

Discussion Paper No. 09-055

Venture Capital and Internationalization

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ZEW

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Economic Research

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Non-technical summary

In the period 2000-2008, more than one third of venture capital-backed companies worldwide received financing from venture capitalists that were not located in the same country as these companies. This paper offers a comprehensive description of how microeconomic as well as macroeconomic factors, which likely affect the availability and profitability of investment opportunities at home and abroad, influence the internationalization patterns. To carry out this comprehensive description, we study the effects these factors have on internationalization patterns from four different perspectives. First, from the perspective of a venture capitalist we analyze its cross-border and domestic deals. Second, from the perspective of the portfolio company we investigate the likelihood that a foreign venture capitalist participates in a particular deal. Third, from the perspective of the portfolio companies' country we examine the number of cross-border deals in this country. Fourth, in a bilateral country setting, in which we combine the macroeconomic factors of the venture capitalists' and the portfolio companies' countries, we focus on the number of cross-border venture capital deals between these two countries. Our analyses from these four different perspectives provide a core understanding of the factors that drive internationalization within venture capital industries from different angles. To fulfill this task, we use a new dataset on worldwide venture capital investments.

The key results from our four perspective analysis can be summarized as follows: domestically experienced venture capitalists seem to be able to exploit the advantages from internationalization more effectively than their less experienced counterparts. Foreign venture capitalists are more likely to participate in larger deals, especially when the portfolio company is located in a small country. Another finding is that companies from the IT, machinery, and biotech sectors are more likely to be financed by foreign venture capitalists than companies in other industries. Internationalization patterns are shaped not only by the characteristics of the venture capitalist, the portfolio company and the deal, but also by macroeconomic factors. Countries with higher expected economic growth, in which more promising investment opportunities for venture capitalists are likely to be generated, stimulate venture capital activity from domestic as well as foreign venture capitalists. A higher stock market capitalization encourages domestic venture capitalists to invest more both at home and abroad.

Das Wichtigste in Kürze

Im Zeitraum von 2000 bis 2008 war bei mehr als einem Drittel der mit Venture Capital finanzierten Unternehmen mindestens ein ausländischer Risikokapitalgeber beteiligt. Die vorliegende Studie untersucht, welche mikro- und makroökonomischen Faktoren, die das Vorhandensein und die Profitabilität von Investitionsmöglichkeiten im In- und Ausland bestimmen, die Internationalisierung der Venture-Capital-Branche beeinflussen. Wir untersuchen den Einfluss dieser Faktoren auf die Internationalisierungsmuster aus vier verschiedenen Blickwinkeln. Erstens untersuchen wir die grenzüberschreitenden und inländischen Transaktionen aus Sicht der einzelnen Risikokapitalgeber. Zweitens untersuchen wir die Wahrscheinlichkeit, dass ein ausländischer Risikokapitalgeber an einer bestimmten Transaktion beteiligt ist aus Sicht der einzelnen Portfoliounternehmen. Drittens analysieren wir die Anzahl grenzüberschreitender Transaktionen aus Sicht einzelner Länder. Viertens untersuchen wir die Anzahl grenzüberschreitender Venture-Capital-Transaktionen aus Sicht von Länderpaaren. Die letztgenannte Sichtweise erlaubt die gleichzeitige Betrachtung von makroökonomischen Faktoren des Landes des Risikokapitalgebers und des Portfoliounternehmens. Unsere aus diesen vier verschiedenen Blickwinkeln gewonnenen Ergebnisse verbessern das Verständnis für die treibenden Kräfte der Internationalisierung der Venture-Capital-Branche. Für diese Untersuchungen verwenden wir einen neuen Datensatz weltweiter Venture-Capital-Investitionen.

Die wichtigsten Ergebnisse können wie folgt zusammengefasst werden: Für Risikokapitalgeber, die bereits Erfahrungen auf dem heimischen Markt gesammelt haben, scheinen die Vorteile der Internationalisierung größer zu sein, als für jene mit geringer Erfahrung. Ausländische Risikokapitalgeber nehmen eher an großen Transaktionen teil. Dies ist vor allem der Fall, wenn das Portfoliounternehmen in einem kleinen Land angesiedelt ist. Außerdem werden Unternehmen der IT-, Maschinenbau-, und Biotechnologiebranche eher von ausländischen Risikokapitalgebern finanziert als Unternehmen in anderen Branchen. Des Weiteren werden Internationalisierungsmuster nicht nur von den Eigenschaften des Risikokapitalgebers, des Portfoliounternehmens und der Transaktion bestimmt, sondern auch von einer Reihe makroökonomischer Faktoren beeinflusst. Länder mit einem hohen erwarteten Wirtschaftswachstum, in denen erfolgversprechende Investitionsmöglichkeiten zu erwarten sind, ziehen Venture-Capital-Investitionen sowohl inländischer als auch ausländischer Risikokapitalgeber an. Eine höhere Kapitalisierung des Aktienmarktes ermutigt inländische Risikokapitalgeber nicht nur zu höheren inländischen, sondern auch zu höheren ausländischen Investitionen.

Venture Capital and Internationalization

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September 2009

Abstract

Cross-border investments represent a substantial share of venture capital activities. We use a new and comprehensive dataset on worldwide investments to analyze the internationalization of venture capital financing. Our results from the perspectives of (i) venture capitalists, (ii) portfolio companies, (iii) portfolio companies' countries and (iv) pairs of venture capitalists' and portfolio companies' countries suggest that some factors, such as viable stock markets, boost investments by domestic as well as by foreign venture capitalists. Therefore, our results are of interest not only to academics but also to policy makers who want to foster the growth of the local venture capital industry and local companies.

Keywords: Venture capital, Internationalization, Macroeconomic factors.

JEL Classification: F21, G24.

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1 Introduction

Venture capitalists (VCs) are often regarded as purely local investors that do not venture beyond their countries' borders (e.g., Gompers and Lerner 1999, Dai and Cumming 2008, Bengtsson and Ravid 2009). This picture is driven by the nature of venture capital deals, which are typically investments in opaque risky ventures where information asymmetries between the entrepreneur and the VC are particularly pronounced (e.g., Amit *et al.* 1998) and where hands-on management support and control is required. However, on the basis of a comprehensive dataset, we find that cross-border deals accounted for 33.4 percent of worldwide total venture capital deals in the period 2000-2008. Thus, in more than one third of the companies that received venture capital financing a foreign VC was involved.

Research that goes beyond making *cross-country* comparisons of local VCs' investments and fund raising (starting with Jeng and Wells 2000, and including a couple of further papers, such as, recently, Lerner *et al.* 2009) towards studying the *cross-border* investment patterns of VCs and the motives behind their internationalization efforts and investment location choice is still in its infancy (see Wright *et al.* 2005). One strand of literature within this rather new research field looks into the impact different legal and institutional systems have on the contracts, governance structures and securities' types in domestic and cross-border deals (Kaplan *et al.* 2007, Lerner and Schoar 2005, Cumming 2005 and Cumming *et al.* 2009). Another strand of literature, which analyzes motives behind cross-border venture capital investments, is grounded on relatively small samples of VCs or portfolio companies or on case studies (e.g., Mäkelä and Maula 2006, Bruner and Chaplinsky 2002, Ribeiro *et al.* 2006, Dixit and Jayaraman 2001, Wright *et al.* 2002, Manigart *et al.* 2006). A recent analysis by Aizenman and Kendall (2008) offers an interesting description of worldwide flows. They analyze the driving factors behind international venture capital and private equity investments using aggregated venture capital and private equity flows between country pairs.

Our study offers a comprehensive description of how microeconomic characteristics as well as macroeconomic factors relate to the internationalization patterns. These factors likely shape the trade-off between risks and expected returns of VCs' cross-border and domestic investments. More specifically, when investing abroad, VCs may benefit through exploiting foreign investment opportunities and through diversifying their portfolios across countries, but these foreign investments likely come at higher costs than domestic investments. The microeconomic characteristics we focus on are the VC's domestic experience, deal size and industry affiliation of the portfolio company. In addition, we employ traditional macroeconomic factors that are related to cross-border activities, such as the countries' expected economic growth, stock market capitalization, innovativeness as well as the legal and fiscal environments in the VC country and the portfolio company (PC) country.

To carry out this comprehensive description, we use four different perspectives that allow us to investigate microeconomic characteristics and macroeconomic factors. First, we take the perspective of the VC and investigate how microeconomic characteristics and macroeconomic factors relate to the number of the VC's cross-border and domestic deals. Second, we take the perspective of the portfolio company and analyze whether or not a foreign VC is involved in the deal with this PC. Third, at the PC-country level, we investigate the number of deals in this country in which foreign VCs participate. Fourth, in a bilateral country setting, which has some parallels to the approach used by Aizenman and Kendall (2008), we combine the VC-country and PC-country macroeconomic factors and analyze their impact on the number of cross-border venture capital deals between these two countries simultaneously. Our analyses from these four different perspectives provide a core understanding of the factors that affect internationalization within venture capital industries from different angles.

Our key findings can be summarized as follows. Most of the above mentioned factors we find to be statistically and economically significant. In particular, a VC's domestic experience goes hand in hand with higher cross-border activity. Foreign VCs are more likely to participate in larger deals, especially when the PC is located in a small country. Countries with higher expected economic growth, in which more promising investment opportunities for VCs are expectedly generated, stimulate venture capital investments from domestic as well as from foreign VCs. A higher stock market capitalization does not only encourage domestic venture capital investments and, thus, the development of the local venture capital industries, but countries with high stock market capitalization also invest more intensively abroad compared to countries with low stock market capitalization. These results are robust towards the different perspectives of our analysis, varying sample sizes and model specifications.

