Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

As good as gold? Benchmarking the impact of public support to venture capital.

Paolo Castelnovo

paolo.castelnovo@uninsubria.it

University of Insubria

Alessandra Caputo

Centre for Industrial Studies (CSIL)

Francesco Giffoni

Centre for Industrial Studies (CSIL)

Aron Gereben

European Investment Bank

Research Article

Keywords: Venture Capital, Matching, Difference-in-Differences, Counterfactual evaluation, SMEs, Mid-caps

Posted Date: August 27th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10551061/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

As good as gold? Benchmarking the impact of public support to venture capital.

Abstract

Young, innovative small and medium-sized enterprises (SMEs) often face financing constraints due to information asymmetries, limiting their access to traditional bank credit. Venture capital (VC) can alleviate these constraints, yet its supply remains insufficient in Europe, motivating public intervention. How publicly backed VC compares with fully private VC in terms of firm-level outcomes, however, remains an open empirical question. We address this issue by evaluating the European Investment Fund's (EIF) intermediated investment model, through which public resources are channelled via privately managed VC funds. Unlike previous studies comparing VC-backed firms with firms that never received VC, we compare EIF-backed firms with a matched sample of firms financed by fully private VC investors. This research design allows us to isolate the incremental effect of the public component of the investment while substantially reducing selection bias associated with access to equity finance. Using a quasi-experimental framework combining exact matching, propensity score matching, and staggered Difference-in-Differences estimation, we find that firms receiving EIF-backed VC perform on par with comparable firms financed by fully private VC. Our findings suggest that publicly backed VC, when delivered through private financial intermediaries, can effectively address equity market failures without compromising firms' post-investment growth and innovation performance.

Keywords: Venture Capital; Matching; Difference-in-Differences; Counterfactual evaluation; SMEs; Mid-caps.

1. Introduction

Young, fast-growing, innovative small and medium-sized enterprises (SMEs) are vital drivers of economic and employment growth (Klenow and Li, 2020; Hallak and Harasztosi, 2019). Despite their importance, they encounter challenges securing funding for their development through traditional banking channels. Financial intermediaries face difficulties in assessing their business potential and monitoring performance because young, fast-growing, and innovative SMEs often engage in riskier endeavours under conditions of a high degree of imperfect information (e.g., the absence of a financial track record). On top of that, start-ups typically generate negative net cash flows during the early stages of their life cycle and therefore lack the reimbursement capacity required for regular bank loans. They often turn to alternative forms of finance, including venture capital (VC) financing[1].

The most recent contributions (e.g. Pavlova and Signore, 2019, 2021; Clò et al., 2022; Bertoni and Tykvová, 2015) conclude that VC investments help companies grow and develop, while only a minority of studies provides evidence that VC financing has no impact or even negative implications for funded companies' performance (see Section 3 for a literature review). VC investments benefit investee companies through different channels. Venture capitalists are more capable of screening entrepreneurial firms with high-growth potential than other financial intermediaries such as banks (Sahlman, 1990). This allows companies to access the financial resources they need, which would otherwise be difficult to obtain without collateral (Kraemer-Eis et al., 2016). Additionally, receiving a VC investment may have a signalling effect that allows investees to access external resources and competencies that would otherwise remain out of reach (Pavlova and Signore, 2019; Hsu, 2006).

Venture capitalists also add value to portfolio companies through the provision of managerial skills and competencies (Gompers et al., 2020; Sørensen, 2007; Luukkonen and Maunula, 2007; Hellmann and Puri, 2002; Hellmann and Puri, 2000) and through their monitoring activities (Sahlman, 1990; Lerner, 1995; Kaplan and Strömberg, 2003). Finally, investees may benefit from their investors' network of business contacts (e.g., suppliers, customers, institutional investors), which may, for instance, result in improved access to additional sources of finance. These complementary financial and non-financial contributions may ultimately generate accreditation effects throughout the investment period and facilitate successful exits through mergers and acquisitions (M&A), initial public offerings (IPOs), and buyouts (Pavlova and Signore, 2021; Colombo et al., 2016; Hochberg et al., 2007; Hsu, 2006; Hellman et al., 2008).

[1] When the investee company is at a development stage, and in the first years of business activity, the investment is referred to as "venture capital". Actually, in modern finance, the term venture capital (VC) covers both investments in the first stage of life of the company and those in a mature stage (Caselli and Negri, 2021).

Despite the acknowledged positive impact of VC financing on investees, the supply of private VC funding in Europe remains limited because of persistent market failures, creating an equity gap and leaving room for public intervention (Invest Europe, 2023; EIBG, 2023). Market failures include, but are not limited to: (i) asymmetric information between investors and entrepreneurs (sometimes related to undisclosed technologies), together with the transaction costs associated with monitoring risky and highly innovative ventures; (ii) coordination failures arising because the institutional infrastructure and networks required for a well-functioning VC market cannot develop without a sufficient pipeline of successful projects, creating a classic chicken-and-egg problem; and (iii) positive externalities, as private investors cannot fully capture or appropriate the broader societal benefits generated by innovation activities undertaken by investee firms (EIBG, 2023; Kraemer-Eis et al., 2016).

Although these market failures are particularly relevant for young, early-stage firms, more mature companies may also benefit from equity financing to unlock growth opportunities, such as regional or international expansion, mergers, or ownership transitions. In these circumstances, equity financing may be more appropriate than traditional debt instruments.

Since the mid-1990s, the EIB Group - including the European Investment Fund (EIF) and the European Investment Bank (EIB) - has offered various equity and quasi-equity products to European companies and, especially through the EIF, has assumed a predominant role as a public risk capital provider in Europe, covering about 60% of public intervention in the VC market. The Group has rapidly increased the supply of equity over the last decade to address market failures and reduce the financing gap, which is particularly severe in Europe compared with Asia and the United States (EIBG, 2023; Kindleberger, 2015). Between 2010 and 2020, the share of public funding provided by the Group in total European VC funds increased by 12% (EIBG, 2023).

The EIB Group, via the EIF, achieves its public policy objectives by investing its own resources and managing funds on behalf of capital providers (mandators), such as the European Commission, through a variety of investment programmes. The EIF predominantly adopts an intermediated model, acting as a limited partner (LP) in privately managed VC funds (Alperovych et al., 2018). Recent evidence shows that the EIF's equity interventions generate a significant mobilisation effect by crowding in additional private VC, thereby expanding the overall supply of risk finance available to innovative firms (Castelnovo et al., 2026). Building on this evidence, the present study shifts the focus from the quantity of capital mobilised to the effectiveness of the EIF delivery model in addressing market failures and improving the post-investment performance of beneficiary firms.

The delivery mechanism of public VC is crucial, as providing financial resources alone may not be sufficient to ensure the successful growth of portfolio companies. An ongoing debate concerns

whether the benefits of VC financing depend on investors' ownership structure and organisational characteristics, and whether publicly backed VC can support firm growth as effectively as fully private investors. Scholars distinguish between independent venture capitalists (IVCs), corporate venture capitalists (CVCs), and government venture capitalists (GVCs)[2], arguing that the identity of the investor may matter as much as the availability of VC financing itself (Gompers and Lerner, 2001; Cumming et al., 2017; Colombo and Murtinu, 2017; Colombo et al., 2016; Alperovych et al., 2015; Bertoni and Tykvová, 2015; Tykvová, 2006; Bottazzi and Da Rin, 2004).

While the evidence remains mixed[3], much of this literature questions governments' ability to support investee firms through direct involvement. Fully publicly supported equity operations appear to be more successful when channelled through privately managed VC funds (Bertoni and Tykvová, 2015; Grilli and Murtinu, 2014, 2015; Sun et al., 2020). More recently, Köpp et al. (2025) provide further evidence on the importance of the delivery model by comparing government-backed VC, EIF-backed VC and fully private VC across Europe. Their findings suggest that EIF-backed investments outperform direct government VC and achieve investment outcomes comparable to, or better than, fully private VC in terms of financing dynamics, exit performance and VC network characteristics. However, their analysis focuses on investment-level outcomes rather than on the subsequent economic and innovation performance of portfolio firms. Consequently, it remains unclear whether the intermediated public VC model adopted by the EIF ultimately translates into firm-level outcomes comparable to those achieved by fully private VC investors.

