

VENTURE CAPITAL

Policy lessons from the VICO project

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**financing
entrepreneurial ventures
in Europe**



Scientific Coordinator of the VICO Project:

Prof. Massimo G. **Colombo**
Politecnico di Milano
massimo.colombo@polimi.it

Partners:

Participant name	Country	Scientific leader
Armines	FR	Philippe Mustar
Politecnico di Milano	IT	Massimo G. Colombo
Università Carlo Cattaneo	IT	Anna Gervasoni
Research Institute of the Finnish Economy	FI	Terttu Luukkonen
Zentrum für Europäische Wirtschaftsforschung GmbH	DE	Tereza Tykvová
Universidad Complutense de Madrid	ES	José Martí Pellón
University College, London	UK	Tomasz Mickiewicz
Vlerick Leuven Management School	BE	Sophie Manigart
Ghent University	BE	Bart Clarysse

For more information, please, see: <http://www.vicoproject.org/>

Contact:

Massimo Colombo: massimo.colombo@polimi.it

Fabio Bertoni: fabio.bertoni@polimi.it

Terttu Luukkonen: terttu.luukkonen@etla.fi

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Executive summary

The VICO project, funded from the EU Seventh Framework Programme¹, studied the impact of venture capital (VC) financing on the innovation rate, employment creation, growth, and competitiveness of high-tech entrepreneurial ventures in Europe and the role VC investors play in helping entrepreneurial firms bridge their resource and competence gaps. The project created a unique hand-collected, large-scale longitudinal dataset on European high-tech companies and VC investments. This dataset provided the backbone for several studies within the project. The project also drew on survey, interview and documentary data. One of the major objectives of the project was to investigate the impact of the heterogeneity of VC investors on the performance of the portfolio firms. This heterogeneity is an important peculiarity of the VC landscape in Europe. In particular, in Europe governmental and bank-controlled VCs are far more important than elsewhere. Moreover, different types of VC investors (independent VC, corporate VC, bank-controlled VC, governmental VC) exhibit different investment patterns and post-investment behaviour. Governmental VCs are specialized in investments in small, young firms, especially in the biotechnology sector, which are relatively neglected by other investor types. They also rarely participate in investment syndicates. Conversely, independent VCs are specialized in expansion investments in relatively older and larger firms.

The VICO project devoted considerable attention to disentangling the “selection” and “treatment” effects of VC investors on the investee firm. The treatment effect refers to the improvement in the performance of the portfolio firm caused by the VC investment, while selection refers to the VC investors being able to choose high quality firms with superior future prospects. Our findings generally supported the view that VC investors had a considerable positive treatment effect on firms’ growth, productivity, as well as investment and innovation performance. VC investors helped their portfolio firms to outperform firms not backed by venture capital even during the financial crisis in 2008–2009. They provided their portfolio firms with the resources and competencies necessary to rapidly readjust their product/market offer during the global crisis.

However, the extent of the treatment effect was contingent on the characteristics of the investor (type, experience) and to some extent also of investee firms. The project demonstrated that experienced VC investors have disproportionately positive effects on employment generation and asset accumulation within the economy. Furthermore, the project showed that independent VC firms exerted an unequivocally positive impact, greater than that documented in previous studies, on the productivity and sales growth of European high-tech entrepreneurial ventures. This effect was largely attributable to the treatment effect rather than to selection by VC investors of highly efficient firms with superior growth prospects. The effect of corporate VC investments on productivity, instead, turned out to be negligible.

With regard to the impacts of the (direct) investments by governmental VCs, when we distinguished between firms backed in the early stages of their life (firms aged five years or less) and relatively more mature firms (aged more than five years), governmental VCs appeared to have a positive impact on the growth of the early stage firms, while the impact was negligible for the more mature ones. University VCs, by contrast, appeared to have a negligible impact regardless of the age of the portfolio firm.

¹ The full title of the project is “Financing Entrepreneurial Ventures in Europe: Impact on innovation, employment growth, and competitiveness”, Grant agreement no. 217485.

The development stage of the firm during the first investment obviously affected the way in which the VC investor was able to exit. Dissolved companies were likely to have had their first investment earlier on during their development cycle while the firms that went public were likely to have had their first VC investment later on when their product was further developed.

Both independent and governmental VCs were helpful in alleviating the financial constraints of the portfolio firms, while bank-controlled and corporate VCs did not have any significant effect in that respect. VCs tended to select firms which were active in patenting and in turn VC-backed companies outperformed otherwise similar non-VC-backed companies in terms of innovation output. Most interestingly, syndicates led by independent VCs but including also governmental VCs exhibit the greatest positive impact on firms' innovation.

The mechanisms by which VCs add value to their portfolio firms were studied by a survey comparing the activity intensity and profiles of government and independent VCs. Independent VCs turned out to be important for the firm in a number of activities which were of significance for the development of the business, such as professionalization (changing the management team and finding board members) and exit orientation. Governmental VCs played a fairly modest role in shaping value-adding behaviour of firms, and this finding held when controlling for factors such as firm age.

The VICO studies suggest that the availability of VC at fair terms seems to motivate nascent entrepreneurs to adopt high growth innovative strategies; they can expect that their ventures will be sustained and supported by VC later on. This implies that the availability of VC has a wider positive impact which goes beyond the investee firms and is related to the emergence of gazelle-type entrepreneurship.

Factors promoting the development of the VC industry include liquid IPO and trade sale markets, which make it easier for VC firms to divest their investments and, thus, to raise further funds as money flows back to the original investors with attractive returns. In this way, VC firms would be able to play an active role investing in unlisted firms to fill the equity gap. Furthermore, VC investments in a country are positively correlated with R&D expenditures, and negatively correlated with the unemployment rate and average span of job tenure. Similarly, demand for VC investments is negatively affected by rigidity in the labour market.

In spite of the fact that during the last decade more than one third of worldwide VC investments have been cross-border deals, the internationalization process of the European VC industry is lagging behind, and the European VC landscape remains quite fragmented. For establishing viable VC industries, promotion of the internationalization process of the European VC industry offers clear benefits. In particular, cross-border VC inflows can partly compensate for unfavourable conditions that local VCs face in countries with underdeveloped stock markets or unfavourable tax and legal conditions for VC investments. We have also found that a combination of cross-border and domestic venture capital promotes the best performance in a portfolio firm.

The VICO project examined policies for venture capital in three countries: France, UK, and Finland. In spite of positive developments, for instance, in the promotion of high-tech entrepreneurial ventures, there is overall failure in the promotion of viable VC industries. Even in the UK, which has been most successful in the emergence of VC, there are inefficiencies in the policy mix of support schemes and ambiguity about the expect-

ed returns of public schemes. There are also weaknesses in the skills of managers working in public funds.

The VICO project suggests several policy recommendations, first, emphasizing a systemic view and targeting framework conditions for the emergence of the VC industry. Furthermore, it notes that a failure to recognize the need for coordinated policies is an important determinant of the modest success of previous policy initiatives in Europe. At the macro level, the project recommends

- shaping the educational system and European culture in favour of an entrepreneurial risk-taking and innovation prone attitude;
- the creation of a VC-friendly tax and regulatory environment, e.g. elimination of double taxation and registration problems, to encourage cross-border VC investments and to reduce national and local fragmentation of the European VC industry;
- encouraging serial entrepreneurship through measures such as changes in bankruptcy laws;
- the creation of liquid markets (IPO and trade sale markets) which facilitate exit strategies for VC investments. For example, schemes providing incentives to individuals investing in firms not listed on the official stock exchanges would increase supply and demand in second tier markets. In this regard, incentives to business angels should also be implemented in a harmonized way.

There are also several micro-level measures recommended, such as:

- provision of selected subsidies on a competitive basis to entrepreneurial firms to improve the pool of entrepreneurial ventures with high-level human capital and high aspirations;
- promotion of support services (like business incubator services) by experienced actors;
- provision of tax-based incentives and co-investment schemes to stimulate private VC firms to invest in young and small high-tech firms, especially in the seed stage;
- measures favouring the entry of VC firms managed by experienced managers through public funds of funds;
- provision of governmental VC funding only through co-investment schemes with experienced private VCs which take the lead, make the screening and selection of the investee firms and provide value-adding services to the investee firms;
- focussing government VC funding on the seed and start-up phases with the objective of attracting private VC investors in subsequent rounds;
- avoiding regional focus in government VC initiatives because it is too narrow a basis for high quality deal flow and operating at the national and/or European level;
- in governmental VC funding, not expecting returns symmetric with those of private VCs.

1 Introduction

The role and impact of venture capital (VC) and private equity (PE) is currently the subject of a major policy debate in Europe. In this context, the VICO research project provides a timely attempt to assess the impact of VC financing on the innovation rate, employment creation, growth, and competitiveness of high-tech entrepreneurial ventures² in Europe. Furthermore, the study investigated the role VC investors play in helping entrepreneurial firms bridge their resource and competence gaps. In this document we provide a concise overview of the main policy-relevant results obtained in the VICO project.