Besides its academic contribution, this paper is of interest to policy makers who want to foster the growth of the domestic venture capital industry and domestic companies. When taking into account the international dimension in venture capital finance, public policy becomes much more complicated, as public policy actions not only affect the domestic and foreign investments of the VCs located in this particular country, but also foreign VCs' participation in this country. Our results suggest that some factors that spur local venture capital industry development, such as viable stock markets, may boost not only domestic, but also foreign venture capital investments in this country.

The remainder of the paper is organized as follows: Section 3 introduces the dataset, presents some statistics on worldwide cross-border and domestic venture capital deals, and introduces the four perspectives we employ in our analyses. In Section 4, we derive hypotheses on factors that are potentially relevant for cross-border and domestic investments. In Section 5, we provide the results from our econometric analyses for each of the four perspectives. Section 6 summarizes the results and gives directions for further research.

2 *Worldwide venture capital deals and internationalization*

We use data on worldwide venture capital deals from Bureau van Dijk's Zephyr database, which offers information on mergers and acquisitions, initial public offerings as well as private equity and venture capital deals. Recently, the existence of this database has started to be registered by researchers working in the field of venture capital and private equity (e.g., Goossens *et al.* 2008, Abdesselam *et al.* 2008, Grimpe and Hussinger 2009, Bloom *et al.* 2008, Brav *et al.* 2009). For the purposes of this paper, we collected information on worldwide venture capital deals within the period 2000-2008, in particular on the geographical locations of the VCs and their PCs. We started with 38,125 total (i.e. domestic and cross-border) deals. Since, in our analysis, we (i) include only non-financial PCs, (ii) exclude corporations and governments as VCs and, finally, (iii) exclude countries for which we do not have macroeconomic data, the number of deals in our final dataset drops to 23,826. The majority of these deals are financed by a syndicate of several VCs. A syndicated deal consists of several connections between single VCs and the PC. The number of these connections, which we call *links* hereafter, in a particular deal thus equals the number of VCs involved in this deal. In total, we count 58,377 VC-PC links in our final dataset.

Figure 1 gives an overview of the worldwide venture capital internationalization within the period 2000-2008. It aggregates the number of domestic, intra- and intercontinental VC-PC links included in our final dataset by continents. Domestic links of Northern American VCs (including the United States and Canada) constitute, with more than 34,000 links in the period 2000-2008, by far the largest figure, followed by European VCs with nearly 11,200 links to domestic PCs. Intracontinental connections are intensive within Europe, with more than 3,400 cross-border VC-PC links. The bulk of intercontinental links take place between Europe and the United States in both directions, with more than 2,600 links of European VCs to PCs in the United States and nearly 1,600 links in the opposite direction.

We use this dataset to analyze the venture capital internationalization from four different perspectives: the VC perspective, the PC perspective, the PC-country perspective and, finally, the bilateral country perspective. For the *VC perspective*, we count the number of cross-border links for each VC and each year, i.e. all links where the PC country differs from the VC country. Moreover, we count the number of domestic links for each VC and each year, i.e. all links where the PC country is the same as the VC country. For the *PC perspective*, we create a dummy variable equal to one if a foreign VC participates in the deal and zero otherwise. We supplement the PC perspective with the *PC-country perspective*. Here, for each PC country and each year, we count the number of deals in which one or more foreign VCs participate. Finally, for the *bilateral country perspective*, we count the number of cross-border links between each VC country and each PC country in each year. Thus, for the VC and the bilateral country perspective, each link between a VC and a PC counts once. For the PC and PC-country perspective, each deal counts once, even if it is financed by more than one VC and, thus, consists of several links.

Table 1 provides information on the dependent variables in our four perspectives. Panel A reveals that our final dataset contains 8,211 VCs. An average VC has 5.68 links to PCs in its home country and 1.45 links to PCs abroad. As Panel B demonstrates, we count 23,826 deals in total; in 7,947 deals at least one foreign VC participates. Panel C shows the number of domestic and foreign deals by the country of the PC. By far, the highest number of venture-backed PCs is located in the United States, where we count 9,370 domestic and 2,854 cross-border deals. Panel D depicts, for selected countries with the largest cross-border venture capital inflows, the number of bilateral cross-border VC-PC links. The most intensive connection is between the United States and the United Kingdom, with 663 links between US VCs and portfolio companies in the United Kingdom, and 923 links in the opposite direction.

Table 2 demonstrates how the number of domestic and cross-border venture capital deals has developed over time (Panel A) and across industries (Panel B). After the burst of the high-tech bubble, the number of venture capital deals experienced a strong decline in 2001 and 2002. The following two years marked a recovery. After stagnation in 2005 and 2006, venture capital activity strongly increased in 2007. Along with the financial crisis, it rapidly declined in 2008. The fraction of cross-border on total deals varied substantially over time, reaching its peak in 2001 with 37.1 percent, and two years later, the lowest point with 29.4 percent. Concerning the distribution of deals across industries, we observe a high concentration in particular industries. During our sample period, most PCs (42.8 percent) were in the computer, IT, and internet services industries. The most pronounced internationalization was in the biotechnology, pharmaceutical, and life sciences industries, in which a foreign VC participated in nearly every second deal.

Given the lack of systematic research in venture capital financing outside the US, we are limited in our ability to calibrate the completeness of the *Zephyr* database. Nonetheless, we can assess its completeness by comparing it with the data in other studies and available in other databases. In the *Zephyr* database, we count 38,125 domestic and cross-border venture capital deals in the period 2000-2008. The most recent paper by Lerner *et al.* (2009) is based on the *Capital IQ* database and includes 45,207 venture capital and growth capital deals worldwide from 1984 through September 2008. Unfortunately, the paper does not provide information on the number of deals within the period 2000-2008 so that it is not directly comparable to our sample. The most widely used database in venture capital research, the *Thomson VentureXpert* database, covers 38,515 companies when searching for worldwide targets involved in venture related deals within the period 2000-2008. Although the *Zephyr* coverage seems to be a bit worse than that of Thomson, the huge advantage is that *Zephyr* offers better information on deal volume and PC industry affiliation than Thomson. For our purposes, we are very much convinced that these advantages outweigh the disadvantage since, among other factors, we are interested in the role of the deal size and the PCs' industry affiliation in internationalization patterns.

3 Factors behind cross-border venture capital investments and our hypotheses

The strategy of this paper is to investigate, from the four different perspectives, which factors shape venture capital internationalization. While we are able to access the impact of the VC and deal characteristics on cross-border activity only in selected perspectives, we include macroeconomic factors in all four perspectives.

3.1 VC domestic experience (H1)

It is widely believed that VCs are purely local investors that do not venture beyond their countries' borders (e.g., Gompers and Lerner 1999, Dai and Cumming 2008, Bengtsson and Ravid 2009). This picture is driven by the nature of venture capital deals, which are typically investments in opaque risky ventures where information asymmetries between the entrepreneur and the VC are particularly pronounced, and which therefore require intensive pre-investment screening, post-investment hands-on management support, and control (see Amit *et al.* 1998). These activities raise VCs' costs and these costs are likely to be higher for cross-border than for domestic deals (e.g., Wright *et al.* 2005, Cumming and Johan 2006b). However, as VCs gain experience, we conjecture that their cost of information gathering and processing will decrease not only in domestic but also in cross-border deals. Thus, they might dare to cross borders more and more often and hereby exploit promising investment opportunities abroad as well as build up geographically diversified portfolios. Therefore, in the VC perspective, we expect the number of cross-border deals to be positively related to the experience that the VC has accumulated in its home country in the past.

3.2 Deal size (H2)

Large venture capital deals are usually financed through a syndicate of several VCs who profit from diversification since syndication allows them to split their limited funds across more portfolio companies (Lockett and Wright 2001, Manigart *et al.* 2006). As the number of VCs typically increases with the deal size, we conjecture that the probability that at least one of the VCs on board is a foreigner will increase with the deal size (e.g., Lerner *et al.* 2009). We expect this effect to be particularly pronounced in small countries, in which the chance to find a domestic partner is presumably lower than in large countries. Moreover, we expect more cross-border deals in countries with larger deals, as it might become more and more difficult to find domestic syndication partners as the deal size rises.

3.3 Expected growth (H3)

High expected economic growth enforces venture capital activity (Armour and Cumming 2006, Gompers and Lerner 1999, Cumming and MacIntosh 2006), as many attractive investment opportunities arise in high-growth countries. More profitable investment opportunities in their home country will encourage VCs' domestic investments while, when they are constrained in raising additional funds, VCs will reduce their investments abroad. Hence, we suppose that higher expected

growth in their home country has a positive impact on VCs' domestic and negative impact on their cross-border investments. In addition, we expect higher expected growth to attract foreign VCs. Thus, it might positively relate to the probability that a foreign VC participates in a given deal. For the PC-country perspective, we suppose an increase in the expected growth of the PC country to lead to a higher number of cross-border deals.

