PATTERNS OF VENTURE CAPITAL INVESTMENTS IN EUROPE

*Fabio Bertoni, Massimo G. Colombo, Anita Quas**

ABSTRACT

We study the investment strategies of different types of Venture Capital investors (VCs) using a unique dataset that includes 1,663 VC first investments made by 846 investors in 737 young high-tech entrepreneurial ventures located in seven European countries between 1994 and 2004. Using a transformed Balassa index, we analyze the relative investment specialization of independent VCs, corporate VCs, bank-affiliated VCs and governmental VCs along several dimensions that characterize investments (e.g., syndication, duration and exit mode) and investee companies (e.g., industry of operation, age, size, development stage, location and distance from investor's premises at the time of the investment). Our findings indicate that VC types in Europe differ markedly in their patterns of investment specialization, especially governmental VC on the one side and private VC on the other. We compare our findings with evidence from the USA and find some interesting differences, notably regarding independent and governmental VCs.

Keywords: Venture Capital, Europe, Specialization, Young innovative companies.

JEL codes: G24, G32

* Corresponding author: mail: anita.quas@mail.polimi.it. Phone: (+39) 02 2399 4085. Address for correspondence: Via Lambruschini 4B – 20156 Milan

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1. INTRODUCTION

Scholars and policymakers agree that venture capital investors (VCs) are fundamental for the development of high-potential innovative entrepreneurial ventures and for economic growth in general (e.g., Gompers & Lerner, 2001; Samila & Sorensen, 2011). However, the literature has long recognized that VCs are heterogeneous and differ along several dimensions, one of the most important being the type of governance and ownership (Da Rin, Hellman & Puri, 2011). In its most familiar form, a VC manages several pools of capital provided by institutional and individual investors. Each pool is organized as a legally separate limited partnership, with a management company serving as a general partner and the investors serving as limited partners (Sahlman, 1990). This is the most common type of VC (independent VC, IVC), but there are also other types of VCs. Non-independent, or captive, VCs are structured as investment vehicles or business units of a parent company. The parent company may be a nonfinancial company, in the case of corporate VC (CVC), a financial intermediary, in the case of bank-affiliated VC (BVC), or a governmental body, in the case of governmental VC (GVC). Regardless of its nature, the parent company of a captive VC provides capital and has substantial influence on the selection and management of investments (Gompers, 2002; Leleux & Surlemont, 2003; Hellmann, Lindsey & Puri, 2008; Dimov & Gedajlovic, 2010; Dushnitsky, 2012).

The differences in ownership and governance between independent and captive VCs, and among different types of captive VCs, supposedly influence the objectives and outcomes of their investment activities. However, most of our understanding on how different types of VCs operate is based on evidence from the USA.[1] A limited number of studies have analyzed different VC types outside the USA and, with few exceptions (Sapienza, Manigart & Vermeir, 1996; Mayer, Schoors & Yafeh, 2005; Bottazzi, Da Rin & Hellmann, 2008; Brander, Qianquian & Hellmann, 2010), have

[1] For a survey of this literature see Da Rin, Hellman & Puri (2011) and Dushnitsky (2012). See Dimov and Gedajlovic (2010) for a comprehensive analysis of the investment strategies of IVC, CVC and BVC in the USA over the period 1962-2004.

mostly focused on specific countries (e.g., Audretsch & Lehmann, 2004, and Tykvová, 2006 on Germany; Bertoni, Colombo & Croce, 2010 and Bertoni, Colombo & Grilli, 2012 on Italy; Cumming, 2006 and Brander, Egan & Hellmann, 2012 on Canada; Cumming, 2007 on Australia). Therefore, our overall understanding of this issue is still partial. In particular, no large-scale analysis has thus far been conducted on the *investment strategies* pursued by different types of VCs outside the USA and on their differences from (or similarities to) the investment strategies of their American counterparts. This is an important gap in the literature because the findings of the studies mentioned above suggest that there are substantial differences in the ways in which different types of VCs operate in different investment environments.

The present paper aims to contribute to filling this gap in the VC literature. For this purpose, we provide a systematic analysis of the investment strategies of different types of VCs in Europe, taking advantage of a new database, the *VICO database*, created by the 7th Framework Programme VICO research project promoted by the European Commission (see www.vicoproject.org). We use information on 1,663 VC first investments made between 1994 and 2004 by 846 VCs in 737 entrepreneurial ventures that were located in seven European countries (i.e., Belgium, Finland, France, Germany, Italy, Spain and the United Kingdom), were less than 10 years old at the time of the VC investment, and operated in the high-tech manufacturing and service industries. We compare the patterns of investment specialization of IVCs, CVCs, BVCs and GVCs along a series of dimensions relating to both investee company characteristics (i.e., industry of operations, age, size, stage of development, localization and distance of investee companies from the investor at the time of the investment) and investment characteristics (i.e., syndication, duration and exit mode). We then compare the evidence from European VCs obtained through the VICO database with similar evidence provided by Thomson One (previously, VentureXpert) on VCs in the USA.

There are three reasons that Europe represents an especially interesting environment for this study. First, Europe is the second largest VC market in the world, after the USA. European VC

investments in the seed, start-up and expansion stages amounted to 3.9 billion Euro in 2011, or 0.03 percent of Europe's GDP (Source: EVCA, 2012), corresponding to approximately one fifth of VC investments in the USA.[2] Second, the available evidence, which our study confirms, notes that the heterogeneity of VCs is much wider in Europe than in the USA, with BVCs and GVCs playing a much more important role (e.g., Bottazzi, Da Rin & Hellmann, 2004; Bottazzi et al., 2008). Third, in the last two decades, European policymakers have committed substantial resources to fostering the development of the European VC market and closing the gap between Europe and the USA in this domain (see Bertoni & Croce, 2011 for a review). However, the results of these policy interventions are generally regarded as quite dismal (Lerner, 2009). Improving our understanding of the peculiarities of the investment strategies of the different actors that operate in the European VC market may help design more effective policy measures.

The paper proceeds as follows. In section 2, we describe the methodology used to examine the investment specialization patterns of the different types of VCs. In section 3, we present the dataset. The results on the patterns of investment specialization of different European VC types are reported in section 4. Section 5 is devoted to comparing our results with the available evidence relating to the USA. Finally, section 6 highlights the contribution of this paper to the VC literature and policy implications conclude the paper.

2. METHODOLOGY

We employ specialization indexes to compare the investment patterns of the different types of VCs in Europe. Specialization indexes were originally used to compare trade flows and evaluate the revealed comparative advantages of different countries (Hoover, 1937; Liesner, 1958). Due to their easy construction and interpretability, they attracted substantial interest in the fields of innovation research and science studies. They were applied to phenomena such as employment and patents

[2] During 2011, VC investments in the seed, start-up and expansion stages in the USA amounted to 19.1 billion USD, or 0.13 percent of the country's GDP (Source: NVCA, 2012).

(e.g., Kim, 1995; Hall & Soskice, 2001). In this work, we used these indexes to measure the divergence in the investment strategies of the different VC types from those of the "average VC". We analyzed specialization along several dimensions relating to investee companies and investment characteristics (see the following section for details).