The structure of this document is as follows:

- Section 2 presents a short description of the **distinctive features** of this research project.
- Section 3 describes the patterns of VC investments in Europe in the period under investigation (1994–2004). Specific attention is devoted to highlighting differences among different **types** of VC investors, namely independent venture capital (IVC), corporate venture capital (CVC), bank-controlled venture capital (BVC) and public sector venture capital (PVC),
- Section 4 presents an overview of the **moderating factors** that affect the impact of VC on target companies: type, experience and international breadth. It also considers the role played by VC during the global crisis.
- Section 5 reports results on the **value-added** by VC investors to portfolio companies through improvements in their strategy, operations, governance, and financial structure. It also examines **matching** between entrepreneurial ventures and VC investors. Finally, it provides new insights on investors' **exit strategies**.
- Section 6 presents a **systemic view** of the co-evolution of the supply and demand for VC in Europe.
- Section 7 provides an overview of the **policy** measures implemented in Europe to support the development of VC and presents policy recommendations based on the results of our project.

Finally, we present an appendix describing the unique dataset compiled during the project and used by several studies in this report.

2 Distinctive features of the project

A vast literature directly or indirectly addresses the importance of VC for young high-tech entrepreneurial ventures and for the static and dynamic performance of an economy. However, from the perspective of a European policymaker, there are several gaps in our knowledge that need to be filled to support the design of more effective policies. First, most of the literature is based on US evidence and, given the considerable differences in the structure and development of the VC industry, findings obtained in the USA are not directly applicable to Europe. Second, there is a need for a comprehensive view

² High-tech entrepreneurial ventures were defined as firms that i) at the time of the first investment were at most ten years old (had obtained their first investment in 1994–2004; VC-backed firms); or had been founded in 1984–2004 (control group firms); ii) were independent at foundation (i.e. they were not controlled by another firm with the exception of a VC), and ii) operated in high-tech manufacturing and service sectors (i.e. biotechnology and pharmaceuticals, computers, electronic components, telecommunication equipment, electronic, optical and medical instruments, aerospace, robotics and automation equipment, software, Internet and telecommunication services, R&D and engineering services).

of the phenomenon, based on a combination of different and complementary perspectives. Accordingly, the project has developed an integrated research framework combining micro- and macro-level analyses, quantitative and qualitative studies, and demand-side and supply-side perspectives. The integration of different perspectives in a unique framework has been emphasised by the compilation of a unique, hand-collected, dataset on European VC investments which has provided the backbone for several studies described in this report.

Specifically, the core aspects of the VICO project addressed the following under-researched aspects of the VC industry which appear to be particularly relevant in Europe:

- **Systemic view:** the VC industry is the result of a dynamic equilibrium between demand for and supply of capital between original capital providers and VC investors as intermediaries, on the one hand, and between them and the young high tech companies, on the other. Understanding the evolution of VC financing requires a systemic view of the evolution of the various constituencies interacting within the industry.
- **Heterogeneity:** VC investors form a very heterogeneous category, in terms of skills, governance structures, objectives and investment horizon. Heterogeneity is more pronounced in Europe than in the US, which could help explain the fundamental differences of the VC industry on the two continents.
- **Internationalization:** despite the increased prevalence of cross-border investments, the VC industry in Europe is still highly fragmented. The mode of internationalization of VC investors and the peculiarity of cross-border VC investments is of crucial importance for the development of the industry in Europe.
- **Value-added:** VC provides portfolio companies with a set of value-enhancing services in addition to money. This non-financial component of the intermediation activity of VC investors deserves specific attention in combination with factors such as heterogeneity of investors and the internationalization process.

3 Patterns of VC investment in Europe

Out of the 8,370 European high-tech entrepreneurial firms included in the VICO database, 759 are VC-backed. In the period 1994–2004 these firms received 1,903 first investments by 948 VC investors whose identity is known.³

We considered 4 different investor types:

- Independent VC investors (IVC), most of which are US-style limited partnerships;
- Corporate VC, affiliated with a non-financial corporation (CVC);
- Bank-controlled VC, affiliated with a bank (BVC);
- Public sector VC (PVC)⁴: this category includes governmental VC and university funds.

We analyzed whether the patterns of investment of these four types of VC investors differ along a series of dimensions. As to the characteristics of investee firms we considered the following:

³ For ten VC-backed firms we do not know the identity of the VC investors. Hence, they are not considered in this analysis.

⁴ A public organisation at central, regional or municipal level has to be in control of at least half of the management company.

- Industry of operations;
- Age;
- Size;
- Stage of development;
- Distance between investee firm and investor;

Location of investee firm: domestic vs. cross-border.

We also considered the following characteristics of the investment:

- Syndication;
- Duration;
- Exit mode.

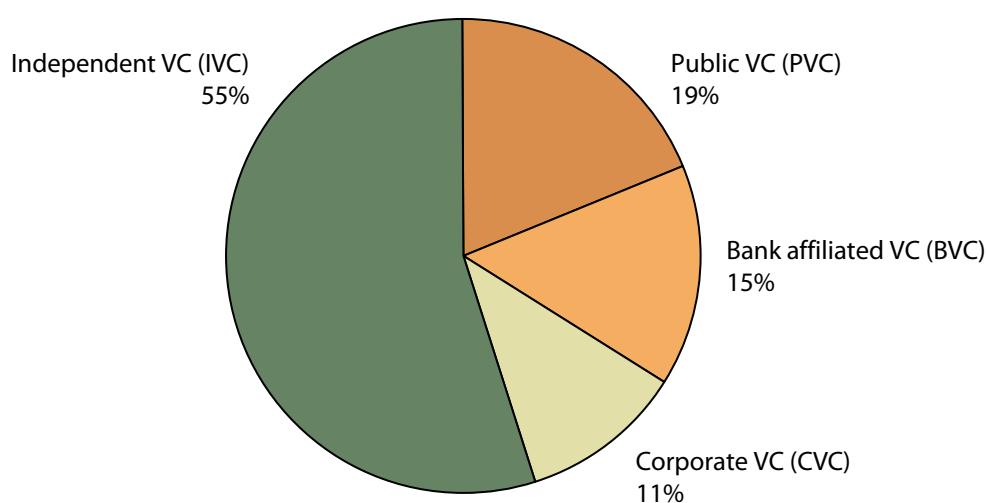
In so doing, the VICO project provided original new insights on the ecology of the VC landscape in Europe.

The distribution of the sample of VC investments by investor type is described in Figure 1. Most investments (55%) are made by IVC investors. However, there is a sizable presence in Europe of BVC and PVC investors (15% and 19%, respectively). CVC is less prevalent (11%).

We measured the relative specialization of the different types of VC investor using the transformed Balassa index.⁵ The findings show that each type of VC investor exhibits significant peculiarities, and these peculiarities are persistent over time, with the partial exception of CVC investors.

The specialization pattern of the different investor types is described in Figures 2 and 3. The main evidence on this issue can be synthesized as follows.

Figure 1 Distribution of the sample of VC investments by type of VC investor



⁵ This index measures the concentration of the investments of a given type of investor (e.g. IVC) in a given category (e.g. biotechnology) in relation to those of the other investor types. A value higher (lower) than zero indicates a greater (smaller) specialization in the category under scrutiny.

- **IVC investors** are less specialized than other investors in very young, small firms in an early development stage, possibly because they have greater risk aversion. They are also characterized by a shorter holding period. This evidence points to a crucial policy issue: How can IVC investors be induced to target younger and smaller firms at the seed/start-up stage? IVC investors also are more specialized in relatively distant firms. The hypothesis that IVC investors mainly invest locally is not confirmed by our data.