The differences in objectives, skills, and governance structures among private and government-backed venture capitalists are likely to influence the impact of VC financing on portfolio companies. Compared with GVCs, private VCs are not only more focused on maximising financial returns, but are also generally considered more effective in selecting promising firms, providing managerial support and monitoring, and designing performance-sensitive contractual arrangements (Cumming and MacIntosh, 2004; Cumming and Johan, 2009; Luukkonen and Maunula, 2007). Consequently, private VCs are expected to have stronger incentives to provide portfolio companies with both the financial and non-financial resources needed to foster firm growth and innovation.

[2] IVC fund managers act as general partners in a limited partnership in which other investors (also institutional ones) invest as limited partners. This is the most common legal structure for VC funds in Europe. CVC is a form of VC investment through which a mature and consolidated company invests in a target company (start-ups or highly innovative small businesses, with high scalability potential), obtaining a minority share of share capital (equity) of this same company. Through CVC investments, companies aim to pursue strategic objectives of monitoring and developing new technologies and / or new business models, accessing new skills, ideas and technologies outside the company perimeter. As compared to GVCs, private VCs are not only more focused on maximising profits, but they are also more skilled for selecting promising portfolio companies, providing coaching and monitoring activities, and have more performance-sensitive contracts than GVCs.

[3] For instance, Brander et al. (2010) conclude that companies funded by government VCs generate fewer innovations, whereas Brander et al.'s (2015) results indicate the opposite.

In this paper, we contribute to the VC literature from three complementary perspectives.

First, we investigate whether public VC interventions delivered through private financial intermediaries can generate firm-level outcomes comparable to those achieved by fully private VC investors. Specifically, we test the hypothesis that the EIF's intermediated investment model is able to overcome the agency problems typically associated with public intervention in VC markets while preserving the value-added services that characterise private VC financing. The testing ground for our analysis is the EIF provision of VC through privately managed funds between 2010 and 2020.

Second, our paper contributes to the emerging literature on the effectiveness of different public VC delivery models by shifting the focus from investment-level outcomes to the subsequent performance of portfolio firms. While recent evidence has compared government-backed, EIF-backed and fully private VC in terms of financing dynamics, exit performance and VC network characteristics, considerably less is known about whether these different investment models ultimately translate into different economic and innovation outcomes for beneficiary firms. We address this question by comparing firms financed through EIF-backed VC funds with a control group composed exclusively of firms that also received VC financing, but from fully private investors. Existing studies typically compare VC-backed firms with firms that never received VC financing. Such comparisons inevitably combine the effects of VC financing itself with differences arising from firms' ability to attract external equity investors. By contrast, our identification strategy isolates the incremental effect of the public component of the investment by comparing firms that all successfully attracted VC funding. This substantially reduces selection concerns related to firms' demand for, and access to, equity finance, providing a more credible counterfactual for identifying the causal effect of publicly backed VC. Consequently, the absence of significant differences between treated and control firms should not be interpreted as evidence that VC has no effect, but rather that the EIF's intermediated investment model performs as effectively as fully private VC investors in supporting the post-investment growth of portfolio firms.

Third, our paper provides timely evidence for the current policy debate on strengthening the European VC ecosystem. Europe is stepping up its ambition to become one of the world's most attractive locations to start and scale innovative companies, narrow the VC investment gap with the United States[4], and strengthen competitiveness through greater participation of both domestic and international investors (Venditti et al., 2025; Draghi, 2024; European Commission, 2024). These

[4] The US VC investments market in 2024 was USD 156.6 billion (0.52% of GDP) compared to USD 22.7 billion of the European market (less than 0.1% of GDP). See OECD || Venture Capital Investments

objectives underpin the emerging Startup and Scale-up Strategy[5] and further reinforce the policy relevance of our analysis. Our empirical findings indicate that firms financed through EIF-backed VC funds perform on par with otherwise comparable firms financed by fully private VC investors across a broad set of economic and innovation outcomes, suggesting that the EIF's intermediated model successfully addresses market failures while preserving the value-creating mechanisms typically associated with private VC.

The paper is organised as follows. Section 2 introduces the EIF intermediated delivery model. Section 3 summarises the main findings on the impacts of VC investments on investees' performance, discussing the role of publicly supported equity funds. Section 4 describes the data, while Section 5 outlines our empirical approach, explaining the identification strategy and discussing its caveats. Section 6 presents and discusses the estimation results, and Section 7 concludes.

2. The EIF intermediated intervention model

The EIF is a pan-European specialist provider of risk finance to SMEs and its shareholders are the EIB, the European Commission, and a wide range of public and private banks and financial institutions. The EIF carries out its activities using either its own resources or those provided by the EIB, the European Commission, EU Member States or other third parties. The EIF's mission is to enhance access to finance for SMEs with the ultimate goal of fostering EU policy objectives such as fostering innovation, entrepreneurship, and regional development, while generating an appropriate return for its shareholders. These goals are pursued by offering targeted financial products to intermediaries, including banks, guarantee and leasing companies, micro-credit providers, and equity funds.[6]

When it comes to equity funds, EIF plays a major role as a public risk capital provider in Europe, with about 60% of the public intervention in the market acting as a limited partner (LP) with a minority stake in privately managed, mainly VC funds. Therefore, it always invests indirectly, through intermediaries, using a hybrid model that combines (majority) private funding with (minority) public sources (Kraemer-Eis et al, 2016), where investment decisions are made by private investors.

The EIF's investments in funds undergo a thorough due diligence process, focusing on different aspects of the investment proposals. Special attention is given to evaluating the VC firm's team

[5] For the EU Startup and Scaleup Strategy see https://research-and-innovation.ec.europa.eu/strategy/strategy-research-and-innovation/jobs-and-economy/eu-startup-and-scaleup-strategy_en Last access in September, 2025.
For the European innovation Act see https://research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/commission-seeks-feedback-future-european-innovation-act-2025-07-09_en Last access in October, 2025.
[6] See the EIF website for details: https://www.eif.org/who_we_are/

quality, their alignment with the EIF's public policy objectives, and their potential to contribute to the growth of portfolio companies, all while ensuring returns in line with prevailing market conditions (EIBG, 2023, Ch .4). On top of that, EIF provides significant structuring input to the supported funds, including improvements in the governance arrangements, documentation and reporting, best market practices from its different investing experiences, support of first-time fund management teams. Accordingly, we examine the EIF indirect VC operations to proxy public intermediated funding.

3. Literature review

3.1 The impact of VC investments on firms' economic and innovative performance

Several scholars have investigated, both in developed and developing countries, the causal link between VC investment and the performance of companies in their portfolios. Most recent studies based on the counterfactual approach compare the performance of VC-backed (treatment group) vs non-VC-backed firms (control group) and indicate that VC contributes to the growth and development of companies. The findings reveal that supported firms outperform non-backed companies regarding key performance indicators.

Pavlova and Signore (2019) evaluated the effects of EIF early-stage VC investments on young and innovative European start-ups. By comparing start-ups supported by the EIF with non-VC-backed companies, they found that EIF-supported start-ups experienced higher economic performance than control firms in many economic indicators, including assets, revenues, employment, and operating costs. Similarly, Bertoni et al. (2011) investigated whether Italian VC-backed companies exhibit superior performance in employment and sales growth compared to non-VC-backed ones. Their findings highlighted that VC investments positively influence companies' growth, with a significant portion of this effect manifesting shortly after the initial round of VC financing. Using an original identification strategy, Bronzini et al. (2020) compared Italian start-ups financed by venture capitalists with firms that had reached the final stage of the investment screening process but were ultimately not financed. Their findings showed that VC-backed firms experienced faster growth than their non-financed counterparts, providing further evidence of the value added generated by VC investors. Positive impacts of VC financing are observed on firms' productivity. Croce et al. (2013) compared portfolio firms' productivity growth in European countries before and after the first VC round, using a matched control group of non-VC-backed firms as a benchmark. They showed that productivity growth is not significantly different between VC and non-VC-backed firms before the first round of VC financing; instead significant differences are found in the first years after the investment event. This suggests that the better performance of VC-backed firms is due to the 'value added' provided by VC investors rather than "screening".