The most widely used family of specialization indexes is derived from a measure that was initially proposed by Balassa (1965). For each dimension *k* characterizing investee companies and investments, we identified a number of mutually exclusive categories. For any given dimension *k*, let $N_{i,j}^{k}$ be the number of investments made by investor type *i* that belong to category *j*. The Balassa Index (BI) is defined as follows:

$$BI_{i,j}^{k} = \frac{N_{i,j}^{k}}{\sum_{j} N_{i,j}^{k}} \cdot \left(\frac{\sum_{i} N_{i,j}^{k}}{\sum_{i,j} N_{i,j}^{k}} \right)^{-1}$$

The first term measures the share of the investments made by investor type *i* in category *j* of dimension *k* over the total number of investments made by investor type *i.* The second term is the inverse of the share of the investments made by any VC type in category *j* of dimension *k* over the total number of VC investments. In other words, BI measures the ratio of the share of the investments made by a given type of VC in a given category of a given dimension to the share of total VC investments in that category.[3]

The BI is easy to compute and has an intuitive definition but also some serious shortcomings (Bowen, 1983; Yeats, 1985; Laursen, 1998; De Benedictis & Tamberi, 2002). A major problem with BI arises in our study due to the substantially different numerosity of investments by different

[3] For example, the specialization of *i*=IVC in the *j=biotechnology and pharmaceutical* category of the *k=industry of operation of investee companies* dimension is measured as the share of IVC investments accounted for by the biotechnology and pharmaceutical industry divided by the share of that industry out of the investments made by all VC investors.

VC types. The problem arises because sampling and measurement errors have a larger impact on VC categories for which the number of investments is smaller.[4] Moreover, when there are few investments, BI tends to have a more asymmetric and skewed distribution (Laursen, 1998). To alleviate these problems, we computed a symmetric version of BI by applying the following transformation (Dalum, Laursen & Villumsen, 1998):

TBI ranges from [−1, 1], and its neutral value is 0. Negative (positive) values of TBI indicate that investor type *i* is less (more) specialized in category *j* of dimension *k* than the average VC. Like BI, TBI not only distinguishes between the investor types that are specialized in a certain category from those that are not, but it also quantifies the degree of specialization (Ballance, Forstner & Murray, 1987). More importantly, this transformation is shown to have two main advantages. First, it attributes the same weight to changes below the neutral value as to changes above the neutral value. Second, the assumption of normality is more acceptable for TBI than for BI (Dalum et al., 1998). It is therefore possible to derive a hypothesis test to determine whether the observed specialization is statistically significant. Under a set of assumptions, TBI is asymptotically normal and its variance can be consistently estimated from the data (Schubert & Grupp, 2011). We can then use this asymptotic distribution to test the null hypothesis that, for a given VC type in a given category of a given dimension, the value of TBI is equal to 0. Rejection of the null hypothesis then gives

[4] For instance, in our sample, the number of IVC investments is larger than the number of CVC investments by a factor of approximately 5.6 (918 vs. 165, respectively). Assume that we only want to compare the sectorial specialization of these two investor types. Suppose that the underlying data generation process is such that IVC and CVC have the same specialization in industry category *j*. Each of their BIs should then be equal to 1. Sampling and measurement errors, however, have a very asymmetric impact on the BI of the two types of VC investors. If, due to sampling or measurement errors, we move 1 single observation in category *j* from the IVC investor type group to the CVC investor type group, we will obtain a decrease in the specialization of IVC investors in category *j* that is approximately 5.6 times smaller than the increase in specialization in category *j* observed for CVC investors.

statistical support to the argument that the TBI is unlikely to be the mere result of measurement or sampling errors.[5]

3. DATA AND DESCRIPTIVE STATISTICS

Our sample of VC investments is drawn from the VICO database built by the VICO project ("Financing Entrepreneurial Ventures in Europe: Impact on Innovation, Employment Growth, and Competitiveness"), supported by the European Commission under the 7th Framework Programme. A full description of the database is provided by Bertoni and Martí Pellón (2011). We limit ourselves to a description of its most relevant aspects.

The database provides detailed information on a large sample of young European entrepreneurial companies operating in the following high-tech sectors: pharmaceuticals, biotechnology, electronic components, computers, telecommunication equipment, electronic medical and optical instruments, robotics and automation equipment, aerospace, telecommunications services, internet, software, and R&D and engineering services. The companies included in the database are located in seven European countries: Belgium, Finland, France, Germany, Italy, Spain, and the United Kingdom. In this study, we focus on a sub-sample of VC-backed companies including 737 companies that received their first round of VC between 1994 and 2004 and were less than 10 years old at that time.

Several country-specific sources were used to identify the VC-backed companies included in the sample: the yearbooks of the Belgium Venture Capital and Finnish Venture Capital Associations, the ZEW Foundation Panel (Germany), the RITA directory and Private Equity Monitor (Italy), the José Martí Pellón Database (Spain), the Library House (now Venture Source, UK), the websites and annual reports of VCs, press releases and press clippings, and initial public offering (IPO)

[5] The transformation that we adopted to compute TBI is common in the literature, but other transformations are also possible (for a review, see De Benedictis & Tamberi, 2002). In particular, BI can be subjected to a log-transformation (Vollrath, 1991) or a symmetrifying transformation (Grupp, 1994). We replicated our analyses using these alternative transformation methods. The TBI that was used is correlated at 99% with both the Grupp (1994) and the Vollrath (1991) specifications and the obtained results are virtually the same.

prospectuses. Moreover, commercial databases, notably, VentureXpert (now Thomson One), VCPro-Database, and Zephyr, were also used. The data were collected at the local level and were checked for reliability and internal consistency by a central data collection unit.

The VICO database provides detailed information about investee company-, investor-, and investment-specific characteristics that can be used to highlight the investment specialization patterns of different types of VCs in Europe. In particular, the characteristics of investee companies include the following dimensions: industry of operation, age, size, stage of development, localization and distance of the investee company from the premises of the VC at the time of the investment. The dimensions that characterize investments are: syndication, duration and exit mode.

VCs are identified and classified according to their type. The classification is driven by the ownership and governance of the management company. An investor characterized by an independent management company is classified as IVC. Captive investors are classified depending on the identity of the entity that controls their management processes. We classify those investors whose parent companies are nonfinancial companies as CVCs and those investors whose parent companies are financial intermediaries as BVCs. If the parent is a governmental body, we classify the investor as a GVC.[6] It should be noted that the ownership and governance of a VC firm, and thus its type, may change over time. An interesting example is provided by the Belgian GIMV, a VC firm established by the Flemish government in 1980, which changed from GVC to IVC after being listed on the stock market in 1997.

Because we are interested in analyzing the investment strategies of VC types, our unit of analysis is the first investment that a VC made in a specific company. We consider only the rounds in which a particular VC firm invests in a particular company for the first time, and exclude all follow-on

[6] There is generally a close correspondence between the type of VC investor and the origin of the funds it invests. IVC firms invest on behalf of institutional investors and wealthy individuals even though they may receive a portion of the funds they invest from public bodies (like the European Investment Fund). Captive investors generally invest funds obtained by their parent companies (CVC and BVC) or public sources (GVC). See Mayer et al. (2005).

rounds from the analysis (see Dimov & Gedajlovic, 2010, for a similar approach). The rationale for this is that when an investor first invests in a company, it reveals the structure of its investment preferences. The same is not necessarily true for follow-on rounds. The inclusion of follow-on rounds would result in a relative overrepresentation of cases in which VC investment is split over several rounds in the computation of specialization indexes. The number of investment rounds is the outcome of a complex contracting process between the investor and the investee company (Gompers, 1995). In other words, the staging of VC investments is endogenous and may vary systematically across industries, countries and phases of the economic cycle. Including all investment rounds, not just the first investment, would thus give us very limited additional information about the structure of investors' preferences and expose us to measurement biases. It is worth highlighting that when two VCs co-invest in the same company, these investments are recorded as two first investments in our analysis. Again, the logic behind this is that a co-investment is informative about the preferences of each of the investors taking part in it.