Figure 2 The relative specialization of the different types of VC investor by characteristics of the investee firms

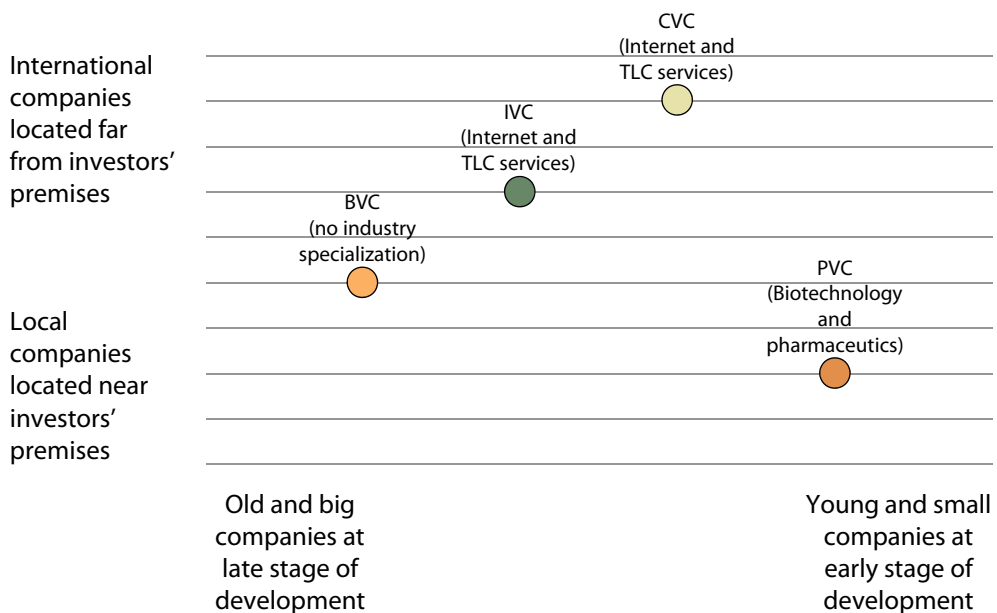
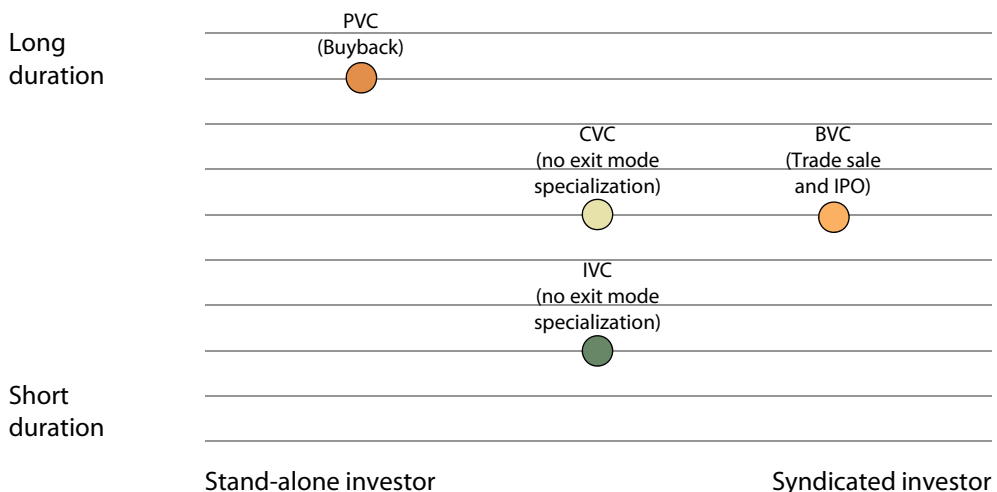


Figure 3 The relative specialization of the different types of VC investor by characteristics of the investee firms



- **CVC investors** exhibit a pattern of specialization quite similar to the “average” investor as to investee firms’ age, size, and development stage. As to the investment characteristics, the specialization pattern of CVC investors is similar to the one of IVC investors, possibly as a result of widespread use of syndication. However, in comparison with IVC investors, CVC investors tend to invest in younger, smaller and less developed companies, probably as a result of their “technology window” investment strategy. CVC investors target firms located abroad and/or far away from their premises. In this perspective, they are the prototype of the global investor (like Intel Capital).
- **BVC investors** focus on local firms to a much larger extent than other investors. They also are more specialized in larger and older firms, in accordance with their objective of supporting the establishment of profitable bank relationships with investee firms. While adopting a low risk investment strategy, they are the investor type most prone to engage in syndication.
- Lastly, **PVC investors** exhibit a pattern of specialization that strongly diverges from the one of all other investor types, in accordance with the view that their role is to fill the financing gap left by IVC and other investor types. They are more specialized in young small firms in the earlier development stage, and concentrate their investment in biotechnology firms, which have a longer product development cycle than firms in other high-tech industries. Accordingly, the duration of their investment is longer than for other investor types. They tend to adopt a “go it alone” investment strategy, and rarely syndicate with other investor types. Lastly, they almost exclusively invest locally. These data clearly indicate that PVC investors have the toughest job as they seek to alleviate imperfections in European VC markets. So the question naturally arises whether they are able to recruit and provide incentives for the skilled personnel needed to bring companies to a development stage where they are able to subsequently attract private VC investors. In this light, the local nature of their investment strategy clearly is a liability, which makes it difficult for PVC investors to reach the necessary critical mass.

4 VC and firm performance: moderating factors

In analyzing the impact of VC investments on performance the research literature distinguishes between the “selection” and “treatment” effect. A positive relation between VC investments and the performance of investee firms may arise because of the ability of VC investors to select high quality firms with superior future prospects (i.e. a selection effect). Alternatively, this relation may be driven by the unique ability of the VC investors to provide investee firms with financial and non-financial resources which, in the absence of the VC investor, would be out of the reach of the investee firms (i.e. a treatment effect).

The VICO project devoted considerable attention to disentangling the two types of effects. Our findings generally support the view that VC investments had a positive treatment effect on firms’ growth, productivity, investment and innovation performance of a sizable economic magnitude. However, the extent of this effect was contingent on the characteristics of the investor (type, experience) and to some extent also of investee firms.

4.1 Role of the experience of the VC firm

The VICO study shows that VC investors with distinct types of experience have different impacts on the growth of high-tech entrepreneurial ventures, where growth is defined with respect to employment and total assets. VC firms with more general experience are particularly good at selecting promising entrepreneurial companies in the pre-investment stage, while VC firms with more industry-specific experience are particularly good at influencing the growth of an entrepreneurial company in the post-investment stage. VCs with high industry-specific experience are hence more likely to help foster the survival of entrepreneurial companies that will form the role models for future entrepreneurs and increase the pool of second-generation entrepreneurs. Thus, when developing entrepreneurial ecosystems, VCs with extensive industry-specific experience may be more important.

These findings have important implications for policy development. First, governments in European countries often try to stimulate the supply of VC to young and innovative ventures by providing funds to the VC industry. Policy makers should take into account, however, that it is not only the volume of financial capital supplied that matters. Policy measures targeting more experienced investors are likely to have disproportionately positive effects on employment generation and asset accumulation within the economy. Hence, rather than spreading support equally over all types of investors, dedicated support to – or co-investment by – reputable players with a strong track record of successful investments would be warranted. If support is given to new VC funds, a move which may help make the European VC industry more competitive, the managers should be experienced (for example, managers spinning out from existing VC funds).

4.2 Impact of different VC types on firm performance

4.2.1 Impact on growth and productivity

The project compared the productivity and growth performance of VC-backed and non-VC-backed high-tech entrepreneurial ventures. Special attention was paid to the role played by different types of VC investors, namely independent (IVC), corporate (CVC) and public sector (PVC) VC investors. The public sector VC investor category was further differentiated between VC firms controlled by governmental bodies (at the national or local level) and university-affiliated VC firms.

The project showed that independent VC investors exerted an unequivocally positive impact on the productivity and growth of European high-tech entrepreneurial ventures, especially when the investment was made in the seed stage. Certainly, this was largely expected. However, in this European study we were able to indicate that independent VC investors had a greater beneficial impact than documented in previous studies, over and beyond the effect generated by selection (i.e. higher prospect firms being more likely to receive VC).

More interestingly, the project highlighted considerable differences among different investor types. They are synthesized in the following sections.

Independent and corporate VC investors

When European high-tech entrepreneurial ventures obtain finance from IVC investors, they exhibit a substantial increase in total factor productivity (TFP) in the year that im-

mediately follows the one in which finance was obtained. This effect is largely attributable to the “treatment effect” of the VC investments rather than to selection by VC investors of highly efficient firms or firms which exhibit fast increases in TFP also in previous years. In general, a surge in the growth of TFP can be seen as stemming from two effects: an increase in output (i.e. sales) growth and improved efficiency in the use of inputs (i.e. capital and labour). The productivity growth of VC-backed companies originates mostly from sales growth, while improved efficiency in the use of labour and/or capital is negligible.

The short-term effect of CVC investments on TFP is negligible. If CVC generates any benefits to portfolio firms, these benefits typically include a reduction of total assets per unit of output.

In another study based exclusively on Italian data, we further analyzed the dynamics of sales and employment growth of IVC-backed and CVC-backed firms in the post-VC investment period. The positive short-term effect on sales growth of IVC investments was confirmed and turned out to be much larger than that of CVC investments. The positive effect of IVC investments on employment growth was much smaller than that on sales growth and comparable to the effect on employment growth of CVC investments. However, it is noteworthy that the positive long-term effects on sales and employment growth of the two types of VC investments were of similar magnitude.

These results are in line with the view that IVC investors, because of the need to make a rapid exit, strive to increase TFP and sales of portfolio companies. This especially applies to less reputable investors that need to “grandstand” (i.e. document their investment ability to capital providers) so as to be able to raise new funds. Having different objectives relating to their “technology window” strategy, CVC investors are more patient, as their investments are partially driven by different objectives (i.e. strategic objective related to a “technology window” investment strategy).