3.4 Market capitalization (H4)

Not only does the general finance and growth literature suggest that financial development is beneficial for attracting foreign capital (e.g., Alfaro *et al.* 2004), but the venture capital literature also finds out that countries with higher market capitalizations receive more venture capital from abroad than countries with low capitalization (Aizenman and Kendall 2008). The recent literature argues that a developed stock market encourages venture capital investments (Jeng and Wells 2000, Black and Gilson 1998, Bascha and Walz 2002) because it offers a profitable exit route and supports VCs' reputation building and fund raising (Gompers 1996). Thus, developed stock markets go hand in hand with developed venture capital industries. Consequently, countries with less developed stock markets may not only have few domestic investments, but they may also source few cross-border investments. Moreover, in countries with less viable stock markets, the probability of a foreign VC's participation might be higher compared to countries with more developed stock markets where many large domestic VCs exist. In line with this reasoning, we expect more cross-border deals in countries with a higher market capitalization.

3.5 Innovativeness (H5)

There is no doubt that venture capital investments and innovative activity are closely related. However, the causality seems to be bi-directional. Not only do venture capital investments stimulate innovation (e.g., Kortum and Lerner 2000), but innovations also attract VCs' investments (e.g., Ueda and Hirukawa 2008). Therefore, we suppose that high innovation levels spur the development of local venture capital industries. Concretely, we expect a higher level of innovativeness in the past to increase the number of current domestic deals. At the same time, when VCs are constrained in fund raising, they will reduce their foreign investments. Moreover, foreign VCs are more likely to invest in countries with higher innovativeness. This increases the probability of a foreign VC's participation as well as the number of deals financed from abroad.

3.6 Legal environment (H6)

Starting with the seminal work of La Porta *et al.* (1997, 1998), a large literature has demonstrated a systematic relationship between a country's legal framework and its financial activities. In the context of venture capital, studies have already shown that the legal framework relates to the size of the countries' venture capital industries (Armour and Cumming 2006, Leleux and Surlamount 2003), to the valuations and returns (Cumming and Walz 2009, Lerner and Schoar 2005), to the quality of support that VCs provide to their portfolio companies (Bottazzi *et al.* 2008) as well as to the structure

of venture capital contracts and deal characteristics (Lerner and Schoar 2004). Cumming and Johan (2007) demonstrate that good laws lead to more efficient deal screening and faster deal origination. Moreover, Cumming and Johan (2006a) argue that a higher quality of a country legal system facilitates exits. In our context, we expect a more favorable legal environment to induce VCs to invest more often at home and less often abroad. We also expect that more favorable legal environment attracts foreign VCs and, thus, increases the probability of a foreign VC's participation and the number of deals financed from abroad.

3.7 Personal taxation (H7)

A high effective personal income tax rate, on the one hand, might dampen venture capital investments in a country because it discourages the accumulation of human capital in this country, reflected, for example, in the number of innovative entrepreneurs, researchers or highly qualified managers (e.g., Trostel 1993). According to this view, we would expect that high personal taxation induces domestic VCs to flee from this country by increasing their investments abroad and reducing their activities at home. We would also expect that high personal taxes discourage foreign VCs from entering this country, so that the probability of a foreign VC's participation and the number of deals financed from abroad decreases when personal taxation increases.

But, on the other hand, as Gordon (1998) and Cullen and Gordon (2007) point out, higher personal taxation might increase individuals' incentives to become entrepreneurs when they are able to exploit the option to incorporate. If this is the case, higher personal income taxes can foster entrepreneurship and raise the demand for venture capital finance. They argue that in the early development stage, when the business experiences losses, entrepreneurs do not incorporate. Then, they are able to save taxes by offsetting these losses against other personal income. Once the business becomes profitable, the entrepreneurs incorporate in order to avoid high personal taxes. According to this view, high personal taxation decreases investments abroad and increases investments at home. Moreover, the higher entrepreneurial activity likely attracts venture capital from abroad, and thereby increases the probability of a foreign VC's participation and the number of deals financed from abroad.

3.8 Our hypotheses and other potentially relevant factors

Table 3 summarizes the above discussion in seven hypotheses for each of the four perspectives. Table 4 offers descriptions, sources and summary statistics for the variables, which we use in the main part of our analysis. For the countries' innovativeness we employ business R&D expenditures in our main estimations, and use patent counts as an alternative measure in a robustness section. As a measure of the legal environment pertinent to venture capital activities, we employ a venture capital legal index from the World Competitiveness Yearbook. We employ more general legal indices as alternative measures in the robustness section.

Our hypotheses cover only a part of the factors which are likely to be relevant for cross-border venture capital investments. We do not consider further characteristics of VCs (such as their size) and further

country-specific factors (such as the law tradition in a particular country or cultural and geographical proximity between the VC and PC country) because we employ econometric approaches that control for these time invariant characteristics. Depending on the perspective, we model fixed effects for each VC, for each PC country or for each country pair. This allows us to substantially reduce the number of coefficients to be estimated. At the same time we control for unobserved heterogeneity. Thus, our outcomes are less likely to be subject to criticism with regards to omitted variable bias or model misspecification.

4 Econometric analyses from the four perspectives

4.1 VC perspective

We start the VC perspective by looking at how VCs' domestic experience and the macroeconomic factors in their home country are related to each VC's number of cross-border deals. Thus, the single VCs are the cross-sectional units in our panel dataset. To explain the number of cross-border deals, we employ the most widely used count data model, the Poisson model (e.g., Cameron and Trivedi 1998). Since the factors that we consider do not measure all characteristics of the VCs and their home countries that may affect their cross-border investments, we model a fixed effect for each VC. In addition, we include year dummies to filter out time-varying unobservable effects, such as world market developments. The fixed effect estimator excludes VCs without any cross-border deals within the period under analysis, since the dependent variable does not vary over time for these VCs. We calculate robust standard errors, as suggested by Wooldridge (1999). This specification produces consistent estimates under relatively weak assumptions, since only the conditional mean must be correctly specified.

Table 5 displays the results from the fixed effect Poisson regressions for three different specifications. Our basic specification (Column 1) reveals the following results, which are, by and large, in line with our hypotheses: the VC's domestic experience significantly increases the number of this VC's cross-border deals (H1). When the expected economic growth in their home country increases, VCs reduce the number of their cross-border deals (H3). A higher stock market capitalization in their home country leads to more cross-border deals (H4). Finally, a more favorable legal environment, measured by the venture capital legal index, and higher personal tax rates reduce the number of cross-border deals (H6 and H7b). The economic effects of these variables on cross-border deals are quite remarkable. A 1 percentage point increase in the expected economic growth in the VC home country (e.g., from its mean of 3.6% to 4.6%) leads to 14.6 percent fewer cross-border deals, whereas an increase in the stock market capitalization by 10 percentage points (e.g., from its mean of 90% to 100% of GDP) increases the number of cross-border deals by 3.6 percent.

Since our dataset covers countries that differ considerably regarding their economic development, we exclude VCs from less developed countries in the second specification. The number of observations drops only slightly (from 18,064 to 17,368), because the vast majority of VCs come from developed countries.¹ All our results based on this subsample are very similar to those from the basic specification. In the third specification, we fend off concerns that our results are driven by the United States, which has the largest and by far the most developed venture capital industry worldwide. Excluding US VCs from our regression reduces the number of observations to 11,968. Despite this sharp reduction in the number of observations, most of our results remain very similar to those of the first two specifications. More domestic experience and a higher stock market capitalization significantly increase the number of cross-border deals, whereas a more favorable legal environment and higher expected growth in the VC's home country significantly reduce the number of cross-border deals. While the impact of taxation, which was only significant at the 15% level in the first and second specification, diminishes, the innovativeness of the VCs' home country, measured by business R&D expenditures, becomes an important driver of cross-border investments when we exclude the United States from our dataset. However, contrary to our hypothesis (H5), VCs located in countries with higher local innovativeness carry out more deals abroad. A possible explanation for this finding is that high local innovativeness spurs domestic venture capitalists' sophistication, which makes crossing borders easier.

We complement the VC perspective by counting the number of each VC's domestic deals in each year and analyze how macroeconomic factors influence the domestic activities employing, again, a fixed effect Poisson model and the same VC-country macroeconomic factors as in the cross-border setting. Compared to the cross-border setting, the number of observations in the domestic setting is much higher for two reasons. First, since the fixed effect estimator excludes VCs without any deals within the period under analysis, we have fewer VCs (i.e. cross-sectional units) in the cross-border than in the domestic setting. Second, domestic deal regressions are based on nine years and the cross-border deal regressions are based on eight years since we use in the latter regressions the VCs' lagged domestic experience, which we constructed from the dataset.

The analysis of domestic deals is grounded in the vast literature analyzing cross-country differences in venture capital investments starting with the seminal paper by Jeng and Wells (2000). However, while the existing studies usually do not distinguish between VCs' domestic and cross-border investments (i.e. they deal with total aggregated investments of VCs located in a particular country), we focus in this part of our analysis on the deals that VCs carry out in their home countries only.