Insert Table 1 here

The distributions of VC investments according to investee companies and investment characteristics are reported in Table 1. The sample includes a total of 1,663 VC investments, the majority of which are made by IVC firms (55.2%). The second largest category is GVC, representing 19.5% of the sample, followed by BVC, accounting for 15.4%. CVC is the smallest category, with 9.9% of the investments. The distribution of investments across industries highlights the interest of European VCs in software (34.2%) and biotechnology and pharmaceuticals (24.4%). Companies operating in internet and telecommunication (TLC) services and ICT manufacturing,[7] accounting for 20.6% and 17.1% of investments, respectively, are also important targets of VC investments. Investments in the remaining sectors are quite rare. Sample companies are typically very young at the time of the

[7] ICT manufacturing includes the following industries: electronic components, computers, telecommunications equipment, and electronic, medical and optical instruments.

investment: only 15.7% of the investments are in companies older than 5 years, while 22.7% of the investments are in newly funded companies (less than 1 year old). The sample companies are also rather small: 38.7% of the investments are in micro companies with fewer than 10 employees, 48.6% are in small companies (i.e., having between 10 and 49 employees), and only 12.8% are in companies with 50 or more employees. Similarly, the majority of VC investments are made in early stages: 24.2% of them occur during the seed stage, 37.0% during the start-up stage and 38.8% during the expansion stage. These data are in line with the evidence reported by Bottazzi et al. (2004), who found that more than half of the first VC investments in Europe were at the seed or start-up stages.

Another variable that has attracted the interest of VC scholars is the geographic distance between the investee company and the investor. In 29.0% of investments, the VC is located less than 10 km away from the investee company and in 19.6% of investments, the distance is between 10 and 50 km. The distance is more than 300 km only for 22.6% of investments. The vast majority (77.5%) of the investments in our sample are domestic. These data confirm the local bias of VCs and their limited internationalization as highlighted by previous studies.[8]

Regarding the investment characteristics, most VC investments (65.7%) are syndicated (see Hopp & Rieder, 2011 for similar evidence on German VCs). We have information on the exit type for 983 investments. Some 30.6% of the investments terminate with write-offs or the liquidation of the investee companies. Trade sales account for 44.3% of investments, and IPOs account for 19.2%. Buy-back by founders is less frequent (5.9%). For investments where exit occurred, we measured investment duration as the number of years between the first round and exit. When exit did not occur, we had a right-censoring problem and computed investment duration as the time between the first round and 2010 (i.e., the year when exit information was collected; results are unaffected if we

[8] For instance, Schertler and Tykvová (2010) found that approximately two thirds of global VC deals between 2000 and 2008 included only domestic investors.

omit these cases from the analysis). Only 8% of investments last for less than 2 years. The most common durations are between 5 and 7 years (37.1%) and between 2 and 4 years (29.2%). A non-negligible share (25.7%) of investments is longer than 8 years in duration.

4. RESULTS

4.1. The investment specialization patterns of different VC types

Tables 2 and 3 show the TBIs of different types of VCs. Let us first focus on investee company characteristics (Table 2). With respect to other types of VC, IVCs are more inclined to invest in internet and TLC services (TBI=0.052, p-value<1%) and less in R&D and engineering services (TBI=-0.280, p-value<5%) and other high tech manufacturing (TBI=-0.182, p-value<10%). CVCs show an even greater specialization in internet and TLC services (TBI=0.150, p-value<1%), are also specialized in the other high-tech manufacturing sector (TBI=0.280, p-value<10%), but abstain from investing in biotech and pharmaceuticals (TBI=-0.179, p-value<5%). BVCs exhibit a less distinct pattern of industry specialization and none of their TBIs is significantly different from 0 at customary confidence levels. Conversely, GVCs have a very distinct pattern of industry specialization. Their TBIs are negative, of large magnitude, and significant in internet and TLC services (TBI=-0.366, p-value<1) and positive, of large magnitude, and significant in the R&D and engineering services (TBI=0.321, p-value<1%) and other high-tech manufacturing (TBI=0.325, p-value<1%). They are also specialized in biotechnology and pharmaceuticals (TBI=0.093, p-value<5%).

Figures relating to age and size of investee companies indicate that IVCs are specialized in relatively young companies (i.e., companies ranging from 3 to 5 years of age, TBI=0.046, p-value<1%), but not in newly founded companies (TBI=-0.042, p-value<10%). Moreover, the TBIs of IVCs increase monotonically with the size of investee companies: they are negative and significant for companies with fewer than 10 employees (TBI=-0.042, p-value<5%) and positive

and significant for companies with between 25 and 49 employees (TBI=0.046, p-value<10%). The investment specialization pattern of BVCs according to company size is similar to that of IVCs but is even more marked. BVCs abstain from investing in companies with fewer than 10 employees (TBI=-0.151, p-value<1%) but are attracted to companies with 50 or more employees (TBI=0.187, p-value<1%). Similarly, with regard to company age, BVCs exhibit a clear aversion for newly created companies (TBI=-0.197, p-value<1%) and a preference for older companies (more than 5 years old, TBI=0.138, p-value<5%). CVCs do not exhibit any specific pattern of investment specialization with regard to the ages or sizes of investee companies. Their TBIs are quite low in absolute value and not significant at customary confidence levels. Again, GVCs show a very different investment specialization pattern from other investor types. In terms of the age of investee companies, GVCs are specialized in companies that are at the foundation stage (i.e., are less than 1 year old, TBI=0.185, p-value<1%) and are averse to 3- to 5-year-old companies (TBI=-0.186, p-value<1%). The TBIs of GVCs decrease monotonically with investee company size: they are large and positive for companies with fewer than 10 employees (TBI=0.189, p-value<1%) and large and negative for companies with 25 to 49 employees (TBI=-0.152, p-value<10%) and especially for companies with more than 49 employees (TBI=-0.575, p-value<1%).

With regard to the company's stage of development at the time of the VC investment, the results are consistent with the evidence presented above. IVCs, CVCs and BVCs exhibit increasing TBI values along company lifecycles. However, only the negative value of the TBI of IVCs for companies at the seed stage (TBI=-0.051, p-value<5%) and the positive value for companies at the expansion stage (TBI=0.037, p-value<1%) are significant. Again, the investment specialization patterns of GVCs are the opposite of those of other investor types. GVCs specialize in companies that are in the seed stage (TBI=0.180, p-value<1%) and neglect companies that are in the expansion stage (TBI=-0.207, p-value<1%).