Role of public sector VC

The results of the project highlighted that public sector VC on average did not have a statistically significant impact on the growth of high-tech entrepreneurial ventures (except for the employment measure). However, when we distinguished between firms backed in the early stages of their life (firms aged five years or less) and relatively more mature firms (aged more than five years), the impact of governmental VC appeared to be positive for the early stage firms, while negligible for the more mature ones. This finding is in line with the pattern of specialization of public sector VCs and suggests that if public sector VCs are to make direct investments in investee firms, these investments are more effective if they focus on very young entrepreneurial firms. It is in this stage that the firms have difficulties in finding alternative sources of financing for their (innovative) projects, and public sector VC seems to be alleviating their financing constraints.

When we distinguished governmental and university VC investments, university VC investments appeared to have a negligible impact regardless of the age of recipient firms. In other words, public sector VC plays a significant financing role for very young firms, when it is provided from government funds as contrasted to university funds. This result questions the creation of a large number of university VC funds in Europe in the last decade.

4.2.2 Impact on investments

The entrepreneurial finance literature agrees that high-tech entrepreneurial ventures are the firms most likely to be financially constrained. In line with this view, the VICO project found that non-VC-backed entrepreneurial ventures were generally financially more constrained than VC-backed ventures and that the two types of firms had considerable differences in their investment activities. As VC-backed companies were on average far less constrained, they were able to invest more. The picture is, however, more nuanced if we take investors' heterogeneity into account.

In particular, IVC appears to be quite effective in increasing firms' investments and alleviating their financial constraints. These positive effects turned out to be persistent over time. Public sector VC was also able to alleviate firms' financial constraints. This result echoed the evidence produced by previous studies showing that public support in the form of subsidies indeed reduced the dependence of firms' investments on the availability of internal cash flow. Finally, BVC and CVC proved to have no significant impact on firms' investment activity.

One of the most intriguing outcomes of our analysis is that we obtained these results even while controlling for the amount invested. In other words, one euro obtained from an IVC does not have the same impact as one euro obtained from another type of investor. Where the money comes from is as important as its quantity.

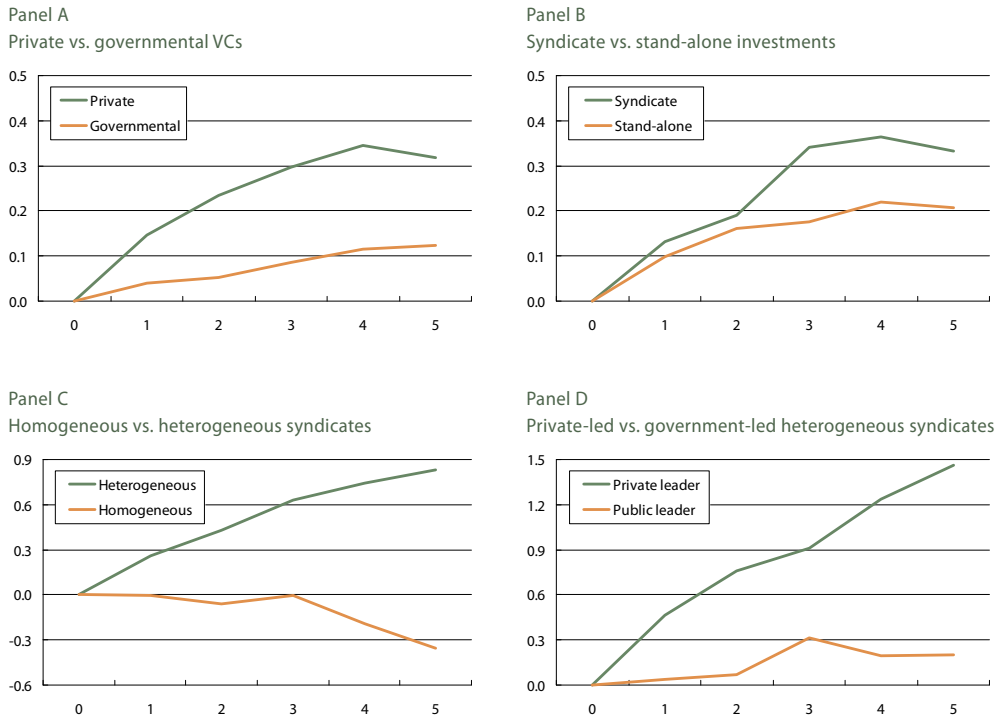
4.2.3 Impact on innovation

Drawing on the VICO data, we investigated how the investor type (governmental vs. private VC investors) and syndication moderate the impact of VC on innovation in portfolio companies. We measured the evolution of the patent stock in a subsample of biotech and pharmaceutical companies one to five years after the first VC investment and, using propensity score matching, we attempted to identify which form of venture capital is best-suited for innovation.

A graphic overview of the main results is reported in Figure 4. Private VCs outperformed governmental ones (Panel A) and syndicated deals were more effective in sustaining innovation than stand-alone investments (Panel B). In companies financed by syndicates and by private venture capitalists the patent stock increased significantly faster than in otherwise similar non-VC-backed companies.

The most interesting and novel result was obtained by combining the two dimensions (investor type and syndication). We analyzed how syndicated deals differed in their impact on the patent stock depending upon whether the syndicate is a homogeneous one (i.e., consisting of only private or only governmental VCs) or a heterogeneous one (consisting of both private and governmental VCs) and upon who leads it (a private or a governmental VC). We found out that companies financed by heterogeneous syndicates outperformed companies financed by homogeneous syndicates (Panel C). Our results finally suggest that the best-suited form for innovation is a heterogeneous syndicate where a private VC investor takes the lead (Panel D). This form of VC outperformed also private stand-alone investments and private-only syndicates.

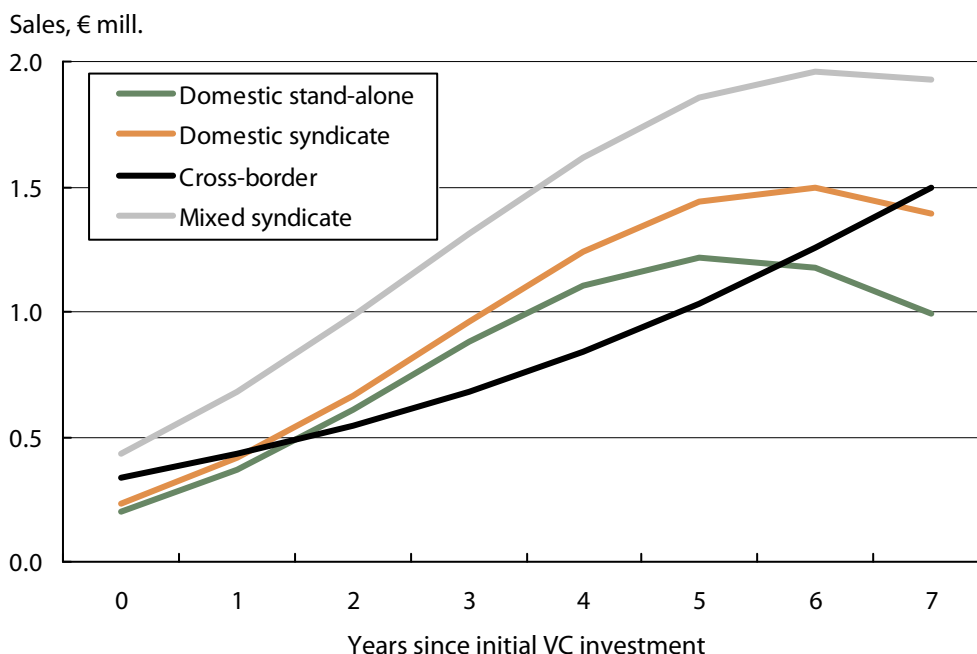
Figure 4 Increase in patent stock (absolute values) for different VC forms 1 to 5 years after the VC investment



4.3 Role of the international span of VC investors

VICO studies showed that high-tech entrepreneurial ventures backed solely by cross-border venture capital investors grew initially at a lower rate than companies backed solely by domestic venture capital investors. In later years, companies backed by cross-border VC investors exhibited higher growth rates, but they only partially caught up with companies backed by domestic VC investors (see Figure 5). Companies backed by a syndicate of domestic and cross-border VC investors experienced more vibrant growth than other VC-backed companies both in the short and the long term. Alternatively, companies initially backed solely by domestic VC firms, which later added an international VC firm to the syndicate, performed equally well as those having international VC firms on board since the first investment round.

Hence, a mix of domestic and cross-border VC firms, either from the outset or later on, leads to portfolio companies that outperform all other combinations. An explanation was that domestic VC firms provide close counselling to portfolio companies, while international VC firms provide internationalization skills and networks. Thus, when developing programmes to stimulate VC investments, governments should stimulate cross-border investment activity both across Europe and with US investors. Focusing only on local or regional investors yields underperforming portfolio companies.