Recent evidence from extra-EU countries confirmed that VC financing contributes to the development of investees. Gornall and Strebulaev (2021) compared the financial history of US public companies founded in the past fifty years with a sample of similar companies from other G7 countries. Using VC-related reforms in the USA as a natural experiment, the authors provided evidence that the VC industry caused the rise of one-fifth of the largest 300 US public companies and that three-quarters of the largest US VC-backed companies would not have existed or achieved their scale without VC financing. Staying within the US, Paglia and Harjoto (2014) examined the influence of PE and VC financing on small and mid-sized single-entity business establishments. They compared a sample of VC-backed single-entity business establishments with their non-VC-backed counterparts, demonstrating that VC financing positively impact net sales and employment growth.

Focusing on China, Guo and Jiang (2013) analysed VC-backed manufacturing firms' performance and R&D activities, comparing them to a control group of non-VC-backed peers. Their analysis showed that VC-backed firms outperformed non-VC-backed firms in profitability, labour productivity, sales growth, and R&D investment. They argued that although venture capitalists select firms with higher profitability and more significant investments in R&D activities, the difference in profitability significantly increases (compared to non-VC baked peers) after VC entry. This supports the "value-added" hypothesis rather than the "screening" hypothesis. These results are enriched by Han and Mei (2018), who demonstrated a positive impact of VC on ROE (return on equity) in Chinese VC-backed SMEs compared to non-VC-backed firms.

In African countries, Kato (2021) conducted a systematic literature review by analysing 50 recently published articles on VC performance from 2010 to 2019 in six emerging economies in Africa, concluding that VC financing positively influenced the growth of VC-backed firms in terms of sales growth, job creation and increase in returns on investment.

Regarding the impact on innovation activity, there is mixed evidence on the positive contribution of VC investments to innovation. Pavlova and Signore (2021) proved the existence of a positive causal link between VC investments supported by the EIF and the subsequent patenting activity of the supported firms, using a sample of VC-backed start-ups supported by the EIF and control firms that did not obtain VC financing over the same period. Clò et al. (2022) drew similar conclusions who analysed the role of European development institutions in supporting innovation. Their empirical study investigated how the involvement of these institutions as investors in equity deals influenced the patenting activity of target firms, showing their positive contribution in mobilising finance to support innovation. Positive effects on the innovation performance of VC-backed firms are also reported by Sun et al. (2020) for China and Bronzini et al. (2020) for Italy.

Different findings are obtained by Lahr and Mina (2016) who developed simultaneous models to investigate whether VC investments increase the patenting performance of firms or whether this effect is a consequence of prior investment selection based on firms' patent output. Relying on a database of US and UK SMEs, they showed that fully accounting for the endogeneity of investment the effect of VC on patenting is insignificant or negative. The study suggested that venture capitalists follow patent signals to invest in companies and are more likely to rationalise, rather than increase, the patenting output of portfolio firms.

3.2 Private vs public VC provision

European venture capitalists are heterogeneous, with a significant presence of governmental investors (Lerner, 1999; Bertoni and Tykvová, 2015; Tykvová, 2006; Bottazzi and Da Rin, 2004). Therefore, a strand of literature on the impacts of VC has focused on the type of VC investor, investigating the extent to which VC's positive effects depend on venture capitalists' ownership and structure. In general, there is no conclusive evidence on the impact by type of investor.

A relevant debate concerns the effectiveness of government VC funds compared to private VC investments. Some studies casted doubt on governments' ability to support high-tech entrepreneurial firms through direct involvement. Grilli and Murtinu (2014) considered portfolio companies receiving GVC or IVC financing, as well as companies receiving VC from both types of investors. Their results showed that IVC investors exert a positive impact on sales growth, while the effect of GVC is not statistically significant. The thesis that private VC funds provide superior benefits to firms is corroborated, among others, by Standaer and Manigart (2016) who suggested that IVC funds are most effective to enhance employment growth in portfolio companies than GVC funds; Cumming et al. (2017) who showed that private IVC-backed companies have better exit performance than government-backed companies; Sun et al. (2020) who, focusing on firms' innovative performance, found that the impact of non-state-owned venture capitalists on patent applications and patent quality is significantly greater than that of state-owned VC.

However, other analysis suggested that, even if possibly not effective by its own, GVC can be a useful to support and complement other types of VC investments. Bertoni and Tykvová (2015) investigated whether GVC can spur invention and innovation in young European biotech companies finding that GVCs as stand-alone investors have no impact on both outcomes, but GVC funds boost the impac of IVC, suggesting they are an effective complement to IVC funds. A positive effect of syndicated investments by both GVC and IVC investors on firm sales growth is found by Grilli and Murtinu (2014), but only when led by IVC investors. Also, Grilli and Murtinu (2015) showed that new technology-based firms financed by public entities underperform in terms of sales, employees, and asset growth with respect to firms invested by private venture capitalists, and do not grow more

than non-VC-backed companies. However, they found a positive and statistically significant impact for public VC support when public VC funds cofinance with private VC funds. Additional evidence on the positive joint effect of GVC and PVC funding is provided by Brander et al. (2015), who suggested that GVC finance can augment PVC funding: enterprises funded by both GVCs and PVCs obtain more investment than enterprises funded by PVCs only, and much more than those funded purely by GVCs.

Some other scholars challenged the idea that GVC leads to inferior portfolio firms' performance compared to PVC. For example, Colombo et al. (2016) reviewed the available empirical evidence on GVC initiatives worldwide, analysing the evolution and the effects of different types of governmental support. In contrast with a lack of success in some countries, they documented several successful GVC initiatives. Luukkonen et al. (2013) showed that the value added by GVC funds to portfolio companies in seven EU countries is not significantly different from that of IVC funds. Lastly, Han and Mei (2018) used a sample of Chinese SMEs to provide insights into the heterogeneity of impact based on the type of entity offering VC support: the Chinese government, national private capitalists, foreign capitalists, or a hybrid form of VC capitalists. They found a greater impact of government-backed VC in comparison to private VC support.

4. Data

We rely on four proprietary databases to build the dataset for our empirical analysis. Specifically, we combined data from the EIF monitoring system with Orbis and Orbis IP data to construct the database on treated firms, while we combined data from the Orbis M&A database[7] with Orbis and Orbis IP data to construct the database on potential controls.

4.1 EIF monitoring database

The EIF monitoring database covers indirect VC operations over the 2008-2020 period. However, the analysis is restricted to firms receiving their first VC investment between 2010 and 2018 in order to ensure an adequate observation window both before and after the investment. Investments made after 2018 are excluded because financial information in our Orbis dataset is available only up to 2021 (the latest year with complete data available at the time of data extraction in February 2023), thereby guaranteeing a minimum three-year post-investment follow-up for all treated firms. Likewise,

[7]The Orbis M&A is a comprehensive international deal information database from Bureau van Dijk. It includes over two million rumoured, announced, and completed merger and acquisitions (M&A) transactions, initial public offering (IPOs), secondary equity offerings (SEOs), and PE and VC deals, with integrated financial and ownership information. It does not impose a minimum deal value to be included in the database, which guarantees that the information is not limited to large deals only.

investments made before 2010 are excluded because our Orbis dataset begins in 2008, ensuring at least two years of pre-investment observations for every treated firm.

The database was cleaned by removing corporates and investees based outside EU28, investees with EIF's VC investment share equal to zero, and investees associated with other operations different from VC. No restrictions were applied as regards the sector of activity of the investees, the location of the fund, the development stage of the company, and the fund strategy.