The results from the domestic deals regressions, which we present in Table 6, are broadly consistent with the findings from the existing cross-country studies and with our hypotheses. The basic

¹ The list of developed countries is based on the GDP per capita and contains the following countries: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Ireland, Israel, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

specification (Column 1) reveals that the number of domestic deals increases with countries' expected economic growth (H3), market capitalization (H4) and innovativeness (H5). A 1 percentage point increase in the expected economic growth in the VC home country leads to 14.2 percent more domestic deals. An increase in stock market capitalization by 10 percentage points increases the number of the domestic deals by 7.6 percent. A 1 percentage point increase in the innovativeness in the VC home country leads to 41.8 percent more domestic deals. The legal environment and personal taxation have positive coefficients as suggested by H6 and H7b, they are, however, not statistically significant. Similar results hold in the specification based on the sample of developed countries only (Column 2) and the sample excluding the United States (Column 3). Personal taxation becomes significant at the 10% level in the latter sample.

4.2 Perspective of the portfolio company

Now we take the perspective of the PC and analyze what factors affect the probability that a foreign VC participates in a particular deal. So, we move from a panel to a cross-sectional setting, with single deals being units of observation. We use a logit model (e.g., Hilbe 2009) since our dependent variable is binary. Besides the PC-country characteristics (including time varying macroeconomic factors and PC-country dummies) and year dummies, we include deal size, an interaction term between the deal size and the PC-country size² and dummy variables for the PCs' industry affiliation. We calculate Huber-White-sandwich corrected standard errors (Huber 1967, White 1980).

Panel A of Table 7 exhibits the coefficient estimates, which give insights on whether an increase in a variable increases or decreases the probability that a foreign VC participates in a deal. However, from the coefficient estimates we do not infer *how much* an increase in a variable increases or decreases the probability that a foreign VC participates. Therefore, Panel B shows the marginal effects evaluated at the sample means. For the dummy variables the marginal effects are calculated by changing the dummy variable from 0 to 1. In order to infer how the deal size affects the probability of the foreign VC's participation, we have to consider that it appears not only as one of the regressors, but that is also part of the interaction term and include this impact in the marginal effect of the deal size.

To gain deeper insights on how the country size changes the marginal effect of the deal size, and thus on the effect of the interaction term, Figure 2 delivers the marginal effects of deal size on the probability of the foreign VC's participation at different percentiles of country size. This picture is important, since the sign of the coefficient estimate, and thus the marginal effect of the interaction term, varies with the country size and the deal size (Ai and Norton 2003). The figure is based on the basic specification (Column 1 in Table 7).

The results with respect to the deal size are in line with our hypothesis (H2). The basic specification (Column 1, Panel B), based on the whole sample, reveals that a doubling in the deal size increases the

² Country size is not employed as a separate regressor because it is included in the country dummies.

probability of a foreign VC's participation by 0.085.³ Figure 2 documents that this effect is less important in large than in small countries. For the countries in the smallest size decile, a doubling in the deal size increases the probability of a foreign VC's participation by 0.104, whereas for countries in the largest decile, the probability increases only by 0.040. Restricting the sample to developed countries only (Column 2) does not change the economic impact of the deal size on the probability of a foreign VC's participation. When we exclude VCs from the United States from the sample (Column 3), a doubling in the deal size increases the probability of a foreign VC's participation by 0.126. Thus, the effect is much stronger in the ex-US sample (0.126 versus 0.085). This finding further supports our reasoning that the probability of a foreign VC's participation is higher in smaller countries.

Most other variables have the expected effects on the probability that a foreign VC participates in a particular deal. Higher expected growth, higher innovativeness and sounder legal environments attract VCs from abroad (H3, H5, H6). For example, a 1 percentage point increase in expected growth increases the probability of a foreign VC's participation by 0.028. Higher market capitalization decreases the probability of a foreign VC's participation (H4). When the market capitalization increases by 10 percentage points, this probability decreases by 0.011. Personal income taxes have a positive, albeit not significant impact (H7b). PCs operating in the IT, machinery, and biotech sectors have a higher probability to attract foreign VCs.

4.3 Perspective of the portfolio companies' country

In the perspective of the PCs' country we count the number of PCs in each country and year that receive venture capital from a foreign VC (from *any* foreign country) and analyze how this number is related to the macroeconomic factors of the PC country. Thus, the PC countries are the cross-sectional units in our panel dataset. As for the VC perspective, we use a Poisson model. We model a fixed effect for each PC country to capture the unobserved heterogeneity among them and we include year dummies. Moreover, we calculate robust standard errors (as suggested in Wooldridge 1999).

Table 8 shows the results, which are broadly consistent with our hypotheses. The first specification, which builds on the whole dataset, already reveals the main patterns: higher expected economic growth (H3), market capitalization (H4) and personal income taxes (H7b) and a sounder legal environment (H6) lead to more deals being financed from abroad. For example, a 1 percentage point increase in the expected growth leads to 25.1 percent more deals financed from abroad. A 10 percentage point increase in the stock market capitalization raises the number of deals from abroad by 6.9 percent. The impact of the countries' innovativeness is positive, but not significant in the basic specification (H5). In the second specification, we check whether countries with larger deal sizes (we

³ A doubling in the deal size (starting from value X) increases the value of our regressor, $\log(\text{deal size})$, by $\log(2X) - \log(X) = \log(2) = 0.693$. The marginal effect of the deal size is 0.1232 (see Table 7, Panel B, Column 1). The economic effect of a doubling in the deal size can then be calculated as: $0.693 * 0.1232 = 0.085$.

employ the 75th percentile of the log deal size as an additional variable) attract more cross-border deals than countries with smaller deal sizes (H2).⁴ The effect is positive, but insignificant.

In a next step, we again restrict our dataset to developed countries only (Columns 3 and 4) and we exclude the United States from the dataset (Columns 5 and 6). The statistical impact of expected economic growth and market capitalization remains very robust towards these varying subsamples. The coefficients on all other variables do not change their signs, but their statistical significance sometimes varies across different models. As an example, the coefficient on innovativeness becomes significantly positive when we exclude developing countries from the dataset.

4.4 Bilateral country perspective

Since our analysis reveals that both, the VC-country and the PC-country macroeconomic factors influence cross-border venture capital deals, we finally turn to a bilateral country setting in which both countries' macroeconomic factors can be analyzed simultaneously. To trace out whether the results discussed so far also hold in a bilateral country perspective, we aggregate the number of VC-PC links for each country pair (in both directions separately) and each year. Thus, country pairs are the cross-sectional units of our panel dataset in the bilateral country perspective. As for the VC and PC perspectives, we use a Poisson model. We employ a fixed effect for each country pair. Because of this fixed effect, all country pairs without any cross-border activity during the observation period are excluded from our regressions. Additionally, we include year dummies and we calculate robust standard errors (as suggested in Wooldridge 1999).

In the bilateral country perspective, this modeling approach has four main advantages: First, we do not have to add VC-country and PC-country dummy variables because we model a fixed effect for each country pair. This substantially reduces the number of coefficients to be estimated. Second, we gain additional degrees of freedom because we do not have to include time invariant bilateral country characteristics such as cultural and geographical distance between countries, since these are incorporated in the fixed effects. Third, this modeling approach also resolves problems otherwise arising from unobserved heterogeneity in bilateral country relationships, which might influence bilateral cross-border venture capital flows, such as the level of sympathy of some nations for other nations, which, again, is incorporated in the fixed effects. Fourth, this method allows us to include VC-country and PC-country macroeconomic factors separately as well as to employ their differences (PC country minus VC country). The latter approach might be very much relevant in this bilateral country perspective because, for example, VCs from Germany might base their decision on how much to invest in France on the difference in the expected growth rates. Moreover, since the coefficients on some variables, such as market capitalization, have the same expected sign for the VC and PC country (see Table 3), the coefficient on their difference provides insights on whether one of the effects prevails.

⁴ Since the 75 percentile of the deal size cannot be calculated for all country-years, the sample size reduces from 351 to 283 country-year observations.

Panel A of Table 9 depicts the results when we jointly include the macroeconomic factors of the VC and PC country. Panel B reports the results when we employ the differences. The findings in Column 1 of Panel A, which is based on the whole dataset, are again mostly in line with our hypotheses and fit nicely into the findings from the previous sections. Higher expected growth and higher personal taxation attract VCs from abroad (H3, H7b). Higher market capitalization and innovativeness of both countries, the VC and PC country, increase the number of bilateral cross-border deals (H4, H5). The estimated impact of the VC-country innovativeness goes in the same direction as in the VC perspective. The coefficients on the other variables are not significant. Most of the economic effects (which refer here to link count) are in their magnitude very similar to those presented for the country perspective (deal count) and VC perspective (link count). In the second specification, we additionally check whether countries with large deals attract more cross-border investments (H2). This effect is insignificant. The effects of both countries' market capitalization and innovativeness as well as the effect of expected economic growth in the PC country are very robust towards excluding developing countries (Columns 3 and 4) and excluding the United States (Columns 5 and 6). Moreover, the deal size becomes significant in both subsample regressions, underpinning the necessity of a foreign VC's participation when the deal size increases.

In Panel B, we check whether the differences in macroeconomic factors have an impact on bilateral cross border deals. Only the coefficients on the differences in expected growth and personal taxes are statistically significant and positive, whereas all other differences are insignificant.

4.5 Robustness checks

We carry out a number of additional regressions in order to yield insights whether the results we have discussed above are sensitive to various sources of changes. First, we employ alternative measures of innovativeness (patent counts) and legal environment (more general legal indices). Second, we use a between estimation for the VC and the bilateral country perspective. These robustness checks broadly confirm our findings (results not reported but available upon request).