Figure 5 Sales growth and cross-border syndication in VC investments

4.4 Role of the VC during the crisis

The global crisis had a considerably negative effect on both the European VC industry and high-tech entrepreneurial ventures.

Data from the EVCA show that the annual amount invested by European VC funds in 2009 and 2010 was in a range of € 3–4 billion, i.e. about half the pre-crisis investment amount. The number of investments also declined substantially because of reduced funding.

The VICO project produced original evidence on the effects of the crisis on European high-tech entrepreneurial ventures through a survey administered to all firms included in the VICO database that were still in existence as independent firms on 1st January 2010. The almost 600 respondent firms exhibited positive pre-crisis dynamics for both sales and employment, as is apparent from Figures 6 and 7. However, sales declined by almost 2% in 2008 and a further 3.7% in 2009. Employment growth was still positive in 2008 (+3.8%), while it declined by 3% in 2009. Quite remarkably, in 2009 sales and employment declined in all high-tech sectors under consideration in the VICO database and in all countries (with the exception of employment of Italian and Spanish firms, which exhibited a very modest increase). This evidence documents the global nature of the crisis for European high-tech entrepreneurial ventures.

As to firm size, larger ventures experienced the negative effects of the crisis on sales and employment growth more rapidly than their smaller counterparts. However, in 2009 firms of all size categories again exhibited negative growth rates of sales and employment, with the only exception of micro firms that were still creating new jobs, even though at a very modest rate.

It is interesting to compare the effects of the crisis on VC-backed and non-VC-backed firms (see Figures 6 and 7). In 2007, VC-backed firms' sales were growing at a much larger average rate (greater than 15%) than their non-VC-backed counterparts. The employment growth rate was also much larger (greater than 10%). The crisis abruptly interrupted this positive sales growth scenario. In 2008 VC-backed firms experienced no sales growth, even though they still performed better than non-VC-backed firms, which showed declining sales. VC-backed firms also performed better in terms of employment

Figure 6 Sales growth rate of VC-backed and non-VC-backed firms, %

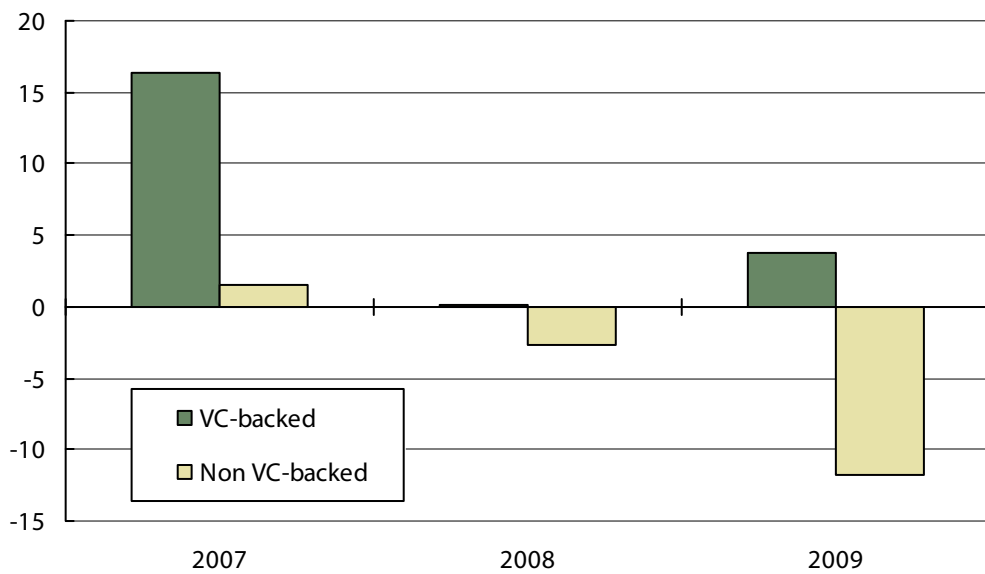
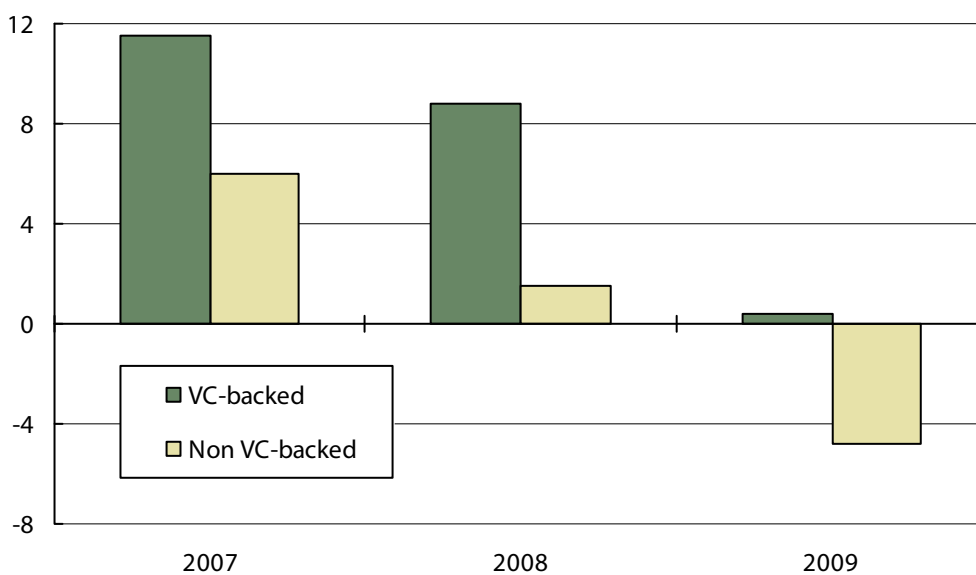


Figure 7 Employment growth rate of VC-backed and non-VC-backed firms, %



creation, which was positive in 2008, even though less positive than in the pre-crisis period, while non-VC-backed firms stopped creating new jobs in 2008. Even more interestingly, in 2009 VC-backed firms exhibited a positive growth rate of sales (about +4%), while non-VC-backed firms experienced a very large decline (about -11%). These latter firms also laid off a portion of their workforce, while VC-backed firms' employment growth rate was still positive.

In sum, VC investments did more than merely help firms grow rapidly in a booming period. The VICO project showed that they also protected European high-tech entrepreneurial ventures from the global crisis, providing them with the resources and competencies necessary to rapidly readjust their product/market offer.

5 How VCs add value: looking inside the black box

5.1 Value-added

Apart from financing, the VICO project examined other post-investment value adding contributions that VCs made to their portfolio firms. Here again special attention was paid to the relative contributions by government⁶ and IVC investors. This study was carried out through a survey controlling for the 'selection' effect which the different investment profiles of the investors might have on the forms of value added. The study focused on the importance of the contribution by the first lead investor to a variety of activities, as assessed by the investee companies. The study also paid attention to potential adverse effects of the post-investment engagement of the investors on the firm.

The major findings of the study included the fact that, compared with government VCs, independent VCs were more important for a number of activities of significance to the development of the business. These included professionalization, e.g., changing the management team and finding board members, and in addition, exit orientation. In contrast, government VCs were not rated to be of great importance for any function of the firm. Even though the overall value-adding behaviour of the two investor types did not differ at a statistically significant level (using a composite indicator for value-adding activities), we found that independent investors performed better in a number of activities. The major finding of this study is that government VCs play a fairly modest role in shaping value-adding behaviour. This finding held when controlling for factors such as firm age and is in broad agreement with the earlier literature.

It was assumed that the activities of the lead investor might have caused friction and adverse effects in the company. The study showed that, overall, such effects were present, but they were minor. There was also little difference between the two investor types in terms of these adverse effects, with the exception that interaction between the investor and the investee suffered from fewer adverse effects when a government VC was the lead (and often the only) investor. Though it may be difficult to interpret the findings concerning the adverse effects – since our measure concerning involvement entailed a judgment of its importance – our findings provide some support for assuming that active involvement especially by IVC investors can lead to friction in the relations between the investor and the management of the investee firm, but these negative effects are overcome by the positive value added provided by the investor.

⁶ Here university funds were excluded because the data was based on a survey and the number of respondents with a lead investor which was a university fund was quite small.

5.2 Matching between firms and VC investors

A considerable share of entrepreneurial ventures does not actively seek VC funding nor is interested in becoming backed by a VC. While our research findings point to the financial and non-financial benefits that VC brings to entrepreneurial ventures, the following question arises: Why are these ventures not keen on receiving VC funding? Though there is a vast literature about the selection process from the perspective of VCs, only a handful of studies analyze the decisions made by entrepreneurial ventures of entering “the VC market”.