Table 1 reports aggregate statistics by country of the EIF indirect VC investments. The dataset includes 11,945 individual VC investments to 5,400 investees.[8] Between 2010 and 2018, total EIF VC investment to European SMEs and midcaps through these operations amounted to EUR 7.1 bn. Significant heterogeneity is observed across countries. France, the United Kingdom, and Germany were the largest recipients, both in terms of the number of investments and the total amount received. However, it is interesting to notice that the average invested amounts largely vary across countries, ranging from EUR 1.2 bn in Portugal to EUR 184 m in Slovakia. When data by year is analysed, the invested amount steadily increased, reaching about EUR 3 billion in 2018. Sectoral distribution of EIF-backed investments is as follows: ICT (42.7%), Services (30.0%), Other (17.4%), Life science (10.3%).[9]

Table 1 – EIF VC investment data by country and by year

By country					
	VC investments (in #)	**Share (in %)**	**Amount (in mEUR)**	**Share (in %)**	**Average size (in kEUR)**
Austria	161	1.35%	59	0.83%	367
Belgium	264	2.21%	155	2.18%	588
Bulgaria	291	2.44%	94	1.32%	321
Croatia	40	0.33%	18	0.25%	445
Cyprus	5	0.04%	4	0.06%	898
Czech Republic	37	0.31%	17	0.23%	450
Denmark	215	1.80%	155	2.19%	723
Estonia	81	0.68%	46	0.65%	570
Finland	294	2.46%	153	2.15%	520
France	1,978	16.56%	1,430	20.11%	723
Germany	2,829	23.68%	1,254	17.63%	443
Greece	378	3.16%	129	1.82%	342
Hungary	24	0.20%	24	0.34%	999

[8] It is possible that a company received multiple EIF-backed VC investments in the same year, or across the years. For the analysis, we treat only the first occasion as treatment.

[9] Each macro-sector aggregates multiple sub-sectors from the underlying EIF classification. For example, the "Other" category includes sub-sectors such as other consumer products manufacturing, mixed farming, and real estate, among others.

Ireland	308	2.58%	128	1.81%	417
Italy	502	4.20%	431	6.07%	859
Latvia	36	0.30%	30	0.42%	836
Lithuania	112	0.94%	51	0.72%	457
Luxembourg	88	0.74%	32	0.44%	359
Netherlands	649	5.43%	443	6.23%	683
Poland	106	0.89%	87	1.23%	823
Portugal	108	0.90%	132	1.85%	1220
Romania	75	0.63%	47	0.66%	622
Slovakia	68	0.57%	13	0.18%	184
Slovenia	15	0.13%	4	0.06%	265
Spain	737	6.17%	543	7.64%	737
Sweden	375	3.14%	243	3.41%	647
United Kingdom	2,169	18.16%	1,388	19.52%	640
Total	**11,945**	**100.00%**	**7,110**	**100.00%**	**595**

By year

	VC investments (in #)	**Share (in %)**	**Amount (in mEUR)**	**Share (in %)**	**Mean size (in kEUR)**
2010	64	0.54%	29	0.41%	454
2011	200	1.67%	112	1.57%	558
2012	483	4.04%	263	3.70%	544
2013	786	6.58%	407	5.72%	517
2014	1,294	10.83%	672	9.46%	520
2015	1,727	14.46%	969	13.63%	561
2016	2,080	17.41%	1,254	17.64%	603
2017	2,321	19.43%	1,463	20.58%	631
2018	2,990	25.03%	1,941	27.30%	649
Total	**11,945**	**100.00%**	**7,110**	**100.00%**	**595**

Source: authors' elaborations based on raw data provided by EIF
Note: The numbers correspond to the raw data and include multiple investments to the same investee.

4.2 Merging EIF operations with Orbis data

We used the Orbis dataset[10] to retrieve information on the financial and economic performance of the beneficiary firms. Then, we complement this information with patent data extracted from the Orbis IP dataset.

[10] Orbis is a commercial dataset containing firm-level financial statements and ownership data. The main advantage is that data are standardised and comparable across countries, and are already converted in Euro. The database is widely used in economic research as a source of firm-level data for micro-econometric analysis and has been widely used in existing studies on the impact of VC investments on investees, including studies by EIF.

Out of our 5,400 unique investees, we successfully paired 82% of the EIF beneficiaries with a record in Orbis and Orbis IP. Regrettably, several matched firms had incomplete time series of their financial data and had to be removed.[11] We undertook a data-cleaning procedure by excluding observations with odd or inconsistent values, following the approach by Amamou et al. (2023). We drop firm-year observations in which data from the balance sheet (e.g. total assets, fixed assets, intangible fixed assets, total shareholder funds, liabilities, and so on) had negative values. We deflated variables using the country-specific Harmonised Index of Consumer Prices (HICP) deflators.

Finally, we kept only industrial companies and removed other typologies of beneficiaries, including financial companies, banks, insurance companies, research institutes, mutual and pension funds, private equity firms, and venture capitalists. These typologies represented around 5% of our database's total number of investees. After this data cleaning procedure, the final database consisted of 4,199 EIF-backed investees over a starting sample of 5,400 unique investees (77.6%).

4.3 Identification of potential controls

In principle, all SMEs and mid-caps based in EU28 that received a VC investment from a non-EIF-backed investor between 2010 and 2018 were eligible candidates to enter the control group. Therefore, we first collected from Orbis information on the full ownership of the funds, fund managers, and business angels[12] that acted as intermediaries for the EIF indirect operations. This was necessary to identify which funds had public investors and exclude them.[13] Secondly, we collected data on all deals included in Orbis M&A. From Zephyr, we downloaded an initial database of 608,375 deals. We performed a data cleaning procedure (Table 2) to identify eligible companies and identified a sample of potential controls of 15,621 companies.

Table 2 - Steps to identify potential controls

#	Action	N. of deals
1	Download from Orbis M&A all completed deals whose target company is in EU28	608,375
2	Identification of deals where EIF final beneficiaries are targets or acquirors	11,536
3	Exclusion of deals where EIF-backed funds are involved (excluding EIF beneficiaries)	30,364
4	Exclusion of deals involving target companies found at step 3	107,003
5	Exclusion of deals when the BvD ID of the target company is missing	70,968
6	Exclusion of deals where the Acquiror BvD ID is missing	133,927
7	Exclusion of deals involving target companies found at step 6	66,469
8	Exclusion of deals where EIF-backed funds are the target	43

[11] In the counterfactual analysis, we need to observe the outcome variables of interest for at least one year before and three years after the equity investment.
[12] The full list of business angels was collected from the EIB website.
[13] A Batch Search based on the name and the country of the fund (manager) or business angel was performed in Orbis to collect information on the BvD ID of the fund or fund manager. Based on the resulting list of BvD IDs, information on BvD IDs of the full lists of funds managed by fund managers, their global ultimate owner (GUO), their domestic ultimate owner (DUO), and their immediate shareholder (ISH) was retrieved from Orbis.

9	Exclusion of deals where the target has never been involved in a VC equity deal[14]	154,695
10	Exclude if the first private equity deal took place in 2022	140
11	Exclude if the latest private equity deal took place before 2010	10,700
12	Exclude if a single deal is recorded per Target and it is an "exit"	1,772

Source: authors' elaboration

Table A.1 in the Appendix shows the distribution of the treated and potential control by country and investment year. Treated and controls are heterogeneously distributed across countries, but the two distributions are almost homogeneous.

5. Empirical strategy

Our empirical strategy was driven by our main testing hypothesis about whether public VC provision through an intermediated model can overcome the agency problems in financial markets, enhancing companies' economic and innovative performance as private VC. Specifically, the empirical strategy relies on two complementary and integrated steps to identify the causal differential impact of EIF-backed public VC relative to fully private VC. In the first step, we construct a matched sample of treated and control firms through a combination of exact matching and propensity score matching (PSM). In the second step, we estimate the treatment effects using the staggered Difference-in-Differences estimator proposed by Callaway and Sant'Anna (2021).

Given this design, similar economic performance of the EIF-backed investees (treated) and non-EIF-backed investees (controls) would suggest that EIF VC investments help companies grow and develop in the same way as fully private VC investors do.

5.1 Matching phase

The objective of the matching procedure is to construct a control group of firms that resembles the EIF-backed beneficiaries as closely as possible in terms of pre-treatment characteristics, while differing only in the source of VC financing. Specifically, we seek to compare firms receiving VC from EIF-backed funds with firms that obtained VC from fully private investors but exhibited similar observable characteristics before the investment.