5 Conclusion

This paper extends the new literature on the factors that shape internationalization within venture capital industries by shedding light on the internationalization patterns and their drivers from four different perspectives: the perspective of the venture capitalist, the perspective of the portfolio company, the perspective of the portfolio companies' country and bilateral country perspective. Our empirical evidence based on an extensive international dataset indicates that venture capitalist, portfolio company and deal characteristics drive the internationalization patterns. Domestically experienced venture capitalists seem to be able to exploit the advantages from internationalization more effectively than their less experienced counterparts. Another finding is that companies from IT,

machinery, and biotech sectors are more likely to be financed by foreign venture capitalists than companies in other industries. Finally, our results indicate that international venture capitalists are more important in larger deals, this effect being particularly pronounced in smaller countries.

Internationalization patterns are shaped not only by venture capitalist, company and deal characteristics, but also by macroeconomic factors. Countries with higher expected growth, higher stock market capitalization and higher innovativeness are more successful in attracting domestic and foreign venture capitalists than countries with low growth chances, a poor stock market capitalization and low innovativeness. At the same time, venture capitalists located in countries with a higher stock market capitalization invest more often abroad than venture capitalists located in countries with a poor stock market capitalization. Moreover, our results are in line with the conjecture that high personal taxation increases individuals' incentives to become entrepreneurs, leading to more venture capital activity from domestic and foreign venture capitalists in countries with high effective personal income tax rates.

Our discussion of cross-border venture capital deals raises a couple of further research questions. First and foremost, in the international context, insights on how venture capitalists structure their portfolios not only in terms of the countries, but also of the industries they select would increase our understanding of the internationalization patterns. More specifically, it would be interesting to know whether country factors or sector factors drive the composition of venture capitalists' portfolios. In addition, the entrance strategy of venture capitalists has not received much attention in the academic literature. In particular, the analysis of cross-border syndication, i.e. the joint investment by domestic and foreign VCs, would deserve a profound investigation, since managing a syndicate across borders is usually much more difficult than managing a local syndicate. Another interesting issue we have not discussed in this paper is the success of cross-border investments in terms of the performance of the portfolio companies as well as the venture capitalists' returns. However, as a sizeable fraction of the deals occurred in the last three years and most of these deals are not exited yet, this investigation must be postponed until later.

Acknowledgements:

Financial support from the 7th Research Framework Programme (FP7) of the European Commission is gratefully acknowledged (Project title: Financing Entrepreneurial Ventures in Europe: impact on innovation, employment growth, and competitiveness, Grant Agreement Number 217485). The authors are indebted to the Bureau van Dijk Electronic Publishing (BvDEP) for providing the data. The current version has benefited from comments by the participants at the VC Fun Research Network, at the FMA European Conference in Barcelona, at the SGF Conference in Zurich and at the conference of the Verein für Socialpolitik in Munich. Jonas Vogt and Jonas Heipertz provided excellent research assistance.

References

- Abdesselam, R., S. Cieply, and A.-L. Le Nadant (2008). Are corporate governance systems typologies relevant? Evidence from European transfers of ownership rights. *Corporate Ownership & Control* 5(2): 87-99.
- Ai, C. and E. C. Norton (2003). Interaction terms in logit and probit models. *Economics Letters* 80: 123–129.
- Aizenman, J. and J. Kendall (2008). The internationalization of venture capital and private equity. NBER Working Paper 14344.
- Alfaro, L., A. Chanda, S. Kalemli-Ozcan and S. Sayek (2004). FDI and economic growth: the role of local financial markets. *Journal of International Economics* 64(1): 89-112.
- Amit, R., J. Brander, and C. Zott (1998). Why do venture capital firms exist? Theory and Canadian evidence. *Journal of Business Venturing* 13: 441-466.
- Armour, J. and D. Cumming (2006). The legislative road to Silicon Valley. *Oxford Economic Papers* 58: 596-635.
- Bascha A. and U. Walz (2002). Convertible securities and optimal exit decisions in venture capital finance. *Journal of Corporate Finance* 7: 285–306.
- Bengtsson, O. and S. A. Ravid (2009). The importance of geographical location and distance on venture capital contracts. Available at SSRN: <http://ssrn.com/abstract=1331574>.
- Black B. S. and R. J. Gilson (1998). Venture capital and the structure of capital markets: Banks versus stock markets. *Journal of Financial Economics* 47: 243–277.
- Bloom, N. R. Sadun and J. Van Reenen (2008), Do private equity owned firms have better management practices? Working paper.
- Bottazzi, L., M. Da Rin and T. Hellmann (2008). What is the role of legal systems in financial intermediation? Theory and evidence. CentER Discussion Paper Series No. 2008-30.
- Brav, A., O. Brav and W. Jiang (2009), The choice of going public and going private: evidence from UK. Working paper.
- Bruner, R. F. and S. J. Chaplinsky (2002). Practices of active private equity firms in Latin America. Available at SSRN: <http://ssrn.com/abstract=909702>.
- Cameron, A.C. and P.K. Trivedi (1998). Regression analysis of count data. Cambridge University Press.
- Cullen, J.B. and R. Gordon (2007). Taxes and entrepreneurial activity: theory and evidence for the U.S. *Journal of Public Economics* 91: 1479-1505.
- Cumming, D. (2005). Agency costs, institutions, learning, and taxation in venture capital contracting. *Journal of Business Venturing* 20: 573-622.
- Cumming, D. and S. Johan (2006a). Corporate social responsibility: domestic and international private equity institutional investment. TILEC Discussion Paper 2006-002.
- Cumming, D. and S. Johan (2006b). Provincial preferences in private equity. *Financial Markets and Portfolio Management* 20(4): 369-398.
- Cumming, D. and S. Johan (2007). Regulatory harmonization and the development of private equity markets. *Journal of Banking and Finance* 31: 3218-3250.
- Cumming, D. and J.G. MacIntosh (2006). Crowding out private equity: Canadian evidence. *Journal of Business Venturing* 21: 569–609.
- Cumming, D., D. Schmidt and U. Walz (2009). Legality and venture governance around the world, *Journal of Business Venturing*, forthcoming.
- Cumming, D. and U. Walz (2009). Private equity returns and disclosure around the world. *Journal of International Business Studies*, forthcoming.

- Dai, N. and D. Cumming (2008). Local bias in venture capital investments. Available at SSRN: <http://ssrn.com/abstract=1034222>.
- Dixit, A. and N. Jayaraman (2001). Internationalization strategies of private equity firms. *The Journal of Private Equity* 5(1): 40–54.
- Gompers, P. A. (1996). Grandstanding in the venture capital industry. *Journal of Financial Economics* 42: 133–156.
- Gompers, P. A. and J. Lerner (1999). What drives venture capital fundraising? NBER Working Paper 6906.
- Goossens, L., S. Manigart, and M. Meuleman (2008). The change in ownership after a buyout: impact on performance. *Journal of Private Equity*. 12(1): 31-41.
- Gordon, R., 1998. Can high personal tax rates encourage entrepreneurial activity? *IMF Staff Papers* 45, 49-80.
- Grimpe, C. and K. Hussinger (2009). The value of technology in takeovers: a comparison of corporate acquisitions and LBOs. Working paper.
- Hilbe, Joseph M. (2009). Logistic regression models. Chapman & Hall/CRC Press.
- Huber, P. J. (1967). The behavior of maximum likelihood estimates under nonstandard conditions. In: *Proceedings of the Fifth Berkeley symposium on mathematical statistics and probability*, Vol. 1. Berkeley, CA: University of California Press: 221–233.
- Jeng, L. A. and P. C. Wells (2000). The determinants of venture capital funding: evidence across countries. *Journal of Corporate Finance* 6: 241–289.
- Kaplan, S., F. Martel and P. Strömberg (2007). How do legal differences and experience affect financial contracts. *Journal of Financial Intermediation*, 16(3): 273-311.
- Kortum S. and J. Lerner (2000). Assessing the contribution of venture capital to innovation. *The Rand Journal of Economics* 31: 674–692.
- La Porta, R., F. Lopez-de-Silanes, A. Shleifer and R. Vishny (1997). Legal determinants of external finance. *Journal of Finance* 52: 1131–1150.
- La Porta, R., F. Lopez-de-Silanes, A. Shleifer and R. Vishny (1998). Law and finance. *Journal of Political Economy* 106: 1113–1155.
- Leleux, B. and B. Surlemont (2003). Public versus private venture capital: seeding or crowding out? A pan-European analysis. *Journal of Business Venturing* 18: 81-104.
- Lerner, J. and A. Schoar (2004). Transaction structures in the developing world: evidence from private equity. MIT Sloan Working Paper No. 4468-04.
- Lerner, J. and A. Schoar (2005). Does legal enforcement affect financial transactions? The contractual channel in private equity. *Quarterly Journal of Economics* 120: 223–246.
- Lerner, J., M. Sorensen and P. Strömberg (2009). What drives private equity activity and success globally? In: *World Economic Forum, Globalization of Alternative Investments Working Papers Volume 2. The Global Economic Impact of Private Equity Report 2009*.
- Lockett, A., and M. Wright (2001): The syndication of venture capital investments. *OMEGA: The International Journal of Management Science* 29(2): 375-390.
- Mäkelä, M. M. and M. Maula (2006). Interorganizational commitment in syndicated cross-border venture capital investments. *Entrepreneurship Theory and Practice* 30(2): 273-298.
- Manigart, S., A. Lockett, M. Meuleman, M. Wright, H. Bruining, H. Landström, P. Desbrières and U. Hommel (2006). The syndication decision of venture capital investments. *Entrepreneurship: Theory and Practice* 30(2): 131–153.
- Ribeiro, L. L., A. G. De Carvalho and C.V. Furtado (2006). Private equity and venture capital in an emerging economy: Evidence from Brazil. Available at SSRN: <http://ssrn.com/abstract=912523>.