Regarding the distance between the investee company and the VC firm, GVCs are the most strongly oriented to local investments. Their TBI is positive and significant for investments in companies located closer than 10 km from their premises (TBI=0.165, p-value<1%), decreases with distance, and is negative and significant for investments farther than 300 km away (TBI=-0.255, p-value<1%). The specialization pattern of BVCs also highlights a preference for local investments. These investors are attracted to companies that are located between 10 and 50 km from them (TBI=0.181, p-value<1%) and abstain from investing in companies that are located farther away (in the "50-300 km" category, the TBI of BVCs is -0.209, p-value<1%). IVCs and CVCs exhibit an opposite pattern of investment specialization, being the most prone to select distant companies. The TBIs of IVCs are negative and significant at conventional confidence levels in the first two distance categories (TBI=-0.053, p-value<1% and TBI=-0.069, p-value<5%), but are positive and significant in the remaining two (TBI=0.063, p-value<1%, and TBI=0.040, p-value<5%). The specialization pattern of CVCs is even more marked: CVCs are specialized in companies located farther than 300 km from their premises (TBI=0.184, p-value<1%), and abstain from investing in local companies (in the less than 10 km category, the TBI is equal to -0.143, p-value<10%). We find similar results relating to cross-border investments. CVCs are more specialized in cross-border investments than the average VC (TBI=0.279, p-value<1%), while GVCs are particularly attracted by national companies (TBI=0.077, p-value<1%). BVCs and IVCs do not show any significant specialization either in national or cross-border investments.[9]

Insert Table 2 here

Let us now consider the investment specialization patterns of different types of VCs relating to investment characteristics (Table 3). BVC is the investor type that exhibits the highest

[9] That the TBI of CVC investors is positive for cross-border investments does not mean that CVC investors are more likely to invest abroad than locally. It means that they are more likely to invest abroad than the "average investor" (and GVC and BVC in particular). Cross-border investments indeed represent only 39.9% of CVC investments, but this value is substantially higher than the overall mean (22.5%).

specialization in syndicated investments (TBI=0.089, p-value<1%), whereas GVC is the investor type with the lowest tendency to syndicate (TBI=-0.089, p-value<1%). This is consistent with the evidence reported above, showing that GVCs have an investment pattern that is substantially different from that of other investor types, making syndication more difficult.

Some significant differences also emerge regarding exit modes. In comparison with other VCs, BVCs more often exit through the IPO of the company (TBI=0.106, p-value<10%) and more rarely through the buyback of the shares (TBI=-0.425, p-value<5%).In contrast, GVCs exhibit large positive values for the TBI corresponding to the buyback exit mode (TBI=0.243, p-value<5%).The specialization indexes of IVC and CVCs relating to exit mode are not significant.

In terms of the duration of the investment, the TBIs of IVC and CVCs again do not significantly differ from 0. BVCs are specialized in the investments up to years in duration (TBI=0.177, p-value<5% and TBI=0.128, p-value<1% for investments shorter than 2 years and between 2 and 4 years, respectively) and abstain from very long investments (TBI=-0.237 in the "More than 8 years" category, p-value<1%). Conversely, GVCs appear to be much more patient. For GVC, TBI values increase monotonically with the duration of investments, with the shorter durations being especially unlikely (TBI=-0.335, p-value<5% and TBI=-0.140, p-value<1%, for durations of less than 2 years and between 2 and 4 years, respectively). A specialization is present in investments whose duration is longer than 8 years (TBI=0.178, p-value<1%).

Insert Table 3 here

To gain further insights into the similarities and differences between the investment specialization patterns of different VC types, we computed the correlation between their TBIs. Each VC type *i*, *i*=IVC, CVC, BVC, GVC, is characterized by a vector of specializations along dimensions (*k*) and categories (*j*). We examined the similarity of these vectors by computing their correlations. Because the number of available observations is rather small (it equals 33, i.e., the total number of

categories considered along all the dimensions), in addition to the parametric Pearson correlation, we also computed the non-parametric Spearman's rank correlation and Kendall's tau rank correlation.

The results are reported in Table 4. The correlation between the investment specialization patterns of private investors (i.e., IVC, CVC and BVC) are generally not significant, with the partial exception of the one between CVC and IVCs, whose Pearson's correlation of TBIs is -0.31 and is significant at 10%. The pattern of investment specialization of GVCs is remarkably different from those of all the other VC types. This is documented by the large negative values of the correlation indexes, significant at the 1% confidence level, with the exception of those relating to the correlation with CVC.

Insert Table 4 here

Last, we used the TBIs to check the stability of the investment specialization patterns of the different VC types over time. This is particularly important because the internet bubble in the late 1990s is thought by scholars and practitioners alike to have altered the investment patterns of VCs (e.g., Green, 2004). To check whether a structural break occurred in the specialization of the different VC types, we computed the TBIs by splitting the sample in two periods: before the burst of the internet bubble (1994-2001) and after the burst of the internet bubble (2002-2004). We then computed the Pearson's, Spearman's and Kendall's correlation indexes of the value of the relating to each investor type between the two periods. The higher the correlation, the more persistent the investment specialization pattern of the VC type is.

Insert Table 5 here

The results are reported in Table 5. The overall correlation, computed on 132 observations, ranges from 0.34 to 0.52, depending on the correlation index. All these correlations are significant at the 1% confidence level, indicating that the pattern of investment specialization of the VC types is quite

stable over time. GVC, IVC and BVCs indeed exhibit high positive correlation values (the correlation ranges from 0.57 to 0.74 for GVCs, from 0.34 to 0.69 for IVCs, and from 0.36 to 0.62 for BVCs; with only one exception, these values are significant at 1% or 5%). Conversely, the TBIs of CVCs before and after the burst of the internet bubble are not significantly correlated. This is consistent with previous findings pointing to changes in investment patterns of CVCs over time (e.g., Dushnitsky, 2012, p. 167-168).

4.2. Investment specialization patterns of different VC types: A synthesis

The results illustrated in the previous section highlight significant differences across the investment specialization patterns of different types of VCs. In comparison with other investor types, IVCs quite surprisingly tend to select relatively older (but not too old) and larger companies in their expansion stages. This pattern of investment specialization is stable over time. If anything, it has been reinforced in the post-internet bubble period.[10] This evidence suggests that European IVCs abstain from the most risky investments. Note also that IVCs care less than other VCs about geographic distance, selecting companies located relatively far away from their premises. The popular Silicon Valley "20 minutes rule", according to which start-up companies located further then a 20-minute drive from the VC firm will not be funded[11], is not confirmed by our data (see Fritsch & Schilder, 2008 for similar evidence).

Previous studies argued that CVC investments are an important element of parent companies' "open innovation" strategies (e.g., Dushnitsky, 2012, p. 164) and, in addition to, or even in substitution of, financial objectives, they are driven by the wish to open a "technology window" on the development of promising new technologies by entrepreneurial ventures (see e.g., Siegel, Siegel &

[10] We compared the TBIs of IVC investors in the pre- and post-internet bubble periods, and tested for the existence of significant differences (results are available from the authors upon request). The only significant difference relates to the "1-2 years" category of the age dimension and indicates a lower inclination to invest in this type of company in the latter period.

[11] "It's not the people you know. It's where you are." The New York Times, 10/22/2006.

MacMillan, 1988; Dushnitsky & Lenox, 2005a). In accordance with this view, Dushnitsky and Lenox (2005b) found that CVCs are particularly attracted by companies operating in industries with high technological ferment. They are also more active in industries with weak intellectual property protection in which other mechanisms to obtain access to promising new technologies (e.g., licenses) are ineffective. This evidence is confirmed by our findings. CVCs were indeed found to specialize in internet and TLC services and abstain from investing in biotechnology and pharmaceuticals. The former industry is characterized by a weak appropriability regime (Coriat, Malerba & Montobbio, 2004; Malerba, 2004) and high technological turbulence in the observation period (Montobbio, 2004). Conversely, IPRs provide efficient protection of proprietary technologies in biotechnology and pharmaceuticals (see e.g., Levin et al., 1987). Previous studies, based on North American data, also indicated that CVCs are less likely to invest in early-stage companies than IVCs (see Cumming, 2006 on Canada; Katila, Rosenberger & Eisenhardt, 2008 and Dushnitsky & Shapira, 2010 on the USA). Our data relating to Europe do not support this claim, most likely as a consequence of the previously mentioned limited preference of European IVCs for this type of investment. We also do not find any evidence that CVCs are more likely to syndicate than average investors. Conversely, CVCs adopt a more global investment strategy than the other investor types and are more prone to select companies located far away from their premises (for similar evidence, see Gupta & Sapienza, 1992; Mayer et al., 2005). Hence, our data confirm the view that CVC is often used by parent companies "to access foreign technologies or learn about and enter geographically distant markets" (Dushnitsky, 2006, p. 397).