To achieve this objective, we combine exact matching with PSM using the *kmatch* estimator in Stata (Jann, 2020), following the practical recommendations in Caliendo and Kopeinig (2008). The two matching approaches serve complementary purposes. Exact matching guarantees comparability along key structural dimensions, whereas propensity score matching balances remaining differences in firm-level characteristics that jointly affect both treatment assignment and post-investment

[14] We consider a deal an equity investment if it is classified in Orbis M&A as "Angel investment", "Capital increase", "Corporate venturing", "Development capital", "or "Venture capital".

performance. The hybrid matching strategy results in a more credible counterfactual and reduces the risk of residual selection bias based on observable characteristics.

More specifically, exact matching is performed on three key dimensions of comparability: the firm's macro-region and sector of economic activity, which are time-invariant characteristics, and the year in which the firm received its first VC investment. Macro-regions are defined according to firms' country of location and comprise six groups representing the main geographical areas of the European VC market, as defined by Invest Europe.[15]

Conditional on these exact strata, we estimate the propensity score using the number of employees as a proxy of firm size, firm age as a proxy for the firm's stage of development and accumulated organizational experience, and the Bureau van Dijk independence indicator[16], which captures the firm's ownership independence by reflecting the degree of ownership concentration and the presence of controlling shareholders.

Finally, nearest-neighbour matching with replacement is implemented to identify the three closest control firm for each treated observation. Allowing replacement improves the quality of the matches by permitting the same control firm to serve as the counterfactual for multiple treated firms whenever it represents the closest available match, a strategy that has been shown to reduce matching bias when the pool of comparable controls is limited (Caliendo and Kopeining, 2009).

Unlike previous studies comparing VC-backed firms with firms that never received VC, our matching procedure is designed to compare firms that have already demonstrated their ability to attract VC investors. Consequently, the subsequent difference-in-differences analysis identifies the incremental effect associated with the public backing of the investment, rather than the broader effect of VC financing itself.

The matching procedure resulted in a final sample comprising 2,971 treated firms and 8,797 matched control firms. The reduction in the number of treated firms relative to the initial sample (4,199 firms) is primarily driven by the constraints imposed by the exact matching procedure, as well as by missing values in the variables used for PSM.

[15] (i) BI (British Isles): UK and Ireland; (ii) CESEE (Central, Eastern and South-Eastern Europe): Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, plus Western Balkans
(iii) DACH: Germany and Austria; (iv) FR&BENELUX: France, Belgium, Netherlands, Luxembourg; (v) NORDICS: Denmark, Finland, Norway, Sweden; (vi) SOUTH: Greece, Italy, Portugal, Spain. See Invest Europe (2021, 2023).

[16] Firms with higher values are characterized by a more dispersed ownership structure, whereas lower values indicate the presence of one or more shareholders exercising substantial or controlling ownership

Table 3 – Variables used in the matching procedure

Variable	Type of matching	Main References
Firm's structural features		
Macro-region[17]	Exact	Pavlova and Signore (2019, 2021); Brown and Earle (2017)
Sector (Invest Europe)[18]	Exact	Pavlova and Signore (2019, 2021); Brown and Earle (2017)
Year of VC investment	Exact	
Other Firm-level characteristics		
Number of Employees	PSM	Amamou et al. (2023); Brown and Earle (2017)
Age	PSM	Pavlova and Signore (2019, 2021); Brown and Earle (2017)
Indipendence indicator	PSM	Pavlova and Signore (2021)

Source: authors' elaborations

Table 4 reports descriptive statistics for the variables included in the PSM procedure for both treated and control firms, before and after matching. Balance on sector, macro-region and VC investment year is ensured by construction, as these variables were used as exact matching criteria.

The t-tests (p value = 0.000) indicate significant differences across all PSM variables, showing that the initial control group was not comparable to the beneficiary firms. Following matching, none of the differences in the PSM variables between the two samples is statistically significant ($p > 0.10$), implying that the matched control group shows sufficient similarity to the treated group and is suitable for comparison. Note that sample sizes differ across variables because of missing observations.

Table 4 - Pre- and Post matching descriptive statistics for variables used in PSM

	Treated		Control group		T-Test	
Variable	**N**	**Mean**	**N**	**Mean**	**|t|**	**p-value**
Pre-matching						
Number of employees	53,747	116.488	171,831	138.247	5.536	0.000
Age	54,587	6.728	187,452	11.069	62.711	0.000
BVD Independence Ind.	54,398	2.999	187,082	2.975	3.362	0.001
Post-matching						
Number of	32,681	100.024	105,564	101.920	1.049	0.294

[17] Categorical: BI, CESEE, DACH, FR&BENELUX, NORDICS, SOUTH
[18] Categorical: ICT, Life science, Service, Other

employees						
Age	41,546	10.627	123,752	10.539	1.373	0.170
BVD Independence Ind.	44,536	3.101	136,276	3.089	1.571	0.116

Source: own elaboration on Orbis and Orbis IP data

5.2 Estimation phase

The estimation of the treatment effect requires an estimator capable of handling the features of our setting. Unlike standard policy evaluations where all treated units receive the intervention simultaneously, EIF-backed VC investments are implemented over several years. Firms enter the treatment group at different points in time according to the year in which they receive their first EIF-supported VC investment. Consequently, our setting is characterised by staggered treatment adoption (or heterogeneous treatment timing), whereby firms are exposed to the treatment in different calendar years.

In this context, conventional two-way fixed effects (TWFE) Difference-in-Differences estimators are no longer appropriate. Recent econometric literature has shown that, under staggered treatment adoption and heterogeneous treatment effects across cohorts or over time, TWFE estimators generally fail to recover the average causal effect of interest. Instead, they estimate a weighted average of multiple two-group comparisons, some of which compare newly treated firms with firms that have already been treated. Because already-treated firms are themselves affected by the intervention, they no longer constitute valid counterfactuals. This contamination may generate negative weights and lead to biased and potentially misleading estimates of the treatment effect (Goodman-Bacon, 2021; de Chaisemartin and D'Haultfoeuille, 2020; Sun and Abraham, 2021).

To address these issues, we estimate treatment effects using the Difference-in-Differences estimator proposed by Callaway and Sant'Anna (2021), which has become the benchmark approach for policy evaluations with staggered treatment timing. Rather than estimating a single average treatment effect through pooled comparisons, this estimator first computes group-time average treatment effects (ATT(g,t)), comparing firms treated in a given cohort only with units that are not yet treated (or never treated) at each point in time. These cohort-specific effects are then aggregated using transparent weighting schemes to obtain the overall Average Treatment Effect on the Treated (ATT). By construction, this approach avoids invalid comparisons between already-treated and newly-treated firms, allows treatment effects to vary both across treatment cohorts and over exposure time, and therefore provides consistent estimates under the standard conditional parallel trends assumption. This framework is particularly well suited to our empirical setting. Since firms receive EIF-backed VC investments in different years between 2010 and 2018, treatment timing is inherently

heterogeneous. The Callaway and Sant'Anna estimator enables us to exploit this variation while correctly accounting for dynamic treatment effects and preserving the causal interpretation of the estimated impacts.

Therefore, following the construction of the matched sample, we estimate the causal effect of publicly backed VC using Callaway and Sant'Anna (2021) DID estimator. Let G=*g* denote the cohort of firms that first receive an EIF-backed investment in year *g*. The estimator identifies the group-time average treatment effect:

$$ATT(g,t) = E[Y_t(g) - Y_t(0) \mid G = g]$$

where $Y_t(g)$ and $Y_t(0)$ denote the potential outcomes under treatment and in the absence of treatment, respectively. In each period, firms belonging to treatment cohort g are compared exclusively with firms that have not yet received treatment, thereby avoiding the contamination arising from comparisons with already-treated firms. The estimation conditions on a vector of covariates, X, including firm size (proxied by the number of employees)[19], firm age, sector of activity, and macro-region, to account for observable differences across firms. The cohort-specific treatment effects are then aggregated following the weighting scheme proposed by Callaway and Sant'Anna (2021) to obtain the overall ATT.

