton, H. T. (2007). FDI in space: Spatial autoregressive relationships in foreign direct investment. *European Economic Review, 51*(5), 1303-1325.

Brenton, P., Di Mauro, F., & Lücke, M. (1999). Economic integration and FDI: An empirical analysis of foreign investment in the EU and in Central and Eastern Europe. *Empirica, 26*(2), 95-121.

Chen, Gompers, P., Kovner, A., & Lerner, J. (2010). Buy local? The geography of venture capital. *Journal of Urban Economics, 67*(1), 90-102. doi: http://dx.doi.org/10.1016/j.jue.2009.09.013

Coeurdacier, N., & Martin, P. (2009). The geography of asset trade and the euro: Insiders and outsiders. *Journal of the Japanese and International Economies, 23*(2), 90-113.

Coval, J. D., & Moskowitz, T. J. (2001). The Geography of Investment: Informed Trading and Asset Prices. *Journal of Political Economy, 109*(4).

Cumming, D., & Dai, N. (2010). Local bias in venture capital investments. *Journal of Empirical Finance, 17*(3), 362-380. doi: DOI 10.1016/j.jempfin.2009.11.001

De Clercq, D., & Manigart, S. (2007). The venture capital post-investment phase: Opening the black box of involvement. *Handbook of research on venture capital*, 193-218.

Espenlaub, S., Khurshed, A., & Mohamed, A. (2015). Venture capital exits in domestic and cross-border investments. *Journal of Banking & Finance, 53*, 215-232.

Florida, R., & Kenney, M. (1988). Venture Capital and High Technology Entrepreneurship. *Journal of Business Venturing, 3*(4), 301-319.

Florida, R. L., & Kenney, M. (1988). Venture Capital, High Technology and Regional-Development. *Regional Studies, 22*(1), 33-48.

Fried, V. H., & Hisrich, R. D. (1994). Toward a Model of Venture Capital Investment Decision Making. *Financial Management, 23*(3), 28-37. doi: 10.2307/3665619

Fritsch, & Schilder, D. (2008). Does venture capital investment really require spatial proximity? An empirical investigation. *Environment and Planning A, 40*(9), 2114-2131.

Fritsch, M., & Schilder, D. (2008). Does venture capital investment really require spatial proximity? An empirical investigation. *Environment and Planning A, 40*, 2114-2131.

Gorman, M., & Sahlman, W. A. (1989). What do venture capitalists do? *Journal of Business Venturing, 4*(4), 231-248. doi: http://dx.doi.org/10.1016/0883-9026(89)90014-1

Griffith, T. L., Yam, P. J., & Subramaniam, S. (2007). Silicon valley's 'one-hour' distance rule and managing return on location. *Venture Capital, 9*(2), 85-106. doi: 10.1080/13691060601076202

Griffith, T. L., Yam, P. J., & Subramaniam, S. (2007). Silicon valley's 'one-hour'distance rule and managing return on location. *Venture Capital, 9*(2), 85-106.

Gupta, A. K., & Sapienza, H. J. (1992). Determinants of venture capital firms' preferences regarding the industry diversity and geographic scope of their investments. *Journal of Business Venturing, 7*(5), 347-362. doi: http://dx.doi.org/10.1016/0883-9026(92)90012-G

Hall, G., & Tu, C. (2003). Venture capitalists and the decision to invest overseas. *Venture Capital: An International Journal of Entrepreneurial Finance, 5*(2), 181-190.

Hochberg, Y. V., Ljungqvist, A., & Lu, Y. (2007). Whom you know matters: Venture capital networks and investment performance. *Journal of Finance, 62*(1), 251-301.

Lindgaard Christensen, J. (2007). The Development of Geographical Specialization of Venture Capital. *European Planning Studies, 15*(6), 817-833. doi: 10.1080/09654310701232137

Lutz, E., Bender, M., Achleitner, A.-K., & Kaserer, C. (2013). Importance of spatial proximity between venture capital investors and investees in Germany. *Journal of Business Research, 66*(11), 2346-2354. doi: http://dx.doi.org/10.1016/j.jbusres.2012.04.016

Madhavan, R., & Iriyama, A. (2009). Understanding global flows of venture capital: Human networks as the "carrier wave" of globalization. *Journal of International Business Studies, 40*(8), 1241-1259.

Mäkelä, M. M., & Maula, M. V. J. (2006). Interorganizational Commitment in Syndicated Cross-Border Venture Capital Investments. *Entrepreneurship Theory and Practice, 30*(2), 273-298. doi: 10.1111/j.1540-6520.2006.00121.x

Martin, Sunley, P., & Turner, D. (2002). Taking risks in regions: the geographical anatomy of Europe's emerging venture capital market. *Journal of Economic Geography, 2*(2), 121-150. doi: 10.1093/jeg/2.2.121

Martin, R., Berndt, C., Klagge, B., & Sunley, P. (2005). Spatial proximity effects and regional equity gaps in the venture capital market: evidence from Germany and the United Kingdom. *Environment and Planning A, 37*(7), 1207-1231.