Let us now turn our attention to BVCs. Previous studies argued that the main objective of this type of VC is to support the establishment of profitable bank relationships with investee companies rather than to realize large capital gains (Hellmann et al., 2008). In accordance with this view, we found that BVCs, compared to IVC and CVCs, are more likely to invest locally, where they could exploit their superior ability to gather soft information (Coval & Moskowitz, 2001; Mayer et al., 2005; Fritsch & Schilder, 2008; Hellmann et al., 2008). Moreover, our results clearly documented

that BVCs employ more passive strategies than other VC types and are more inclined to invest in older and larger companies that, being in a later stage of development, are closer to an IPO. In fact, we find that BVCs are relatively more likely to exit through an IPO than other investor types and are specialized in investments of shorter durations. In addition, they more frequently employ syndication as a means of reducing investment risk.[12]

Finally, GVCs exhibit a pattern of investment specialization that differs from that of all other investor types. Previous studies argued that the rationale for the creation of GVCs is to fill the funding gap that is left by private investors (Lerner, 1999; Lerner, 2002).[13] In accordance with this argument, we found that GVCs are specialized in investments that are not attractive to other investor types. Because of the information asymmetries surrounding young, small high-tech companies and their high risks of failure, these companies find it difficult to attract private funding, especially at the seed stage (e.g., Carpenter & Petersen, 2002; Hall, 2002). These difficulties are magnified in industries, such as biotechnology, in which there are long lead times and substantial resources are needed for new product development. Our data show that these are precisely the categories in which GVCs are specialized. The duration of the investments of GVCs is also longer than for all other investor types. Moreover, in line with previous studies (e.g., Gupta & Sapienza, 1992; Mayer et al., 2005; Fritsch & Schilder, 2008), we found that GVCs more frequently select local investment targets, which is consistent with the fact that GVC programs in Europe have often been created to implement regional development objectives (Leleux & Surlemont, 2003). Finally, that the investment strategies and specific policy-related objectives of GVCs differ from those of

[12] Hellmann et al. (2008) claim that BVC investors "let others do more of the origination work rather than themselves" (p. 521) and "avoid early-stage investments" (p. 536). On this latter issue, see also Tykvová (2004), Mayer et al. (2005), and Cumming (2006).

[13] This objective is generally shared by public policy measures in support of high-tech entrepreneurial firms. For instance, Audretsch (2003) claimed that, in the USA, the "SBIR awards provide a source of funding for scientists to launch start-up companies that otherwise would not have had access to alternative sources of funding" (p. 133) and that "the emphasis on SBIR and most public funds is on early stage finance, which is generally ignored by private venture capital" (p. 133).

other investor types explains why they rarely take part in syndicated investments and are forced to invest on a stand-alone basis.

5. PATTERNS OF VC INVESTMENT SPECIALIZATION IN EUROPE AND THE USA

Our results are based on a sample of VC investments in companies located in Europe. It is therefore interesting to explore the extent to which they are specific to the European institutional context or whether they represent a general characterization of VCs. In the previous section, we have shown that some of our results resemble those obtained by prior studies, most of which relate to the USA, while others do not. The aim of this section is to more systematically compare the investment specialization patterns that we found in our study with similar evidence on VC investments in the USA. For this purpose, we employed the Thomson One database (previously VentureXpert, retrieved on 12/23/2011), which has been extensively used in the VC literature. According to this database, between 1994 and 2004, 3,457 investors belonging to the four types of investors considered in this paper were responsible for 24,242 first VC investments in 9,024 companies with fewer than 10 years of age, operating in high tech sectors and located in the USA. The distributions of these investments according to the type of investor, industry of operations, age of investee companies at the time of the investment, and syndication are reported in Table 6.[14]

Insert Table 6 here

Of these investments, 68.0% were made by IVCs, 17.4% by CVCs, 12.2% by BVCs and the remaining 2.5% by GVCs. A χ^2 test shows that this distribution is significantly different from that observed in Europe (p-value<1%). In particular, the importance of IVCs is much lower in Europe than in the USA and CVC investments are relatively more frequent in the USA than in Europe,

[14] We do not consider the stage of development of investee companies at the time of the VC investment because the classification, being to some extent subjective, is not entirely comparable across the two datasets.

whereas BVC and, more remarkably, GVC investments are more frequent in Europe. There are also significant differences across the USA and Europe relating to the distribution of VC investments by industry of operations and age of investee companies. Moreover, American investments are syndicated more often.

Similarly to what was performed in the previous sections, we computed TBIs for each VC type in the USA for the three dimensions for which a meaningful comparison was possible and tested their significance. We then computed the Pearson's, Spearman's and Kendall's correlation indexes of the TBIs of the VC types in the USA and Europe. Table 7 reports the correlation indexes, and Table 8 presents the TBIs for the VC types in the USA.

Insert Table 7 here

The results indicate that the specialization patterns of the VC types in the USA and Europe differ quite substantially. The overall correlation indexes reported in Table 7 are low and not significant at customary confidence levels. We also computed the correlation indexes for each dimension of the TBIs. We found that the patterns of investment specialization of VC types in the USA and Europe are not correlated along the industry dimension. Table 8 shows that the only industries in which the investment specialization patterns of VC types are similar are biotech and pharmaceuticals and internet and TLC services. In both Europe and the USA, GVCs are specialized in the former industry and abstain from investing in the latter, whereas the opposite is true for CVCs.

Table 7 also shows that the investment specialization patterns in the USA and Europe are not correlated along the age dimension (the Spearman's and Kendall's correlation indexes are negative, though not significant). The most striking difference is the inverted role of IVC and GVC in the two institutional contexts. In the USA, IVCs are specialized in very young companies and abstain from investing in 3- to 5-year-old companies, whereas GVCs specialize in this type of company (Table

8). This evidence confirms that IVCs in Europe are less attracted to risky investments than those in the USA (see e.g., Kaiser, Lauterbach & Schweizer, 2007).

Insert Table 8 here

Finally, the investment specialization patterns of VCs in the USA and Europe are very similar in terms of syndication. The Pearson and Spearman correlations are equal to 75% and 71%, respectively, and both are significant at 95% confidence level; the Kendall correlation, though not significant, is quite high (0.5).

6. CONCLUSIONS

In this study, we have taken advantage of a new source of large-scale detailed data on VC investments in young, high-tech entrepreneurial companies in Europe: the VICO dataset. We have analyzed the investment specialization patterns of four different types of VCs (IVCs, CVCs, BVCs and GVCs) between 1994 and 2004. We have shown that these VC types tend to select European companies with different characteristics relating to their industry of operation, age, size, stage of development, localization and distance from the premise of the VC at the time of the investment. The four types of VCs also differ in their propensity to syndicate and in the duration and type of exit of their investments. In addition, we have documented that the investment specialization patterns of different types of VCs are quite stable over time, with few exceptions. This evidence confirms the view proposed by previous studies (e.g., Dimov & Gedajlovic, 2010) that IVC, CVC, BVC and GVC play different roles in the VC ecosystem and often do not compete with each other for the same types of deals. Moreover, we have shown that there are similarities but also remarkable differences between the investment specialization patterns of VC investments in Europe and those observed in the USA in the same period. In this respect, the most striking difference is that, in Europe, IVCs refrain from investing in very young, small, seed-stage companies. This investment gap is filled by GVCs, which in Europe account for a sizable share of total VC investments, contrary to the situation in the USA.