We estimate impacts for the full set of outcomes reported in Table 5, where they are classified into four groups: (i) firm's innovation activity; (ii) economic performance, (iii) assets and employment; (iv) financing mix.

Table 5 - Outcome variables

Variable	Definition
Innovation activity	
N of patent families[20]	Number of patent families filed
Economic performance	
Turnover (EUR thousands)	Total operating revenues (incl. net sales, other operating revenues and stock variations); values do not include VAT.
Profit/Loss before taxes (EUR thousands)	All operating revenues minus all operating expenses plus results from financial activities of the company.
EBIT margin (%)	Earnings before interest and taxes (EBIT) divided by total operating revenues, measuring the firm's operating profitability before financing and tax expenses.
Return on Equity (ROE) (%)	Share of net income over total assets. It is an indicator of how profitable a company is with respect to its total assets.

[19] When the outocme variable is the number of employees, firm size is proxied by the amount of total assets.

[20] For each patent family, the year of the earliest priority date was used as the reference year for temporal assignment.

Assets and employment outcome indicators	
Capital (EUR thousands)	Issued share capital (authorised capital)
Total assets (EUR thousands)	Total amount (after depreciation) of non-current assets plus total amount of current assets.
N of employees	
Cost of personnel	Detail of all the employees' costs of the company (including pension costs)
Financing mix	
Tangible assets over tot assets	All tangible assets/total assets
Intangible assets over tot assets	All intangible assets such as formation expenses, research expenses, goodwill, development expenses and all other expenses with a long-term effect over total assets/total assets
Liquidity ratio	A measure of how well the start-up meet its short-term financial liabilities

6. Results

Table 6 presents the aggregated ATT estimates for the outcomes considered. Overall, the analysis provides no evidence of statistically significant differences in the economic performance of firms financed through EIF-backed VC funds and comparable firms financed by non-EIF-backed VC funds, with the only exception of the liquidity ratio, where EIF-backed firms outperform their non-EIF-backed counterparts. This results suggests that EIF-backed VC investments are as effective as fully private VC investments in supporting firm growth and development.

We then adopt an event-study approach to investigate the dynamics of treatment effects over the pre- and post-investment periods. Figure 1 illustrates the estimated ATTs for each relative period before and after the investment, as obtained using the Callaway and Sant'Anna (2021) estimator. Across all outcomes, pre-treatment coefficients remain close to zero and do not display systematic trends, providing support for the identifying assumption of parallel trends and supporting the effectiveness of our matching strategy. Post-treatment effects are generally not statistically significant, with only sporadic statistically significant effects observed in a limited number of post-treatment periods. Table A.2 in the Appendix reports the dynamic ATT estimates for each relative year in the pre- and post-treatment periods, for each outcome variables.

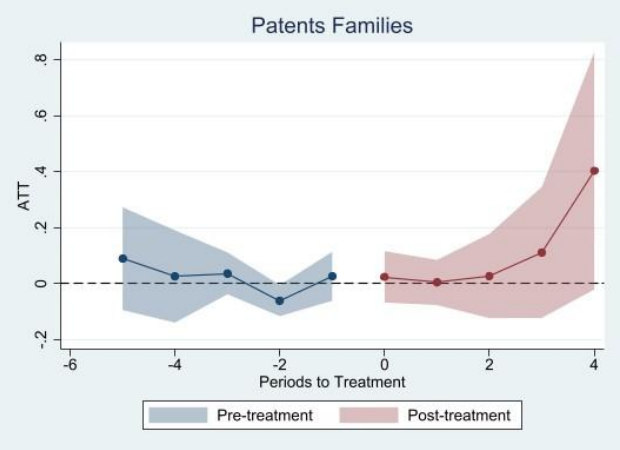
Table 6 – Aggregated ATT estimates

	Pat. Fam.	Turnover (k €)	Profits (k €)	EBIT marg.	ROE	Tot. Assets (k €)
ATT	0.131	2076.253	-145.203	0.009	-0.583	1934.177
	(0.137)	(0.385)	(0.903)	(0.273)	(0.876)	(0.199)
	Employees	**Capital (k €)**	**Cost of Empl.**	**Tang. Ass. / Tot. Ass.**	**Intang. Ass. / Tot. Ass.**	**Liq. Ratio**
ATT	0.362	239.530	0.041	-0.004	0.090	0.658**
	(0.923)	(0.661)	(0.492)	(0.325)	(0.385)	(0.020)

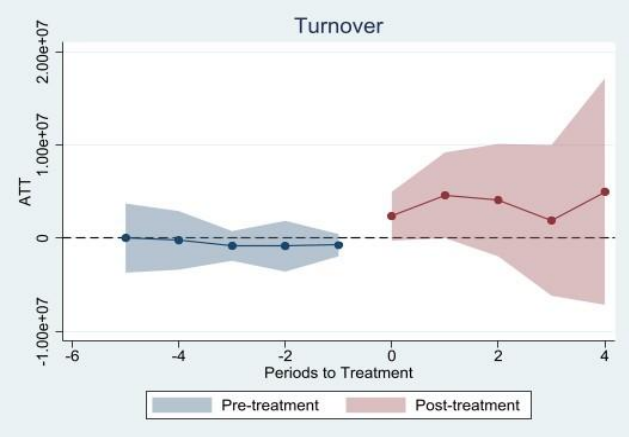
*Note: p-value in parenthesis: * p < 0.05, ** p < 0.01, *** p < 0.001. All regressions control for firm size and age, geographical, sector, and year fixed-effects.*

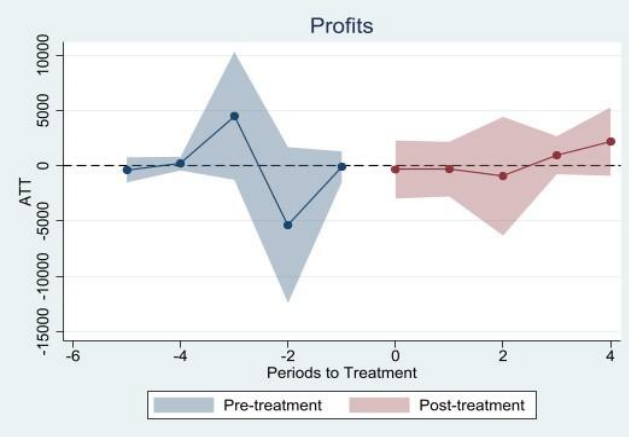
Figure 1 – Event-study plots based on Callay & Sant'Anna estimation results