This decision depends positively on the (perceived) goodness of the firms’ business ideas and negatively on the resources firms have for realizing these ideas. Firms characterized by potentially profitable business ideas but lacking internal resources (e.g. financing, managerial expertise, a good network of contacts) represent the ideal target for VC investors. This is what we label as the “frog kissing” side of the matching process between VC and investment candidates: other things being equal, VCs prefer a frog which can be turned into a prince by providing it with the resources necessary to develop the firm’s business idea, rather than an (expensive) prince himself.

We analyzed both the determinants of the decision by 202 Italian high-tech entrepreneurial ventures to enter the VC market, and the subsequent selection by the VC investors. Our empirical test-bed, Italy, is a rather adverse environment for VC and thus a particularly interesting setting for this kind of study.

We found that search costs negatively influence the likelihood of a high-tech entrepreneurial venture being on the VC market. Firms located in geographical areas where there is a dearth of VC abstain from looking for external capital. The opposite holds true for firms created by entrepreneurs, who are a typical target for VC investors (e.g. individuals with economic and managerial educations). Moreover the availability of other sources of financing (e.g. debt, personal finance) has a negative effect on the likelihood of firms looking for VC.

These findings are in line with the view that entrepreneurs will be discouraged from looking for VC if they expect that obtaining VC is difficult or if they have sufficient alternative funding. The policy implications are obvious. A larger and more competitive VC industry encourages entrepreneurs to look for VC and to adopt a business model based on higher growth ambitions.

5.3 Exit orientation

The VICO project analyzed the way in which the timing for raising capital influences exit strategies. Specifically, we wanted to understand whether raising capital early in the development of the company or postponing the financing event influences the exit likelihood of the investors. We compared companies that decide to *bootstrap* until they achieved certain level of development with companies that raise external capital early on after their creation.

Entrepreneurs who decide to bootstrap and raise capital later use that time to develop their technology and to test the market. The more developed the product/service, the lower the market and technology risk and, thus, the more numerous the investors who might be attracted by the opportunity. As a result, entrepreneurs will be more likely to raise money from well-performing investors and from investors that are better qualified to provide the company with value-adding services. Well-performing investors are more

able to support entrepreneurs with their business ideas and will be more likely to take the company public.

In accordance with this view, the results of the analysis showed that:

- The companies that were more likely to go public (i.e. through an IPO) were those that decided to bootstrap and delayed the moment to raise VC and were thus more developed when they raised capital (e.g. they had a bigger international presence).
- The companies that were already dissolved at the time of data collection are the ones that raised money earlier in their development process.

These findings highlight the importance of helping companies to develop their technology and test the market at an early stage after their foundation, in preparation for VC investment. There are two ways to do this:

- By promoting programmes that provide companies with early professional mentorship such as the accelerator programmes (i.e. Seedcamp, Springboard, Startup Weekend,...). Through these programmes, entrepreneurs are able to develop their opportunities further, reduce the uncertainty, and therefore, attract more well-performing investors. As a result, the fit between the company and the investor will be better and more companies would be taken public, thus improving the performance of VCs. The issue then is how to design these schemes to improve their efficiency and effectiveness.⁷
- By promoting professionally managed public sector VC activities which focus on the provision of seed and start-up capital. These organisations have been shown by other VICO studies to help very young high-tech entrepreneurial ventures grow their business. However, the ability of these governmental VC investors to attract skilled personnel, to provide non-financial support to portfolio companies and to participate in syndication with other VC investors remains a question mark.

6 The co-evolution of VC: a systemic view

6.1 VC and entrepreneurship

Based on the sample of middle and high income countries (mostly OECD), the VICO project found that the availability of VC in a country has a significant positive effect on the likelihood of the emergence of new entrepreneurial projects with high growth and high innovation potential. The availability of VC seems to motivate nascent entrepreneurs to adopt high growth innovative strategies; they can expect that their ventures will be sustained and supported by VC later on. This implies that the availability of VC has wider positive impacts beyond the investee firms obtaining VC funding. It more generally affects the emergence of “gazelle” types of entrepreneurship, even if some of these enterprises would never seek or obtain VC investments.

Moreover, we found that VC had a higher impact than other categories of formal and informal finance on the entry of high-growth enterprises. From the perspective of supporting innovative, high growth potential entrepreneurial ventures, the policy focus should clearly be on the development of VC.

⁷ Business angels may play a similar role. This important issue, which goes beyond the scope of the VICO project, deserves a careful evaluation and the collection of additional evidence.

Albeit subjective, high growth aspirations of entrepreneurs are crucial for economic development. They motivate entrepreneurs to engage in high value added activities. Even if many of the ventures fail, for generating strong microeconomic foundations for growth and development it is sufficient that some of them succeed. A key policy lesson from these findings is that we should devote attention to transforming new innovative projects into high value gazelles and in order to achieve that promote the availability of VC.

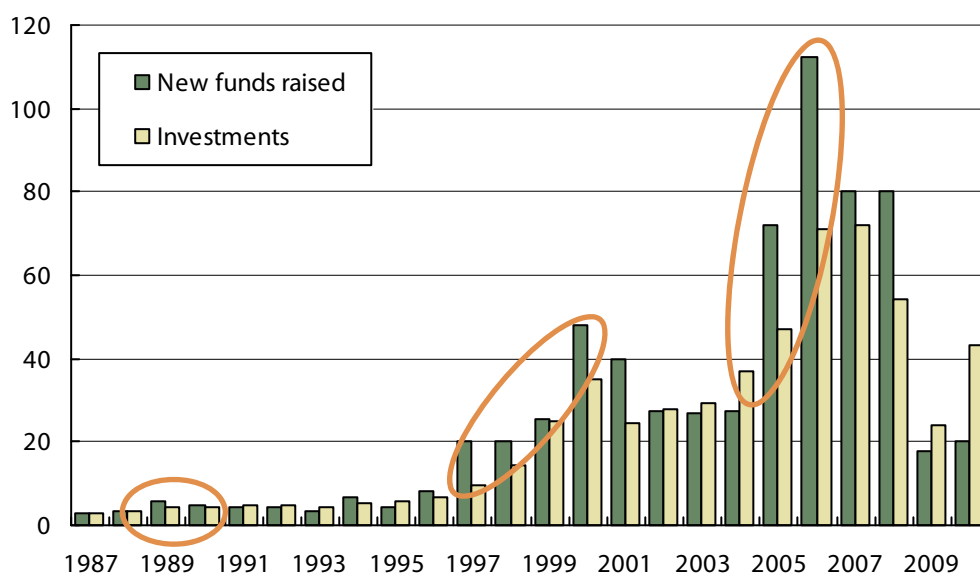
There are further relevant findings related to the institutional and business environment. In particular, in line with previous research, we were able to confirm that strong protection of intellectual property rights in a country results in nascent entrepreneurship with more innovative and more high-growth aspirations.

The propensity to innovate and attitudes towards risk-taking seem to be key factors underpinning the supply of projects with high growth potential. It is therefore important to adopt public policies that shape both the educational system and national culture to become more supportive and more rewarding towards innovative activities, risk-taking and entrepreneurial effort.

6.2 Demand and supply view: fundraising and investment

The VICO project analyzed factors affecting fundraising and VC and PE investment using the largest multi-country, homogeneous dataset ever collected. VC and PE activity showed a dramatic increase between 1997 and 2007. But there is also evidence of the variability of fundraising and investment figures over time, stressing the need for further research on their determinants. Regarding Europe, as Figure 8 shows, there have been sharp fluctuations in fundraising and investment figures over time and imbalances in the short term between the two.

Figure 8 Aggregate venture capital and private equity flows in Europe in 1987–2010, € bill.



Source: EVCA 1988–2011 Yearbooks.

VC/PE activity is very different from that of other financial intermediaries, as investors are faced with complex investment decisions because of the significant lags between fundraising and investment of these funds in unlisted firms. As regards fundraising, it takes on average 12 to 18 months to raise cash for a new fund. Turning to the investment side, since each investment requires from three to six months to be completed, it usually takes between three to four years to allocate the commitments of a VC fund. This situation leads to both sides of the market behaving in a way which is not compatible. For instance, when the internet bubble exploded there were lots of newly closed funds the original targets of which were no longer attractive. Similarly, when the financial crisis started, a great deal of funds focussing on buyouts had recently raised cash, but investments dropped dramatically due to the lack of debt. On the other hand, when there is a shortage of funding for interesting projects, then it would take more than one year to attract money for those projects. As a result of the lags in the fundraising and investment processes, the VC/PE markets do not easily reach equilibrium and might be subject to imbalances that should be addressed with flexible legal, tax, labour and VC/PE industry-specific regulation.