This study offers two original contributions to the VC literature. First, the VC literature has long recognized that the ownership and governance of VC firms is an important source of heterogeneity in VC markets. In particular, previous studies have shown that the investment strategies and practices of IVCs differ from those of captive VCs and that the private or governmental ownership of captive VCs also makes a considerable difference (Gompers, 2002; Cumming & MacIntosh, 2006; Hellman et al., 2008; Katila et al., 2008; Dushnitsky & Shaver, 2009; Dimov & Gedalojvic, 2010). Moreover, previous studies have documented that there is considerable variation across different geographical areas in the presence of different VC types (Mayer et al., 2005). Hence, the differences detected in the functioning of the VC market in different geographical areas may simply be a consequence of a "composition" effect (e.g., Sapienza et al., 1996). Our study makes further progress in the understanding of the sources of these differences by showing that the composition effect provides only a partial explanation. Whereas the investment strategies of private captive VCs in Europe broadly resemble those used in the USA, the investment strategies of IVCs differ quite remarkably across the two geographical areas. A possible explanation lies in the need to "grandstand" – i.e., to take actions that signal investment capabilities – of European IVCs (Gompers, 1996), who are supposedly less experienced and reputable than their American counterparts and struggle to rapidly achieve good results to be able to raise new capital. Nonetheless, we do not observe any evidence that the specialization of IVCs in risky investments increases over time. Therefore, it is unlikely that the pattern of investment specialization of this type of investor is simply a consequence of the immaturity of the European VC market, the limited experience and reputation of VCs, which presumably increase over time, and the supposed more limited diffusion of the investment practices that are popular in the USA (e.g., stage financing, carried interest). Instead, as suggested by Bruton, Fried & Manigart (2005), this pattern is possibly the result of the institutional environment in which investors operate (see also Li & Zahra, 2012). From this perspective, regulatory factors (such as the level of protection of minority shareholders, which influences the propensity of investors to invest in younger, early-stage, riskier companies),

and cognitive factors (such as the status of entrepreneurs, which influences the birth rate of entrepreneurial ventures), are likely to play an important role. Although the analysis of this issue lies beyond the scope of the present paper – and would require an enlargement of the VICO dataset to allow for country-level analysis – it is clearly an interesting direction for future research.

Second, this study offers an original contribution to the debate about governmental intervention in the VC market. In the past two decades, governments around the world, notably in Europe, have paid increasing attention and committed considerable resources to the development of an active VC market. In particular, GVC firms (and other government-supported VC firms) have been created in several countries (Brander et al., 2010), and in some of them, such as Canada and South Korea, they have become the dominant VC type. Although there is a lack of large-scale comprehensive empirical studies on the effects of GVCs on the performance of investee companies, the available evidence suggests that these effects have been less positive on average than those of private VC investments along a series of dimensions including company investments (Bertoni, Croce & Guerini, 2012; Brander et al., 2010) and growth (Grilli & Murtinu, 2012).[15] Some studies have even suggested that GVCs may "crowd out" private VCs: by raising cheap capital, they may attract the best deals and out-bid offers by private VCs (see Cumming & MacIntosh, 2006 and Brander et al., 2012 for evidence consistent with this argument relating to Canada; see Armour & Cumming, 2006 for international evidence; see Leleux and Surlemont 2003 for evidence supporting the view that in Europe, GVCs did not crowd out private VCs). In sum, VC scholars are quite skeptical about the effectiveness of policy intervention in this domain (see e.g., Lerner, 2009). This study has provided

[15] A possible reason is that GVC investors provide limited value-enhancing services to investee companies (Luukkonen, Deschryvere, Bertoni & Nikulainen, 2011). In accordance with this view, the effects seem to be more positive when GVC investors syndicate with private VC investors. For instance, while analyzing a large sample of VC-backed companies in 25 countries, Brander et al. (2010) documented that these syndicated investments have outperformed other types of VC investments in terms of the total amount of investment obtained by companies and the likelihood of successful exit (i.e., through IPOs and third-party acquisitions). Bertoni and Tykvova (2012) found similar results with regard to the patenting activity of young European biotech and pharmaceutical companies. In Europe, however, GVC investors are quite unlikely to form a syndicate, as has been documented in the present study, probably due to the divergence of their objectives with those of private investors.

a systematic illustration of the investment strategies of GVCs in Europe in a period during which European governments have been very active to foster VCs' activity. Our data document that GVCs have specialized in industries (biotech and pharmaceuticals) and types of companies (young, small, seed-stage companies) that have proved quite unattractive for private VCs in Europe, thereby filling the entrepreneurial financing gap left by private VCs. However, our results also suggest that GVCs have not been able to attract private VCs to the young, small, early-stage companies and may even have contributed to decreasing their interest – notably, of IVCs – in these types of companies.

This study also has important implications for European policymakers, indicating some guidelines for improving policy intervention. First, European policymakers have been trying since well before the Lisbon Agenda (e.g., European Commission, 1998) to create an EU-wide VC market for early-stage high-potential companies. Our results are in line with the view that, despite these efforts, the European VC market remains quite fragmented. In particular, IVCs in Europe do not exhibit any pronounced propensity for cross-border investments. Recently, this aspect has been the object of specific measures by European policymakers aimed at regulatory simplification and harmonization. In particular, in a series of recent Acts (most notably the Small Business Act and the Single Market Act), the European Commission has committed itself to promoting cross-border VC investments through the adoption of new rules ensuring that, by 2012, VC funds established in any Member State can invest freely throughout the EU (the so-called pan-European passport for VCs). While this is clearly a positive initiative for IVCs, a parallel mechanism leading to a more immediate increase of the internationalization and reduction of the fragmentation of the European VC market would be to increase CVC investments, which are relatively less numerous in Europe than in the USA. Indeed, we have shown that this type of VC has a natural propensity to invest at long distances and across national borders.

Second, as previously mentioned, IVCs in Europe are not attracted to early stage deals. This gap has been filled by GVCs, with poor results. It is therefore doubtful that this form of governmental

intervention is appropriate for the promotion of a dynamic European VC market. Although our findings provide only suggestive evidence that GVC investments may have crowded out private investments, they point to some serious additional weaknesses of this policy that are not mentioned in previous studies and indicate the need for its reconsideration. On the one hand, GVC investments are highly localized. GVCs are the most prone to investing in companies located closer than 10 km and the least likely to invest abroad. This is most likely the consequence of the local natures of their mandates because they have often been established by regional authorities with local development objectives.[16] The local bias of GVCs creates two types of problems. First, it exacerbates the fragmentation of the European VC market. Second, it exposes GVCs to the risk of regulatory capture (Lerner, 2002), thereby jeopardizing their investment selection abilities. Our findings argue in favor of the removal of the regulatory constraints that lead to this local bias. On the other hand, GVCs are the least inclined to syndicate, possibly as a consequence of their unique investment specialization pattern. The VC literature has long recognized the benefits of syndication in terms of reduction of risk exposure and better monitoring of investee companies (Brander, Amit & Antweiler, 2002). These benefits are likely to be especially important for GVCs, who generally lack the high-powered incentives and investment expertise of their independent private peers (Lerner, 2002). Indeed, the (scarce) available evidence points towards the effectiveness of syndicates that involve GVCs (see footnote 14). Therefore, GVCs should abandon a "go it alone" investment strategy and use syndication with private investors in combination with suitable incentive schemes (e.g., based on asymmetric capital gain sharing arrangements) to attract smart money to the sectors of the European entrepreneurial economy where it is more needed.