Mason. (2007). *Venture Capital: A Geographical Perspective*. Cheltenham, UK: 'Edward Elgar Publishing, Inc.'.

Mason, & Harrison, R. T. (2002). The Geography of Venture Capital Investments in the UK. *Transactions of the Institute of British Geographers, 27*(4), 427-451. doi: 10.2307/3804471

Mason, C. M., & Harrison, R. T. (1995). Closing the Regional Equity Capital Gap - the Role of Informal Venture Capital. *Small Business Economics, 7*(2), 153-172. doi: Doi 10.1007/Bf01108688

Petersen, M. A., & Rajan, R. G. (2002). Does Distance Still Matter? The Information Revolution in Small Business Lending. *The Journal of Finance, 57*(6), 2533-2570. doi: 10.1111/1540-6261.00505

Portes, R., & Rey, H. (2005). The determinants of cross-border equity flows. *Journal of International Economics, 65*(2), 269-296. doi: http://dx.doi.org/10.1016/j.jinteco.2004.05.002

Portes, R., Rey, H., & Oh, Y. (2001). Information and capital flows: The determinants of transactions in financial assets. *European Economic Review, 45*(4), 783-796.

Powell, W. W., Koput, K. W., Bowie, J. I., & Smith-Doerr, L. (2002). The Spatial Clustering of Science and Capital: Accounting for Biotech Firm-Venture Capital Relationships. *Regional Studies, 36*(3), 291-305. doi: 10.1080/00343400220122089

Sapienza, H. J. (1992). When do venture capitalists add value? *Journal of Business Venturing, 7*(1), 9-27. doi: http://dx.doi.org/10.1016/0883-9026(92)90032-M

Sapienza, H. J., Manigart, S., & Vermeir, W. (1996). Venture capitalist governance and value added in four countries. *Journal of Business Venturing, 11*(6), 439-469. doi: http://dx.doi.org/10.1016/S0883-9026(96)00052-3

Saxenian, A. (2002). Transnational communities and the evolution of global production networks: the cases of Taiwan, China and India. *Industry and Innovation, 9*(3), 183-202.

Schertler, A., & Tykvová, T. (2011). Venture capital and internationalization. *International Business Review, 20*(4), 423-439. doi: http://dx.doi.org/10.1016/j.ibusrev.2010.07.009

Silva, J. S., & Tenreyro, S. (2006). The log of gravity. *The Review of Economics and statistics, 88*(4), 641-658.

Sorenson, & Stuart. (2001). Syndication networks and the spatial distribution of venture capital investments. *American Journal of Sociology, 106*(6), 1546-1588.

Sorenson, O., Rivkin, J. W., & Fleming, L. (2006). Complexity, networks and knowledge flow. *Research Policy, 35*(7), 994-1017.

Sorenson, O., & Stuart, T. E. (2001). Syndication networks and the spatial distribution of venture capital investments1. *American journal of sociology, 106*(6), 1546-1588.

Tesar, L. L., & Werner, I. M. (1995). Home bias and high turnover. *Journal of International Money and Finance, 14*(4), 467-492. doi: http://dx.doi.org/10.1016/0261-5606(95)00023-8

Tinbergen, J. (1962). *Shaping the World Economy; Suggestions for an International Economic Policy*: Twentieth Century Fund, New York.

Tykvová, T., & Schertler, A. (2011). Cross-border venture capital flows and local ties: Evidence from developed countries. *The Quarterly Review of Economics and Finance, 51*(1), 36-48. doi: http://dx.doi.org/10.1016/j.qref.2010.09.005

Uysal, V. B., Kedia, S., & Panchapagesan, V. (2008). Geography and acquirer returns. *Journal of Financial Intermediation, 17*(2), 256-275. doi: http://dx.doi.org/10.1016/j.jfi.2007.12.001

Wright, M., Pruthi, S., & Lockett, A. (2005). International venture capital research: From cross-country comparisons to crossing borders. *International Journal of Management Reviews, 7*(3), 135-165. doi: 10.1111/j.1468-2370.2005.00113.x

Zook. (2002). Grounded capital: venture financing and the geography of the Internet industry, 1994-2000. *Journal of Economic Geography, 2*(2), 151-177.

Zook. (2004). The knowledge brokers: venture capitalists, tacit knowledge and regional development. *International Journal of Urban and Regional Research, 28*(3), 621-641. doi: 10.1111/j.0309-1317.2004.00540.x