Moreover, the fundraising activities by VC and PE investors compete with each other. Historically in Europe, PE seems to have overwhelmingly won the competition. In the past, the high risk-adjusted returns obtained by PE investors led to the creation of mega-funds which were only limited by the number of large firms which could be subject to buyouts and the difficulty in raising debt to leverage the transactions. In the VC markets the poor performance of European funds has led to a low number of private sector funds complemented by various public sector schemes. The oversupply of money in PE markets, combined with excess liquidity in financial institutions, led to a speculative evolution of buyout deals.

In fundraising, high liquidity (i.e. ease of exit through IPOs and trade sales or secondary buyouts) seems to have a significant effect on VC/PE fundraising over time, whereas returns to alternative assets are not significantly related to new funds raised. Liquidity is important for fundraising, since VC and PE investments are illiquid and long-term in nature. This issue is even more important for VC investments where the difficulty in finding suitable exit options seems to be an important reason for underperformance of Europe's VC industry. As a consequence, the fundraising side of the VC market does not show the same muscle found in the fundraising side of the PE market. In this regard, well developed IPO and trade sale markets would make it easier for VC institutions to divest their portfolio firms (and to help them grow faster) and, therefore, to raise further funds as money flows back to the original investors with attractive returns. In this way, VC firms would be able to play an active role investing in unlisted firms to fill the equity gap.

On the investment side, factors such as IPO and M&A activity in the industry concerned influence the volume of investments. Furthermore, VC investments in a country are positively correlated with R&D expenditures, and negatively correlated with the unemployment rate and average span of job tenure. Similarly, demand for VC investments is negatively affected by rigidity in the labour market. The more difficulties a company faces in adapting its structure to changing market conditions, the lower the chances of surviving an economic downturn. Moreover, in good times, forward-looking firms, with potential for growth, will slow down expansion of employment, to alleviate risks related to future unforeseen negative external shocks. Hence, as is apparent e.g. in Spain, rigid labour regulations hamper recovery from negative periods of the economic cycle.

6.3 Internationalization of the VC industry

In the last decade, more than one third of worldwide VC investments have been cross-border deals.⁸ However, cross-border investments are still quite underdeveloped in Europe (e.g. they account for only 16% of the more than 2000 VC investments recorded by the VICO database). When taking into account the international dimension of VC finance, the public policy becomes more complex since its actions not only affect investments by domestic VCs in domestic and foreign companies but also foreign VCs' activities in the country. In other words, public policy aiming to foster a VC industry has to draw attention to internationalization in VC finance.

For policy makers aiming to establish viable VC industries, our research analysis offers several important insights that indicate the need to promote the internationalization process of the VC industry on a European and global scale. (i) The internationalization of the VC industry that started in the mid 1990s helps to improve the availability of VC in a country. (ii) Cross-border VC inflows can partly compensate for unfavourable conditions that local VCs face in countries with underdeveloped stock markets or unfavourable tax and legal conditions for VC intermediation. (iii) The most relevant factors for high VC investment activity, from both domestic and foreign VCs, seem to be the innovativeness and the economic prosperity of a country. Thus, policy makers in countries where VC is less developed should aim at creating public policies that endorse innovative entrepreneurs and the country's business environment, including macroeconomic fundamentals and sound fiscal policy. Such policies may act as a catalyst for new domestic VCs as well as help attract foreign investors.

These suggestions are based on our investigation of the economic determinants of net cross-border VC inflows for country pairs.⁹ For this investigation, we employed a dataset of VC investments in European and North American countries. Our results on net cross-border inflows can be summed up as follows. Countries with higher expected growth and past stock market returns receive larger net cross-border inflows. This result suggests that VC investments originate in countries with a low VC demand and target countries with a high demand. Moreover, countries with larger stock markets (higher stock market capitalization) have lower net cross-border inflows than countries with a small stock market (low stock market capitalization). This finding may indicate that VCs located in countries with viable stock markets can raise funds on more favourable terms than VCs located in countries with poor stock markets, funds that are invested both locally and abroad. The tax and legal environments for VC intermediation also play a decisive role: countries with poor environments receive higher net cross-border inflows than countries with favourable environments. This last finding may suggest that VCs located in countries with attractive tax and legal environments for VC intermediation have incentives to invest their funds in jurisdictions with less favourable tax and legal conditions, since they possess comparative advantages over local investors there. Last but not least, we also documented dynamic responses in net cross-border inflows: The past values of net cross-border inflows positively affect their current values. This persistence effect may be due to transaction costs or informational asymmetries when VCs exploit expected return differences between potential investment opportunities in

⁸ A VC investment is defined as "cross-border" if the investee firm is located in a country which differs from the home country of the VC investor.

⁹ Net cross-border inflows are positive when a country attracts more venture capital finance from another country than it invests there.

different countries. However, it may also reflect herding behaviour in cross-border VC investments or other typical features of VC finance, such as round financing or fund specialization.

Given that international investments are important in the development of portfolio companies, we can pose a follow-up question: how do domestic VC firms internationalize? Our results indicate that especially domestic VC firms' international resources (comprising both VC managers with international experience, and a firm's track record of previous international investment) stimulate international investment activity better than external resources such as international syndication networks. In order to stimulate internationalization of the domestic VC industry it is therefore preferable that VC managers develop international work experience rather than VCs develop syndicates with international partners. How this could be achieved in Europe through public policy measures is nevertheless another question.

7 Which policies for VC?

7.1 VC policy: State of the art

The VICO project carried out case studies of VC policies in three different European countries: France, UK and Finland, where policy makers have recently been quite active in this area.

The study in **France** indicated an important shift in the French VC policy. While French policy makers used to focus on large companies, since the second half of the 1990s the emphasis has gravitated towards the promotion of high-tech entrepreneurial ventures and the emergence of a VC industry. The latter is conceived as being inseparable from the creation and development of high-tech entrepreneurial ventures. There have been many measures to support the creation of university spin-offs and other technology-intensive firms. These have been fairly successful and have promoted the creation of a fair number (100–150) of new high tech firms annually. However, in terms of the promotion of a VC industry, the measures have been less successful. Especially private seed and early stage investments have virtually disappeared and overall, a large part of VC investment in the country is supported by public schemes. Public support had, however, a positive impact in that during the global crisis the French VC sector was kept afloat by the public funds. There is also a paradox that VC investment in young and innovative firms, the riskiest niche of venture funding, is funded by individual citizens investing their savings by means of tax incentives through mutual funds, and by public funds.

The VC industry in the UK is, and has always been, the biggest and most successful in Europe. It has been more effective in finding money, funding success stories and creating employment than other VC industries in Europe. Surprisingly, one of the main reasons for this relative success is undoubtedly the early governmental support it received. Although very liberal, the UK government has provided efficient support to VCs.

However, there remain problems in the policy mix. Our analysis shows that there is a need for the UK government to have a clear strategy regarding the choice of actors relevant to closing specific kinds of equity gaps, and a need for specific and follow-up public schemes to support these actors. It seems that one of the mistakes of the British government was to define a unique equity gap between £200k and £2M. This is obviously not prudent, since this gap can go as far as £5M or more for, e.g., biotech companies. Thus,

regarding high-tech, capital intensive start-ups, there is a need for funds able to support these firms in multiple rounds. This does not appear to have been the case so far: multiple schemes have been implemented, but some of them have not been cost-effective because they lacked further rounds of public support (University Challenge Funds, for example). A clear strategy, based on quantitative assessment of what would be efficient support depending on the nature of the start-up, could lead to the implementation of more relevant and more efficient schemes.

In addition, another uncertainty in government strategy seems to lead to inefficiencies. When designing a scheme like Regional Venture Capital Funds, one should be clear about the objectives of such an investment, e.g., whether it needs to seek sizable returns to investment or whether it should be a social actor, privileging job creation as a (social) return to investment. Currently the aim is not that clear, resulting in obvious loss in the efficiency of the support provided.

Furthermore, public funds or mixed ones should be managed by skilled and experienced private investors, with a good investment track record. This has not been the case so far, especially for the regional funds.

The study on the **Finnish** pre-seed and seed stage policies paid special attention to a recent new scheme, the new business accelerator VIGO Programme, started in 2009. It aims to emulate the Israeli model of a business incubator programme generally regarded as highly successful. The scheme combines existing early-stage public funding schemes which provide funds but not coaching for portfolio firms, with a novel concept of selecting and coaching of portfolio firms by private actors who have experience of high-growth enterprises and who raise additional private funds making it a co-funding scheme. Furthermore, the scheme targets the best cases nationally, not regionally, in contrast to earlier practice. Thus, from its inception the scheme had a great potential for success. In its design and implementation, however, the Finnish scheme deviated from the Israeli model in important respects, highlighting the importance of the attention to detail in design for the success of a policy scheme.

There are several potential pitfalls in policy design, which this study highlighted:

- Pushing through a new policy scheme too quickly does not allow for legislative changes, which the achievement of the targets would require.
- Existing governmental VC organisations have vested interests in continuing the prevailing practices, though these ought to be changed.
- If governmental VC funds have return requirements which are symmetrical to those in private funds, they are less likely to provide a remedy to market failures and can crowd out private investors. This point has EU-wide implications for the regulations concerning public funding of enterprises.