- Trostel, P.A. (1993). The effect of taxation on human capital. *The Journal of Political Economy* 101(2): 327-350.
- Ueda, M. and M. Hirukawa (2008). Venture capital and innovation: which is first? Available at SSRN: <http://ssrn.com/abstract=1242698>.
- White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 48(4): 817–838.
- Wooldridge, J.M. (1999). Distribution-free estimation of some nonlinear panel data models. *Journal of Econometrics* 90: 77-97.
- Wright, M., A. Lockett and S. Pruthi (2002). Internationalization of Western venture capitalists into emerging markets: Risk assessment and information in India. *Small Business Economics* 19(1): 13-29.
- Wright, M., S. Pruthi and A. Lockett (2005). International venture capital research: from cross country comparisons to crossing countries. *International Journal of Management Reviews* 7(3): 135-166.

Figure 1: Domestic and cross-border (intracontinental and intercontinental) VC – portfolio company links

This figure depicts the number of domestic, cross-border intracontinental and cross-border intercontinental VC-portfolio company links within the period 2000-2008, aggregated by continents. Links refer to each single connection between a VC and a portfolio company.

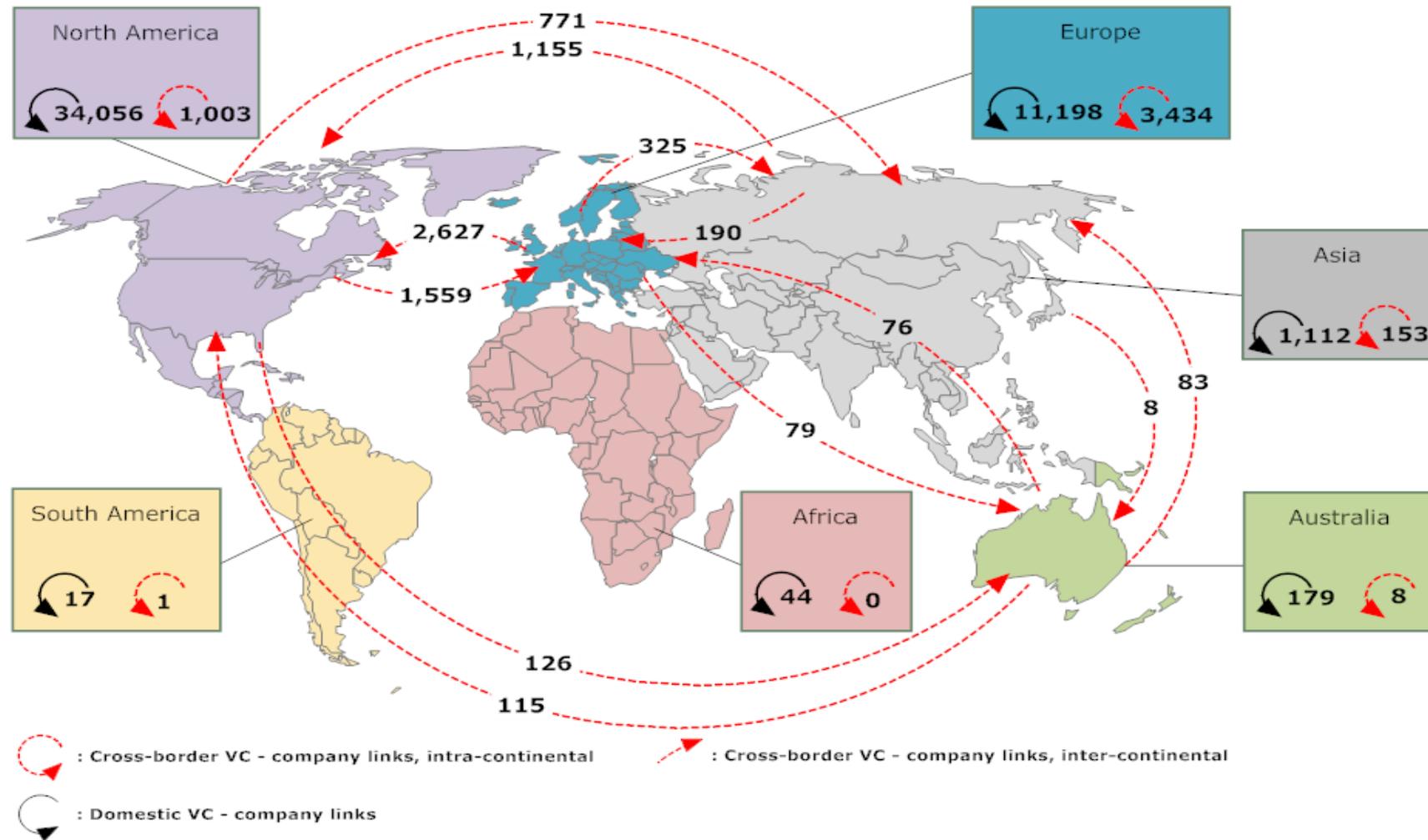


Figure 2: Marginal effect of the deal size on the probability of a foreign VC's participation in the portfolio company perspective

This figure depicts the marginal effect of the log deal size on the probability that a foreign VC participates in a particular deal. Here, we consider that log deal size appears not only as one of the regressors, but also as part of the interaction term. The figure is based on the regression from the first column in Table 7 evaluated at different country size deciles and at the means of all other variables.

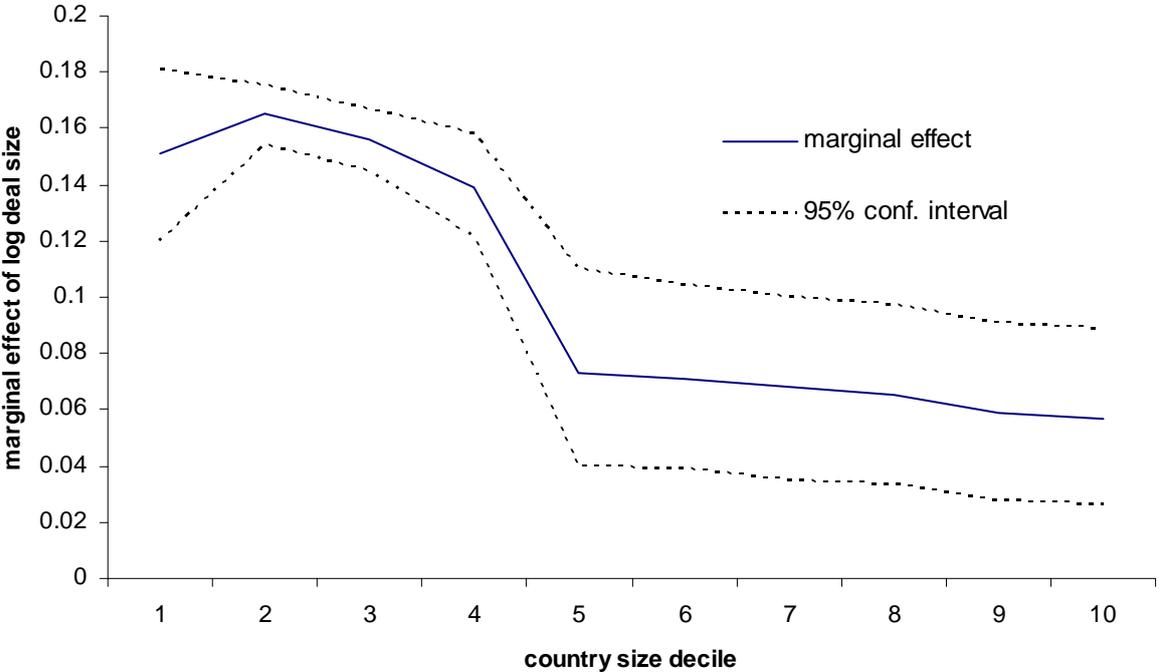


Table 1: The four perspectives of internationalization

This table shows the internationalization patterns within the period 2000-2008 from four different perspectives. Panel A depicts the VCs' average number of links to foreign and to domestic portfolio companies (VC perspective). Panel B shows the number of cross-border and domestic deals in the dataset (portfolio company perspective). Panel C reveals the number of cross-border and domestic deals carried out in each sample country (portfolio companies' country perspective). Panel D reveals the number of bilateral cross-border VC-PC links for selected country pairs (bilateral country perspective).