[16] Investment vehicles founded by a regional or national government are often statutorily prevented or otherwise discouraged from investing outside regional or national borders. The quite obvious reason for this is that policymakers would find it difficult to explain to taxpayers in one region or country why their money is being used to support companies in another region or country. SITRA, a Finnish GVC, provides an interesting counter example. SITRA invests a portion of VC funds outside Finland, claiming that the objective of these cross-border investments is to create a window to the international VC market and learn about new investment practices. At the end of 2010, the international portion of the assets managed by SITRA had a book value of 42 million Euro, corresponding to 6% of total assets (SITRA, 2011).

Finally, to support the development of the European VC market, other indirect policy measures based on a "fund of funds" co-financing logic may prove to be more effective than the establishment of GVC firms. The Australian IIF governmental program provides an interesting and successful example.[17] An advantage of this type of co-financing measures is that it may easily be extended to early-stage financing provided by (groups of) individual investors, such as (super) angels.[18] Measures inspired by the same principles might also be used to support other seed financing mechanisms, such as crowdfunding platforms, which provide a new form of intermediation between innovative ideas and distributed individual investors and are rapidly gaining ground (e.g., Schwienbacher & Larralde, 2012). In sum, while highlighting the weaknesses of the investment strategies pursued by GVCs in Europe, our study indicates that these alternative policy measures are worth serious consideration by European policymakers.

[17] The Innovation Investment Fund was created in 1997. The evidence provided by Cumming (2007) documents that the IIF program has facilitated early-stage investments in high-tech start-ups and the provision of monitoring and value-added services to investee companies.

[18] For an overview of policy measures in this area, see EBAN (2008) and Aernoudt, San José and Roure (2007). The European Angels Fund, recently established by the European Investment Fund, provides a concrete example. See http://www.eif.org/what_we_do/equity/eaf.

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TABLES AND FIGURES

Table 1: Distribution of the first VC investments included in the sample

	N	%		N	%
Investor type					
Independent VC (IVC)	918	55.2%			
Corporate VC (CVC)	165	9.9%			
Bank-affiliated VC (BVC)	256	15.4%			
Public VC (GVC)	324	19.5%			
Total	1,663	100.0%			
Investee company characteristics					
Industry of operation			*Age at the time of the investment*		
ICT manufacturing[a]	284	17.1%	<1 year	378	22.7%
Biotech and pharmaceutics	405	24.4%	1-2 years	560	33.7%
Other high-tech manufacturing[b]	34	2.0%	3-5 years	464	27.9%
Software	568	34.2%	>5 years	261	15.7%
Internet and TLC services	343	20.6%			
R&D and engineering services	29	1.7%			
Total	1,663	100.0%	Total	1,663	100.0%
Size at the time of the investment			*Development stage at the time of the investment*		
<10 employees	430	38.7%	Seed	312	24.2%
10-24 employees	339	30.5%	Start up	476	37.0%
25-49 employees	201	18.1%	Expansion[c]	499	38.8%
>49 employees	142	12.8%			
Total	1,112	100.0%	Total	1,287	100.0%
Distance between investor and investee company			*Localization*		
<10 km	407	29.0%	Same country as the investor	1,288	77.5%
10-50 km	275	19.6%	Different country from the investor	375	22.5%
50-300 km	318	22.6%			
>300 km	404	28.8%			
Total	1,404	100.0%	Total	1,663	100.0%
Investment characteristics					
Syndication			*Exit mode*		
Syndicated investments	1,093	65.7%	IPO	189	19.2%
Non-syndicated investments	570	34.3%	Trade Sale	435	44.3%
			Buyback	58	5.9%
			Write-off or liquidation	301	30.6%
Total	1,663	100.0%	Total	983	100.0%
Duration[d]					
<2 years	101	8.0%			
2-4 years	367	29.2%			
5-7 years	467	37.1%			
>8 years	323	25.7%			
Total	1,258	100.0%			

[a] Electronic components, computers, telecommunication equipment, electronic, medical and optical instruments. [b] Robotics and automation equipment, aerospace. [c] This category also comprehends few (17) investments in buyouts or other later stages. [d] Years between first investment and year of exit year or, if no exit occurred until the end of the observation period (2010).

Table 2: TBI relating to investee company characteristics.

	IVC		CVC		BVC		GVC	
Industry of operation								
ICT manufacturing[a]	0.019		-0.123		-0.020		0.015	
	(0.023)		(0.094)		(0.065)		(0.054)	
Biotech and pharmaceutics	-0.013		-0.179	**	0.013		0.093	**
	(0.020)		(0.080)		(0.050)		(0.038)	
Other high-tech manufacturing[b]	-0.182	*	0.280	*	-0.447		0.325	***
	(0.104)		(0.168)		(0.273)		(0.096)	
Software	-0.014		0.023		-0.003		0.028	
	(0.016)		(0.049)		(0.040)		(0.033)	
Internet and TLC services	0.052	***	0.150	***	0.029		-0.366	***
	(0.019)		(0.057)		(0.054)		(0.070)	
R&D and engineering services	-0.280	**	0.163		0.057		0.321	***
	(0.127)		(0.223)		(0.201)		(0.105)	
Age at the time of the investment								
< 1 year	-0.042	*	0.032		-0.197	***	0.185	***
	(0.022)		(0.065)		(0.067)		(0.033)	
1-2 years	0.001		0.030		-0.007		-0.014	
	(0.015)		(0.049)		(0.041)		(0.036)	
3-5 years	0.046	***	-0.046		0.050		-0.186	***
	(0.016)		(0.063)		(0.043)		(0.051)	
> 5 years	-0.033		-0.038		0.138	**	-0.019	
	(0.027)		(0.090)		(0.054)		(0.059)	
Size at the time of the investment								
< 10 employees	-0.042	**	0.024		-0.151	***	0.189	***
	(0.019)		(0.054)		(0.051)		(0.027)	
10-24 employees	0.002		0.058		0.026		-0.068	
	(0.021)		(0.062)		(0.047)		(0.053)	
25-49 employees	0.046	*	-0.178		0.068		-0.152	*
	(0.026)		(0.116)		(0.063)		(0.081)	
> 49 employees	0.048		-0.006		0.187	***	-0.575	***
	(0.032)		(0.118)		(0.063)		(0.121)	
Development stage at the time of the investment								
Seed	-0.051	**	-0.062		-0.080		0.180	***
	(0.024)		(0.086)		(0.067)		(0.036)	
Start up	-0.008		-0.005		-0.015		0.034	
	(0.016)		(0.059)		(0.046)		(0.034)	
Expansion	0.037	***	0.040		0.057		-0.207	***
	(0.014)		(0.053)		(0.039)		(0.047)	

Table 2: TBI relating to investee company characteristics (cont.)

	IVC		CVC		BVC		GVC	
Distance between investor and investee company								
< 10 km	-0.053	***	-0.143	*	-0.013		0.165	***
	(0.020)		(0.084)		(0.050)		(0.030)	
10-50 km	-0.069	**	-0.035		0.181	***	0.024	
	(0.027)		(0.095)		(0.047)		(0.051)	
50-300 km	0.063	***	-0.107		-0.209	***	-0.016	
	(0.019)		(0.094)		(0.074)		(0.050)	
> 300 km	0.040	**	0.184	***	-0.001		-0.255	***
	(0.017)		(0.051)		(0.049)		(0.056)	
Localization								
Same country of the investor	-0.009		-0.127	***	-0.001		0.077	***
	(0.006)		(0.029)		(0.016)		(0.009)	
Different country from the investor	0.030		0.279	***	0.002		-0.404	***
	(0.019)		(0.041)		(0.053)		(0.068)	

Legend. The table shows the TBI for each investor in each category of invested firms. Standard deviations are in parentheses. *p<10%; **p<5%; ***p<1%. [a] Electronic components, computers, telecommunication equipment, electronic, medical and optical instruments. [b] Robotics and automation equipment, aerospace.