The study also highlighted the importance of policy coordination in the promotion of entrepreneurship and innovative high-growth enterprises, since the latter require measures in more than one policy area. For this coordination to become effective, it needs to be tackled at a high political level, and there needs to be a strong commitment and persistence to achieve a multidimensional policy change.

7.2 Policies for VC and high-tech entrepreneurship: What should be done?

On the basis of the results of the VICO project we make the following policy recommendations.

1. As a general premise, our findings indicate that there are positive mutual feedbacks between the development of a dynamic sector of high-tech entrepreneurial ventures and an efficient VC industry. Hence, policy measures should adopt a **systemic view**, targeting framework conditions, and the demand for and supply of VC. Failure to recognize the need for coordinated policies is an important determinant of the modest success of previous policy initiatives in Europe.
2. Our findings confirm the view advanced by previous studies that **framework conditions** play a key role. In this respect, we emphasize the importance of the following actions:
 - a. Policy measures should aim at shaping the **educational system** and **European culture** in favour of an entrepreneurial risk-taking and innovation-prone attitude. This has been shown to promote the emergence of innovative entrepreneurial projects with high growth aspirations which attract VC.
 - b. Policy measures should create a tax and regulatory environment encouraging **cross-border VC investments** and **fundraising** and **reduce the national and local fragmentation of the European VC industry** by generating a European-level standardized regulatory framework for VC, which eliminates e.g. double taxation and registration problems.¹⁰
 - c. Encouraging entrepreneurship and especially **serial entrepreneurship** by incentives, such as changing the bankruptcy laws to allow for experienced entrepreneurs to start new businesses.
 - d. Policy measures should favour the creation of **liquid exit markets** (trade sale markets, in particular) for VC investments. Among other measures, schemes providing incentives to individuals – especially to **business angels** – investing in firms not listed on the official stock exchanges would increase supply and demand in second tier markets.
3. It is useful to distinguish policy measures targeting the demand and supply sides.
 - a. **Demand side policy measures** include:
 - i. Policy measures selectively favouring the **creation of entrepreneurial firms with high-level human capital and entrepreneurs with high growth aspirations**, e.g. through the provision of selective subsidies on a competitive basis (like the US SBIR programme) at European level. The fragmented and non-discriminatory nature of the support provided in the past by national governments and local public institutions in this area has been a source of inefficiencies. Public policies should also **encourage both public and private investments in R&D**, thus creating more opportunities for high-tech entrepreneurship.

¹⁰ The introduction of the European VC passport is a policy measure that goes in the above mentioned direction. See also the Report of Expert Group on *Removing tax obstacles to cross-border Venture Capital Investments* at: http://ec.europa.eu/taxation_customs/resources/documents/taxation/company_tax/initiatives_small_business/venture_capital/tax_obstacles_venture_capital_en.pdf.

- ii. Policy measures stimulating the **provision of support services** (like business incubator services) **by experienced private actors**, who can help high-tech entrepreneurial ventures reach a development stage that makes them attractive targets for VC investors.
- b. **Supply side policy measures** include:
- i. Policy measures stimulating private VC firms to **invest in European young and small high-tech firms** through appropriate tax-based incentives and co-investment schemes, which stimulate risk-taking by experienced investors.
 - ii. Policy measures favouring **entry of VC firms led by experienced managers**, including international VC firms, for example, through the conditions regarding the provision of capital from public funds of funds, so as to increase competition in the European VC industry and reduce the costs incurred by high-tech entrepreneurial ventures searching for VC. Special attention should be paid to the attraction of private actors to early stage venture funding through public co-investment.
 - iii. Government VC funding should as a principle be channelled through **co-investment schemes** with experienced private VCs with effective incentives for the managers of private VCs (like investing their own resources). The latter should take the lead, make the screening and selection of the investee firms and take care of the coaching and provision of value-adding services to help the investees with vital business skills.
 - iv. Government VC funding should **focus on the seed and start-up phases** with the objective of attracting private VC investors in subsequent rounds.
 - v. **Regional focus** in governmental VC funding **should be avoided**. Regional funds try to select the rare success stories from a small pool of investment targets, and therefore their performance is typically unsatisfactory. They should not be subsidised from country or European-level public funds. Operations should preferably take place at the national and/or European level to ensure adequate deal flow.
 - vi. In governmental VC funding, **returns symmetric** with those generated by the private VCs **should not be expected** since governmental VC funding can be justified by social performance targets.

Appendix: The data

The VICO project collected a database comprised of 8,370 young innovative companies from seven European countries (Belgium, Finland, France, Germany, Italy, Spain and the United Kingdom). A detailed description of the construction of the dataset can be found at: <http://ssrn.com/abstract=1904297>. We limit ourselves here to a brief description of the data collection process.

The objective of the data collection process was to compile a large sample of new technology-based companies in order to provide a comprehensive picture of VC activity in high-tech sectors. All companies included in the sample were founded after 1984, were independent at foundation, and operate in the following high-tech sectors: pharmaceuticals, ICT manufacturing, robotics, aerospace, telecommunications, internet, software, web publishing, biotech, other R&D services. The sample contains both successful and non-successful deals and both surviving and non-surviving (e.g. bankrupt, acquired) companies.

The dataset includes two strata of companies: the first includes a sample of VC-backed companies and the second a control group of non-VC backed companies. The number of companies to be collected by each country-specific team in the VC-backed stratum was initially set to satisfy two criteria: proportionality to the size of the VC industry in each country, number of companies should be sufficiently large that country-specific studies can be conducted. The control group was set to be 10 times larger than the VC-backed stratum.

The data were collected by the local team from each country. Information collected at the local level was checked for reliability and internal consistency by each national team and regularly sent to a central data collection unit which ensured that information across countries was consistent and comparable and its availability balanced. The data-set consists of 8,370 companies, 759 of which were VC-backed. The breakdown by country, foundation period and sector is provided in Table A.1.

The larger stratum (the “control group”) is composed of non VC-backed companies deriving from a random extraction (conditional on the criteria reported above) from different calendar year versions of Bureau Van Dijk’s Amadeus dataset and complemented by other country-specific sources.¹¹

The smaller stratum contains VC-backed firms. Each local team started the identification of the VC-backed sample by performing a query on VentureXpert and then complemented the list by accessing other, often country-specific, sources.¹² The recourse to several sources of information allows the dataset to embrace a set of VC investors which is usually largely underrepresented by more customary commercial data providers (e.g., corporate venture capital, university affiliated venture capital, governmental venture capital). All VC-backed companies received their first round of VC between 1994 and 2004 and were less than 10 years old at that time.

All (local and parent) VC investors involved in companies in the VC-backed stratum across all stages were identified and information was collected about their management typology. We observe a total of 3,475 investments, i.e. events in which one VC invests in

¹¹ Sources include: industry associations, chambers of commerce, commercial firm directories, Zephyr, Creditreform, the ZEW Foundation panel, and the Research on entrepreneurship in advanced technologies (RITA) directory.

¹² Sources include: VCs’ websites, local venture capital associations, press releases, press clippings, IPO prospectuses, stock exchange records, Zephyr, the Library House, the ZEW Foundation panel, VCPro-database, BVK directory, the Research on entrepreneurship in advanced technologies (RITA) directory, Private equity monitor, José Martí Pellón’s VC database, and Web capital Riesgo.

one company in a given point in time (e.g. a syndicate of 3 VC investors involved in 2 rounds of financing generates 6 investments according to this definition). For each investment we gathered detailed information about: who is involved in the deal (identity of the investment management company and the investment fund, when applicable), identity of the leader of the syndicate (if applicable), the amount invested and equity interest acquired, contact person in the management company involved in the deal.

Table A.1 Distribution of the VICO sample

Panel A: Distribution by country

Country	VC-backed	Control group	Total
Belgium	89	826	915
Finland	68	692	760
France	112	1,616	1,728
Germany	134	1,206	1,340
Italy	98	959	1,057
Spain	82	794	876
UK	176	1,518	1,694
Total	759	7,611	8,370

Panel B: Distribution by industry

Sector	VC-backed	Control group	Total
Biotech & Pharmaceutical	159	706	865
ICT manufacturing	124	1,380	1,504
Internet	134	842	976
Software	256	3,502	3,758
TLC	44	343	387
Other high-tech manufacturing	23	437	460
Other high-tech services	19	401	420
Total	759	7,611	8,370

Panel C: Distribution by foundation period

Foundation period	VC-backed	Control group	Total
1984–1989	22	1,000	1,022
1990–1994	92	1,147	1,239
1995–1999	339	2,609	2,948
2000–2004	306	2,855	3,161
Total	759	7,611	8,370