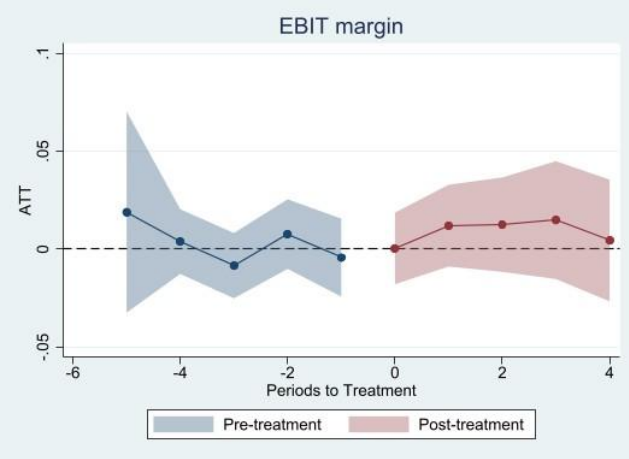
Panel A - Innovation activity

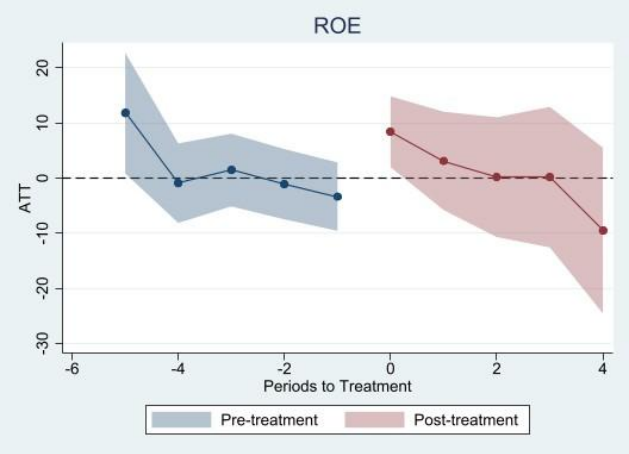


Panel B - Economic performance

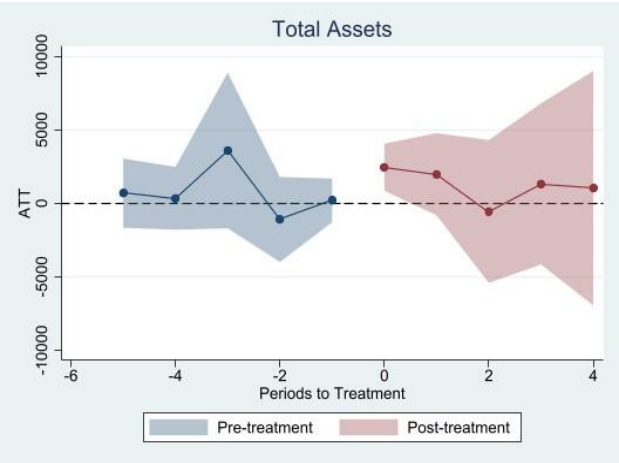


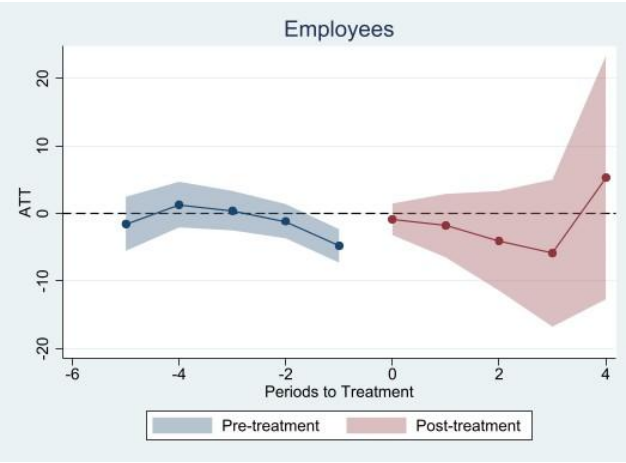


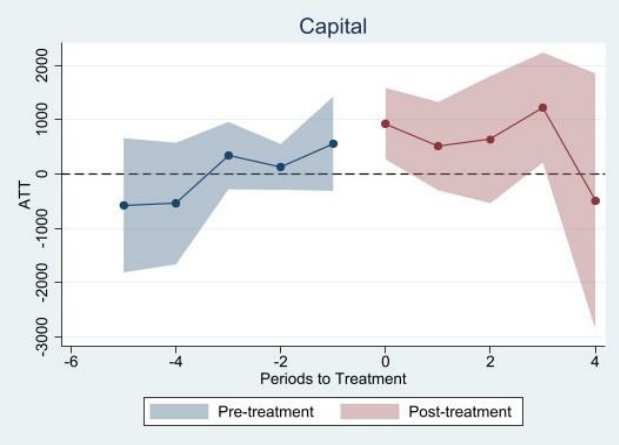


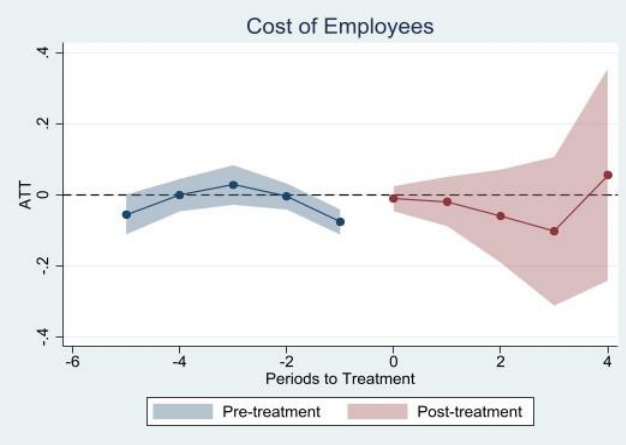


Panel C - Assets and Employees

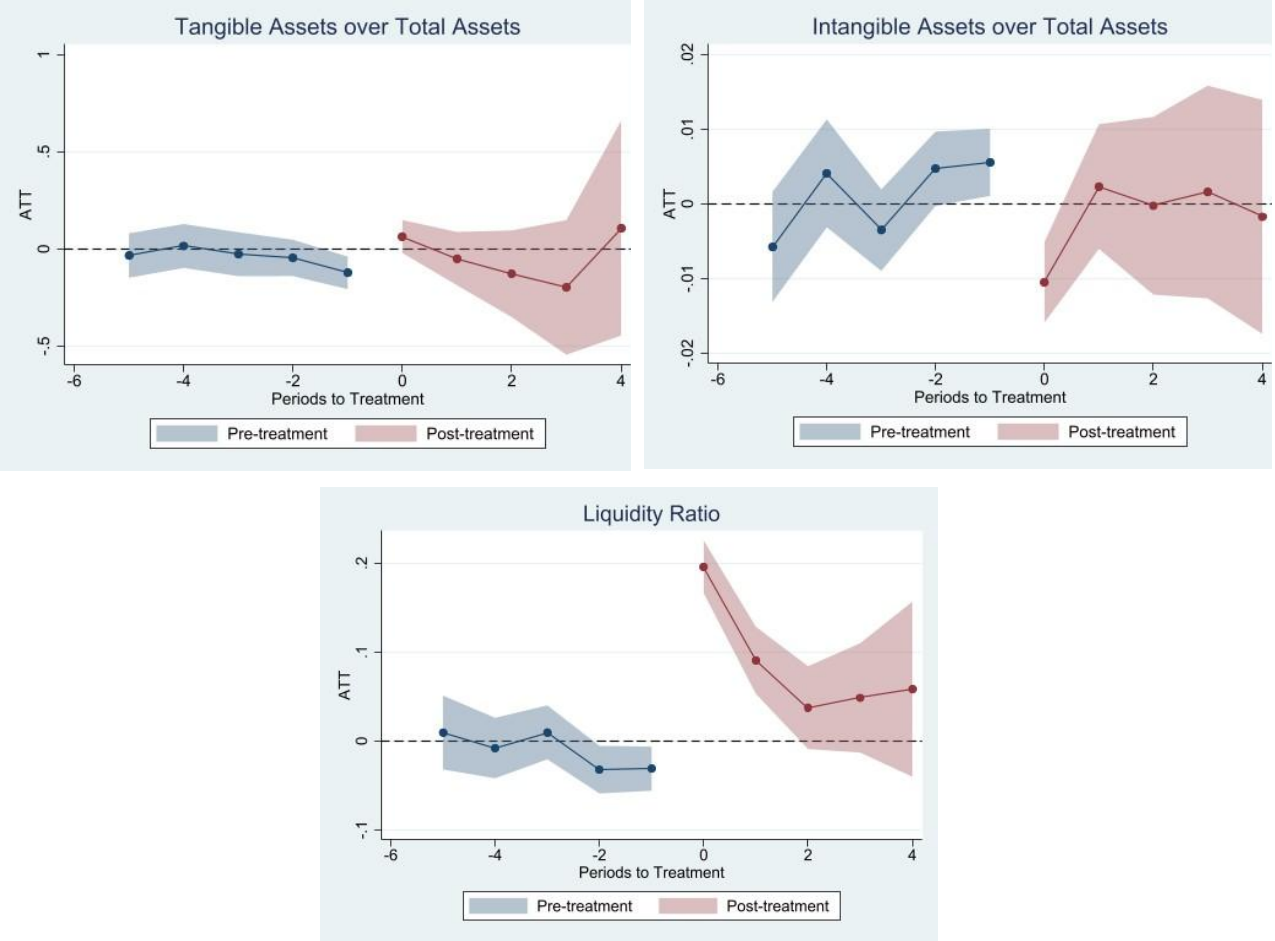








Panel D - Financing Mix



Source: own elaboration using Stata

Heterogeneity of impact. To further explore whether the relative effectiveness of EIF-backed VC varies across different contexts, we re-estimate the model separately by macro-region and sector of economic activity. Tables A.3-A.5 in the Appendix report the estimated ATT based on separate estimations for different subsamples. The subsamples are defined according to the geographical area in which firms are located, using the EIF macro-regional classification, and according to the sector in which they operate, based on the EIF sectoral classification used for its investment activities.