Panel A: VC perspective

No. of VCs	Average no. of cross-border links	Average no. of domestic links
8,211	1.45	5.68

Panel B: Portfolio company (PC) perspective

No. of deals	No. of cross-border deals (at least one foreign VC)	No. of domestic deals (all VCs are domestic)
23,826	7,947	15,879

Panel C: Portfolio company (PC) country perspective

PC country	No. of cross-border deals (at least one foreign VC)	No. of domestic deals (all VCs are domestic)	PC country	No. of cross-border deals (at least one foreign VC)	No. of domestic deals (all VCs are domestic)
Australia	201	92	Lithuania	7	5
Austria	44	45	Luxembourg	15	2
Belgium	111	152	Malaysia	8	8
Brazil	12	10	Netherlands	146	187
Bulgaria	10	2	New Zealand	9	20
Canada	387	686	Nigeria	1	1
Chile	1	2	Norway	77	80
China	270	84	Phillippines	2	0
Czech Republic	7	3	Poland	24	13
Denmark	107	112	Portugal	26	21
Egypt	6	1	Russian Federation	38	19
Estonia	6	3	Saudi Arabia	0	2
Finland	111	162	Singapore	32	8
France	503	1,140	South Africa	9	26
Germany	390	620	Spain	117	489
Greece	1	9	Sweden	244	380
Hong Kong	17	2	Switzerland	115	39
Hungary	10	6	Thailand	5	1
India	184	75	Turkey	7	8
Ireland	129	84	Ukraine	3	1
Israel	298	198	United Kingdom	1,214	1,540
Italy	155	124	United States	2,854	9,370
Japan	28	24	Uruguay	0	1
Jordan	1	1	Vietnam	5	21

cont. on the next page

Table 1 – cont.

Panel D: Bilateral country perspective

No. of bilateral cross-border links between VCs and portfolio companies for selected country pairs										
PC / VC country	Canada	China	France	Germany	Israel	Sweden	United Kingdom	United States	Other	Total
Canada		4	7	4	6	4	43	492	70	630
China	0		5	2	3	4	38	226	169	447
France	16	0		49	6	12	232	199	271	785
Germany	1	0	49		0	7	208	137	252	654
Israel	9	0	14	47		3	49	289	55	466
Sweden	2	0	14	9	1		89	45	150	310
United Kingdom	14	8	86	82	21	18		663	445	1,337
United States	515	28	226	397	508	125	923		1,543	4,265
Other	17	3	159	196	8	111	492	742	648	2,376
Total	574	43	560	786	553	284	2,074	2,793	3,603	

Table 2: Domestic and cross-border venture capital deals over time and across industries

This table demonstrates the development of domestic and cross-border venture capital deals over time (Panel A) and across industries (Panel B) within the period 2000-2008.

Panel A: Time dimension

	No. of domestic deals	No. of cross-border deals	No. of total deals	Share of cross-border on total deals (in %)
2000	1,735	927	2,662	34.8
2001	1,551	913	2,464	37.1
2002	1,331	666	1,997	33.4
2003	1,547	644	2,191	29.4
2004	1,872	849	2,721	31.2
2005	1,825	972	2,797	34.8
2006	1,896	1,055	2,951	35.8
2007	2,297	981	3,278	29.9
2008	1,825	940	2,765	34.0
Total	15,879	7,947	23,826	33.4

Panel B: Industry dimension

	No. of domestic deals	No of. cross-border deals	No. of total deals	Share of cross-border on total deals (in %)
Computer, IT and Internet Services	7,190	2,997	10,187	29.4
Industrial, Electric and Electronic Machinery	2,417	1,268	3,685	34.4
Biotechnology, Pharmaceutical and Life Sciences	921	875	1,796	48.7
Personal, Leisure and Business Services	1,849	824	2,673	30.8
Communications	431	302	733	41.2
Other	3,071	1,681	4,752	35.4
Total	15,879	7,947	23,826	33.4

Table 3: Summary of the hypotheses

This table summarizes our hypotheses for the four perspectives. While we are able to access the impact of the VC and deal characteristics on cross-border activity only in selected perspectives, we include the macroeconomic factors in all four perspectives. For variables descriptions and definitions see Table 4.

		VC perspective		Portfolio companies' perspective	Portfolio companies' country perspective	Bilateral country perspective	
		1a	1b	2	3	4	
		No. of cross-border deals	No. of domestic deals	Probability of a foreign VC's participation	No. of cross-border deals in the PC country	PC country	VC country
VC domestic experience	H1	+	n.a.	n.a.	n.a.	n.a.	n.a.
Deal size	H2	n.a.	n.a.	+	n.a.	n.a.	n.a.
Deal size interacted with PC-country size		n.a.	n.a.	-	n.a.	n.a.	n.a.
Deal size in the PC country		n.a.	n.a.	n.a.	+	+	n.a.
Expected growth	H3	-	+	+	+	+	-
Market capitalization	H4	+	+	-	+	+	+
Innovativeness	H5	-	+	+	+	+	-
Legal environment	H6	-	+	+	+	+	-
Personal taxation	H7a	+	-	-	-	-	+
	H7b	-	+	+	+	+	-
REGRESSION RESULTS		TABLE 5	TABLE 6	TABLE 7	TABLE 8	TABLE 9	

Table 4: Descriptions, sources and summary statistics for the regressors

This table offers descriptions, sources and summary statistics of the regressors we use in our four perspective framework.

Name	Description	Source	Mean	Std. Dev.
VC domestic experience	Annual number of domestic deals	Zephyr	0.63	2.21
Deal size	Deal value (thousands of euros)	Zephyr	16,288.9	69,421.21
Expected growth	Expected real GDP growth rate for the next 3-5 years	Datastream	3.6	1.6
Market capitalization	Stock market capitalization/GDP	www.worldbank.org	0.9	0.82
Innovativeness	Business R&D expenditures/GDP	www.worldcompetitiveness.com	0.94	0.82
Legal environment	Venture capital legal index (higher value is better)	www.worldcompetitiveness.com	5.11	1.36
Personal taxation	Effective personal income tax rate (%)	www.worldcompetitiveness.com	17.8	9.4

Table 5: Cross-border deals in the VC perspective

This table depicts the results from fixed effect Poisson models. The dependent variable is the number of cross-border links counted for each VC in each year within the period 2001-2008. A fixed effect is modelled for each VC. All RHS variables are defined in Table 4 and are based on the countries in which the VCs are located. Innovativeness is measured by the business R&D expenditures; the legal environment is captured by the venture capital legal index. Robust standard errors (Wooldridge 1999) are in parentheses. ***, **, *, ^ denote significance at the 1, 5, 10, and 15 percent level.

	(1)	(2)	(3)
	Whole sample	Developed countries	Without US
log(VC dom. experience), lagged	0.4285*** (0.097)	0.4303*** (0.097)	0.3899*** (0.122)
Expected growth	-0.1459^ (0.098)	-0.1634^ (0.101)	-0.1632* (0.089)
Market capitalization, lagged	0.3595* (0.190)	0.3342* (0.197)	0.4168** (0.200)
Innovativeness, lagged	0.4289 (0.494)	0.4148 (0.505)	1.0481** (0.458)
Legal environment, lagged	-0.2594^ (0.177)	-0.2645^ (0.181)	-0.2963* (0.173)
Personal taxation, lagged	-0.0188^ (0.012)	-0.0196^ (0.012)	0.0085 (0.012)
year dummies	yes	yes	yes
VC fixed effects	yes	yes	yes
χ^2	210.54***	210.10***	159.01***
Number of observations	18,064	17,368	11,968
Number of VCs	2,258	2,171	1,496

Table 6: Domestic deals in the VC perspective

This table depicts results from fixed effect Poisson models. The dependent variable is the number of domestic links counted for each VC in each year within the period 2000-2008. A fixed effect is modelled for each VC. All RHS variables are defined in Table 4 and are based on the countries in which the VCs are located. Innovativeness is measured by the business R&D expenditures; the legal environment is captured by the venture capital legal index. Robust standard errors (Wooldridge 1999) are in parentheses. ***, **, *, ^ denote significance at the 1, 5, 10, and 15 percent level.

	(1)	(2)	(3)
	Whole sample	Developed countries	Without US
Expected growth	0.1424*** (0.033)	0.0756** (0.034)	0.1567*** (0.039)
Market capitalization, lagged	0.7556*** (0.105)	0.6053*** (0.119)	0.8597*** (0.121)
Innovativeness, lagged	0.4177*** (0.161)	0.2376^ (0.160)	0.5215*** (0.198)
Legal environment, lagged	0.0299 (0.033)	0.0228 (0.035)	0.0358 (0.041)
Personal taxation, lagged	0.0064 (0.012)	0.0059 (0.012)	0.0193* (0.011)
year dummies	yes	yes	yes
VC fixed effects	yes	yes	yes
χ^2	386.74***	306.95***	227.93***
Number of observations	63,819	61,632	28,143
Number of VCs	7,091	6,848	3,127

Table 7: The probability of a foreign VC's participation in the portfolio company perspective

This table depicts the coefficients (Panel A) and the marginal effects (Panel B) from logit models for the probability that a foreign VC participates in a particular deal for the period 2000-2008. All RHS variables are defined in Table 4 and are based on the country in which the portfolio companies are located. Innovativeness is measured by the business R&D expenditures; the legal environment is captured by the venture capital legal index. Huber-White-sandwich robust standard errors (Huber 1967, White 1980) are in parentheses. ***, **, *, ^ denote significance at the 1, 5, 10, and 15 percent level.