Table 3: TBI relating to investment characteristics.

	IVC	CVC	BVC		GVC	
Syndication						
Syndicated investments	-0.001	0.016	0.089	***	-0.089	***
	(0.008)	(0.025)	(0.016)		(0.022)	
Non-syndicated investments	0.002	-0.032	-0.229	***	0.136	***
	(0.015)	(0.054)	(0.053)		(0.027)	
Exit Mode						
IPO	0.002	-0.097	0.106	*	-0.080	
	(0.029)	(0.108)	(0.061)		(0.081)	
Trade Sale	0.004	0.025	0.018		-0.050	
	(0.016)	(0.050)	(0.038)		(0.044)	
Buy-back	-0.006	0.003	-0.425	**	0.243	**
	(0.057)	(0.187)	(0.195)		(0.096)	
Write-off or liquidation	-0.006	0.017	-0.045		0.051	
	(0.022)	(0.069)	(0.057)		(0.049)	
Duration[a]						
< 2 years	0.027	0.030	0.177	**	-0.335	**
	(0.040)	(0.136)	(0.089)		(0.130)	
2-4 years	-0.013	0.089	0.128	***	-0.140	***
	(0.020)	(0.056)	(0.043)		(0.053)	
5-7 years	0.015	-0.042	-0.030		0.001	
	(0.016)	(0.058)	(0.047)		(0.037)	
> 8 years	-0.016	-0.066	-0.237	***	0.178	***
	(0.022)	(0.077)	(0.076)		(0.035)	

Legend. The table shows the TBI for each investor in each category of investment style. Standard deviations are in parentheses. *p<10%; **p<5%; ***p<1%. Standard deviations are in parentheses. [a] Years between first investment and year of exit year or, if no exit occurred, until the end of the observation period (2010).

Table 4: Pearson, Spearman and Kendall rank correlation for transformed Balassa indexes

	IVC		CVC		BVC		GVC	
Pearson								
IVC	1.00							
CVC	-0.31	*	1.00					
BVC	0.22		-0.15		1.00			
GVC	-0.68	***	-0.16		-0.63	***	1.00	
Spearman								
IVC	1.00							
CVC	-0.01		1.00					
BVC	0.23		0.05		1.00			
GVC	-0.79	***	-0.17		-0.68	***	1.00	
Kendall [a]								
IVC	1.00							
CVC	0.00		1.00					
BVC	0.16		0.03		1.00			
GVC	-0.58	***	-0.13		-0.50	***	1.00	

Legend. *p<10%; **p<5%; ***p<1%. Number of observations: 33. [a] We report Tau-a statistic.

Table 5: Pearson, Spearman and Kendall rank correlation for the transformed Balassa indexes before and after the internet bubble

Type of VC	Number of observations	Pearson		Spearman		Kendall[a]	
Overall	132	0.34	***	0.52	***	0.38	***
IVC	33	0.69	***	0.49	***	0.34	***
CVC	33	-0.23		0.16		0.14	
BVC	33	0.36	**	0.62	***	0.44	***
GVC	33	0.70	***	0.74	***	0.57	***

Legend. *p<10%; **p<5%; ***p<1%. [a] We report Tau-a statistic.

Table 6: Distribution of the first VC investments in the USA between January 1st, 1994 and December 31th, 2004.

	N	%		N	%
Investor type					
Independent VC (IVC)	16,478	68.0%			
Corporate VC (CVC)	4,207	17.4%			
Bank affiliated VC (BVC)	2,955	12.2%			
Public VC (GVC)	602	2.5%			
Total	24,242	100.0%			
Industry of operation of investee company			***Age of investee company at the time of the investment***		
ICT manufacturing	3,751	15.5%	<1 year	5,646	23.5%
Biotech and pharmaceutics	2,283	9.4%	1-2 years	9,601	40.0%
Other high-tech manufacturing	311	1.3%	3-5 years	6,447	26.9%
Software	9,243	38.1%	>5 years	2,282	9.5%
Internet and TLC services	7,428	30.6%			
R&D and engineering services	1,226	5.1%			
Total	24,242	100.0%	Total	23,976	100.0%
Syndication					
Syndicated investments	19,452	80.2%			
Non-syndicated investments	4,790	19.8%			
Total	24,242	100.0%			

Source: Thomson One.

Table 7: Pearson, Spearman and Kendall rank correlation between the TBI of European and USA VCs

	Number of observations	Pearson		Spearman		Kendall[a]
Overall	60	0.24		0.20		0.15
Industry of operation of investee company	24	0.14		0.17		0.15
Age of investee company at the time of the investment	16	0.09		-0.17		-0.12
Syndication	8	0.75	**	0.71	**	0.50

Source: Elaboration of Thomson One data and VICO data. Details on the industry reclassification are available from the authors upon request. **p<5%. [a] We report Tau-a statistics.

Table 8: TBI relating to investee company and investment characteristics in the USA

	IVC		CVC		BVC		GVC	
Industry of operation of investee company								
ICT manufacturing	-0.002		0.041	***	-0.041	*	-0.034	
	(0.005)		(0.015)		(0.021)		(0.049)	
Biotech and pharmaceutics	-0.015	**	-0.063	***	0.082	***	0.276	***
	(0.007)		(0.023)		(0.024)		(0.041)	
Other high-tech manufacturing	-0.011		-0.125	*	0.138	**	0.217	
	(0.020)		(0.070)		(0.063)		(0.134)	
Software	0.006	**	-0.009		-0.011		-0.047	*
	(0.003)		(0.009)		(0.011)		(0.028)	
Internet and TLC services	-0.002		0.019	*	-0.001		-0.077	**
	(0.003)		(0.010)		(0.013)		(0.034)	
R&D and engineering services	0.008		-0.046		0.002		0.084	
	(0.009)		(0.032)		(0.037)		(0.079)	
Age of investee company at the time of the investment								
<1 year	0.052	***	-0.143	***	-0.141	***	-0.016	
	(0.003)		(0.015)		(0.018)		(0.039)	
1-2 years	-0.014	***	0.036	***	0.031	***	-0.043	
	(0.003)		(0.008)		(0.010)		(0.028)	
3-5 years	-0.027	***	0.054	***	0.043	***	0.085	***
	(0.004)		(0.011)		(0.013)		(0.031)	
>5 years	-0.004		-0.009		0.042	*	-0.054	
	(0.007)		(0.022)		(0.025)		(0.070)	
Syndication								
Syndicated investments	-0.025	***	0.049	***	0.061	***	-0.009	
	(0.001)		(0.003)		(0.003)		(0.010)	
Non-syndicated investments	0.091	***	-0.267	***	-0.360	***	0.037	
	(0.003)		(0.019)		(0.024)		(0.039)	

Legend: The table shows the TBI for each investor in each category of investment style. Standard deviations are in parentheses. *p<10%; **p<5%; ***p<1%. [a] "Early stage" in Thomson One.
Source: Elaboration of Thomson One data. Details on the industry reclassification are available from the authors upon request.