Panel A: Coefficients

	(1)	(2)	(3)
	Whole sample	Developed countries	Without US
log(Deal size)	3.0912*** (0.330)	3.2153*** (0.350)	1.5791*** (0.496)
log(Deal size)Xlog(Country size)	-0.0872*** (0.011)	-0.0912*** (0.012)	-0.0306* (0.018)
Expected growth	0.1320** (0.054)	0.1505** (0.058)	0.1762*** (0.058)
Market capitalization, lagged	-0.5237*** (0.133)	-0.6396*** (0.161)	-0.5221*** (0.142)
Innovativeness, lagged	0.5440*** (0.211)	0.7268*** (0.230)	0.249 (0.229)
Legal environment, lagged	0.2713*** (0.072)	0.2779*** (0.078)	0.2970*** (0.080)
Personal taxation, lagged	0.0162 (0.012)	0.0187 (0.013)	0.0161 (0.014)
Industry dummies			
...Computer, IT and Internet Services	0.3126*** (0.057)	0.3317*** (0.059)	0.4258*** (0.077)
...Industrial, Electric and Electronic Machinery	0.4260*** (0.064)	0.4521*** (0.066)	0.2703*** (0.088)
...Biotechnology, Pharmaceutical and Life Sciences	0.8961*** (0.075)	0.9176*** (0.076)	0.5529*** (0.110)
...Personal, Leisure and Business Services	0.1614** (0.073)	0.1744** (0.075)	0.0868 (0.097)
...Communications	0.1567 (0.110)	0.1179 (0.114)	0.4638*** (0.156)
year dummies	yes	yes	yes
PC-country dummies	yes	yes	yes
χ^2	2541.23***	2239.56***	1392.52***
Number of observations (deals)	19,107	18,451	8,263

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Table 7 – cont.

Panel B: Marginal effects

	(1)	(2)	(3)
	Whole sample	Developed countries	Without US
log(Deal size)	0.1232*** (0.013)	0.1213*** (0.014)	0.1812*** (0.008)
Expected growth	0.0283** (0.012)	0.0314** (0.012)	0.0433*** (0.014)
Market capitalization, lagged	-0.1124*** (0.029)	-0.1336*** (0.034)	-0.1283*** (0.035)
Innovativeness, lagged	0.1168*** (0.045)	0.1518*** (0.048)	0.0612 (0.056)
Legal environment, lagged	0.0582*** (0.015)	0.0580*** (0.016)	0.0730*** (0.020)
Personal taxation, lagged	0.0035 (0.003)	0.0039 (0.003)	0.004 (0.003)
Industry dummies			
...Computer, IT and Internet Services	0.0674*** (0.012)	0.0696*** (0.012)	0.1050*** (0.019)
...Industrial, Electric and Electronic Machinery	0.0958*** (0.015)	0.0997*** (0.015)	0.0670*** (0.022)
...Biotechnology, Pharmaceutical and Life Sciences	0.2114*** (0.018)	0.2135*** (0.019)	0.1373*** (0.027)
...Personal, Leisure and Business Services	0.0354** (0.016)	0.0374** (0.017)	0.0214 (0.024)
...Communications	0.0345 (0.025)	0.0252 (0.025)	0.1154*** (0.039)

Table 8: Number of cross-border deals in the perspective of the portfolio companies' country

This table depicts results from fixed effect Poisson models. The dependent variable is for each portfolio companies' country and each year within the period 2000-2008 the number of deals in which at least one foreign VC participates. A fixed effect is modelled for the portfolio companies' countries. All RHS variables are defined in Table 4 and are based on the countries in which portfolio companies are located. Innovativeness is measured by the business R&D expenditures; the legal environment is captured by the venture capital legal index. Robust standard errors (Wooldridge 1999) are in parentheses. ***, **, *, ^ denote significance at the 1, 5, 10, and 15 percent level.

	(1)	(2)	(3)	(4)	(5)	(6)
	Whole sample		Developed countries		Without US	
log(Deal size, 75th pct.)		0.005 (0.075)		0.0428 (0.072)		0.0186 (0.072)
Expected growth	0.2509*** (0.053)	0.2286*** (0.050)	0.1432*** (0.041)	0.1393*** (0.042)	0.2612*** (0.057)	0.2365*** (0.054)
Market capitalization, lagged	0.6909*** (0.168)	0.6564*** (0.155)	0.3073* (0.157)	0.3180** (0.155)	0.7690*** (0.172)	0.7322*** (0.156)
Innovativeness, lagged	0.5640 (0.440)	0.3685 (0.329)	0.2929* (0.174)	0.2307^ (0.149)	0.5690 (0.496)	0.3623 (0.367)
Legal environment, lagged	0.0974^ (0.062)	0.0885 (0.070)	0.0717 (0.050)	0.0711^ (0.047)	0.076 (0.072)	0.0637 (0.083)
Personal taxation, lagged	0.0166^ (0.011)	0.0143^ (0.010)	0.0099 (0.009)	0.0091 (0.009)	0.0213^ (0.014)	0.0179 (0.013)
year dummies	yes	yes	yes	yes	yes	yes
country fixed effects	yes	yes	yes	yes	yes	yes
χ^2	1311.58***	1485.97***	1000.37***	1618.79***	610.51***	722.60***
Number of PC countries	39	36	26	26	38	35
Number of observations	351	283	234	217	342	274

Table 9: Number of cross-border VC-portfolio company links in the bilateral country perspective

This table depicts results from fixed effect Poisson models. The dependent variable is the number of cross-border links between VCs and portfolio companies counted for each country pair and each year within the period 2000-2008. A fixed effect is modelled for each country pair. All RHS variables are defined in Table 4. PC denotes the portfolio companies' country, and VC denotes the VCs' country. Innovativeness is measured by the business R&D expenditures; the legal environment is captured by the venture capital legal index. In Panel A, PC-country and VC-country macroeconomic factors are included separately in the models, while in Panel B, the difference in the macroeconomic factors between the PC country and the VC country are used. Robust standard errors (Wooldridge 1999) are in parentheses. ***, **, *, ^ denote significance at the 1, 5, 10, and 15 percent level.

Panel A: Macroeconomic factors of the PC and VC countries

	(1)	(2)	(3)	(4)	(5)	(6)
	Whole sample		Developed countries		Without US	
log(Deal size, 75th percentile) (PC)		0.0647 (0.056)		0.1239** (0.050)		0.1241** (0.057)
Expected growth (PC)	0.6346*** (0.151)	0.6010*** (0.154)	0.2159* (0.127)	0.2505* (0.130)	0.7050*** (0.223)	0.6827*** (0.223)
Expected growth (VC)	0.3772*** (0.127)	0.3720*** (0.127)	0.2680* (0.147)	0.2701* (0.148)	0.4553*** (0.116)	0.4459*** (0.115)
Market capitalization, lagged (PC)	0.2251*** (0.043)	0.2123*** (0.041)	0.1378*** (0.028)	0.1391*** (0.028)	0.1449*** (0.049)	0.1332*** (0.048)
Market capitalization, lagged (VC)	0.0045 (0.035)	0.0067 (0.034)	0.0035 (0.034)	0.0029 (0.033)	-0.0194 (0.047)	-0.0169 (0.047)
Innovativeness, lagged (PC)	0.7093** (0.359)	0.4957* (0.283)	0.4048** (0.184)	0.2993* (0.163)	0.7958*** (0.298)	0.6256** (0.276)
Innovativeness, lagged (VC)	0.5135** (0.237)	0.5065** (0.233)	0.4072* (0.226)	0.4237* (0.229)	0.9601** (0.379)	0.9455** (0.371)
Legal environment, lagged (PC)	0.085 (0.064)	0.0738 (0.072)	0.0527 (0.059)	0.0561 (0.058)	0.0075 (0.063)	-0.0076 (0.068)
Legal environment, lagged (VC)	-0.0186 (0.042)	-0.0266 (0.041)	-0.0346 (0.039)	-0.0358 (0.039)	0.0535 (0.065)	0.0475 (0.064)
Personal taxation, lagged (PC)	0.0182^ (0.013)	0.0151 (0.012)	0.0103 (0.012)	0.0086 (0.012)	0.0077 (0.014)	0.0072 (0.014)
Personal taxation, lagged (VC)	-0.0088 (0.010)	-0.0089 (0.010)	-0.0112 (0.010)	-0.0115 (0.010)	-0.0006 (0.014)	-0.0004 (0.014)
year dummies	yes	yes	yes	yes	yes	yes
country-pair fixed effects	yes	yes	yes	yes	yes	yes
χ^2	243.77***	239.13***	211.27***	215.66***	185.42***	197.36***
Number of country pairs	418	412	318	317	348	344
Number of observations	3,762	3,527	2,862	2,774	3,132	2,951

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Table 9 – cont.

Panel B: Difference in macroeconomic factors of the PC country and the VC country

	(1)	(2)	(3)
	Whole sample	Developed countries	Without US
Expected growth difference (PC minus VC)	0.1254*** (0.040)	0.0530** (0.027)	0.1142*** (0.038)
Market capitalization, lagged diff. (PC minus VC)	0.1568 (0.147)	-0.071 (0.114)	0.1716 (0.210)
Innovativeness, lagged difference (PC minus VC)	-0.0739 (0.228)	-0.0823 (0.156)	-0.1911 (0.318)
Legal environment, lagged difference (PC minus VC)	0.0132 (0.044)	0.0243 (0.035)	-0.0690^ (0.047)
Personal taxation, lagged difference (PC minus VC)	0.0189** (0.009)	0.0126* (0.007)	0.009 (0.012)
year dummies	yes	yes	yes
country-pair fixed effects	yes	yes	yes
χ^2	207.68***	190.00***	107.28***
Number of country pairs	418	318	348
Number of observations	3,762	2,862	3,132