Overall, the heterogeneity analysis provides little evidence of systematic differences in treatment effects. Although a limited number of statistically significant coefficients emerge across specific subsamples and outcome variables, these effects are isolated and do not reveal any consistent geographical or sectoral pattern. Rather than pointing to context-specific advantages or disadvantages of EIF-backed VC, the results broadly confirm the baseline findings, suggesting that its relative performance compared with fully private VC remains remarkably stable across different regional and industrial environments. Interestingly, the few significant differences that emerge are concentrated in

measures related to firms' financial structure, particularly liquidity, which is consistent with the baseline estimates. By contrast, no systematic heterogeneity is observed for firms' innovation activity or economic performance.

7. Conclusions

This paper examines whether publicly backed VC delivered through private financial intermediaries generates firm-level outcomes comparable to those achieved by fully private VC investors. More specifically, we test the hypothesis that the EIF's intermediated investment model is able to preserve the value-added services typically associated with private VC while addressing the market failures that justify public intervention. By exploiting a novel database of EIF indirect VC operations in the EU27 and the UK between 2010 and 2018, our results indicate that firms financed through EIF-backed VC funds perform on par with comparable firms financed by fully private VC investors. In particular, firms receiving VC funding through EIF-backed funds exhibit comparable employment growth and innovation performance, and these findings remain robust across different firm subgroups. Overall, we find no evidence that the public component of the investment leads to systematically different firm-level outcomes relative to fully private VC financing.

Beyond the specific case of the EIF, our findings make two broader contributions. First, they contribute to the literature on public VC by showing that the effectiveness of public intervention depends not only on the provision of financial resources, but also on the institutional design through which those resources are delivered (Bertoni and Tykvová, 2015; Grilli and Murtinu, 2014, 2015; Sun et al., 2020). Second, our identification strategy advances the empirical literature by comparing publicly backed VC recipients with firms that also received VC, rather than with firms that never accessed equity finance. This allows us to isolate the incremental effect of the public component of the investment while substantially reducing selection concerns related to firms' ability to attract VC.

The findings also have important policy implications. Rather than replacing private investors, the EIF's intermediated model appears capable of combining public policy objectives with the expertise, incentives and governance mechanisms of private VC funds. This evidence supports the rationale for public interventions that leverage private financial intermediaries to address financing gaps while preserving investment efficiency. The approach may be particularly relevant for public-backed investments in strategic technologies or industries characterised by high uncertainty, long investment horizons and significant externalities, such as artificial intelligence, biotechnology, cybersecurity, quantum technologies, defence and other strategic industries targeted by recent European industrial policies (Anghel et al., 2020; Reuters, 2022; European Commission, 2024).

Nevertheless, our analysis is subject to some limitations. First, the matched sample is smaller than the initial population because of both the stringent matching requirements and missing information in the firm-level data extracted from Orbis. Although this is a well-known limitation of the database, Orbis remains the most comprehensive source available for cross-country firm-level analyses. Second, the control group was identified using Orbis M&A, a database originally developed for mergers and acquisitions rather than VC transactions. Although comparisons with alternative sources suggest that coverage has substantially improved in recent years, some VC deals may not have been captured in the earlier part of the sample period. Finally, information on firms' development stage at the time of investment was unavailable for control firms, requiring us to proxy this dimension using firm age.

Future research could extend the present framework by jointly comparing firms financed through publicly backed VC, firms financed by fully private VC, and firms that never received VC. Such a design would allow researchers to disentangle the overall effect of VC financing from the incremental contribution of the public component of the investment, thereby providing a more comprehensive assessment of the role of public interventions in VC markets.

References

Abadie, A. and G. Imbens (2011). Large Sample Properties of Matching Estimators for Average Treatment Effects. *Econometrica* 74.1, pp. 235-267

Alperovych, Y., A. P. Groh, and A. Quas (2020). Bridging the Equity Gap for Young Innovative Companies: The Design of Effective Government Venture Capital Fund Programs. *Research Policy* 49 (10): 18pp.

Álvarez, L., García-Posada, M., & Mayordomo, S. (2023). Distressed firms, zombie firms and zombie lending: A taxonomy. Journal of Banking & Finance, 149, 106762.

Amamou, R., Gereben, A., and Wolski, M. (2023). Assessing the impact of the EIB's intermediated lending to SMEs during funding shocks. *Small Business Economics,* 60: 975–1007.

Angrist, J. D., & Pischke, J. S. (2009). Mostly harmless econometrics: An empiricist's companion. Princeton university press.

Bertoni, F., & Tykvová, T. (2015). Does governmental venture capital spur invention and innovation? Evidence from young European biotech companies. *Research Policy*, 44(4), 925-935.

Bertoni, F., Colombo, M.G., & Grilli, L. (2011). Venture capital financing and the growth of high-tech start-ups: Disentangling treatment from selection effects. *Research Policy*, 40(7), 1028–1043.

Bollaert, H. and Delanghe, M. (2015). Securities Data Company and Zephyr, data sources for M&A research. Journal of Corporate Finance, vol. 33, pp. 85 – 100.

Bottazzi, L., & Da Rin, M. (2004). *Financing entrepreneurial firms in Europe: Facts, issues, and research agenda*. Venture Capital, Entrepreneurship, and Public Policy. MIT Press, Cambridge, MA, 3-32.

Brander, J. A., Du, Q., & Hellmann, T. (2015). The effects of government-sponsored venture capital: international evidence. *Review of Finance*, 19(2), 571-618.

Brander, J. A., Egan, E. J., & Hellmann, T. F. (2010). Government Sponsored versus Private Venture Capital. In: Lerner, J., Schoar, A. (Eds.), International Differences in Entrepreneurship. University of Chicago Press, Chicago, (USA), pp. 275-320

Brown, J. D. and Earle, J. S. (2017). Finance and growth at the firm level: Evidence from SBA loans. *The Journal of Finance*, 72(3):1039{1080.

Caliendo, M., & Kopeinig, S. (2008). Some Practical Guidance for the Implementation of Propensity Score Matching. *Journal of Economic Surveys*, 22(1), 31–72.

Callaway B, Sant'Anna P.H.C. (2019). Difference-in-Differences with Multiple Time Periods.

Clò S., Frigerio M. & Vandone D. (2022). Financial support to innovation: The role of European development financial institutions. *Research Policy*, 51(10)

Colombo, M. G., & Murtinu, S. (2017). Venture capital investments in Europe and portfolio firms' economic performance: Independent versus corporate investors. *Journal of Economics & Management Strategy*, 26(1), 35-66.

Colombo, M. G., Cumming, D. J., & Vismara, S. (2016). Governmental venture capital for innovative young firms. *The Journal of Technology Transfer*, 41(1), 10-24.

Croce, A., Martí, J., & Murtinu, S. (2013). The impact of venture capital on the productivity growth of European entrepreneurial firms: 'Screening'or 'value added'effect? *Journal of Business Venturing*, 28(4), 489-510.

Cumming, D. J., & MacIntosh, J. G. (2006). Crowding out private equity: Canadian evidence. *Journal of Business venturing*, 21(5), 569-609.

Cumming, D., & Johan, S. (2009). Pre-seed government venture capital funds. *Journal of International Entrepreneurship*, 7(1), 26-56.

Cumming, D., Grilli, L., & Murtinu, S. (2017). Governmental and independent Venture Capital investments in Europe a firm-level performance analysis. *Journal Corporate Finance, 42,* 439-459.

EIB (2023). Evaluation of EIB Group equity and quasi-equity support for small business and mid-caps.

Engel, D., Stiebale, J. (2014). Private equity, investment and financial constraints: firm-level evidence for France and the United Kingdom *Small Business Economics*, 43, 197–212.

European Commission (2024). Access To Equity Financing for European Defence SMEs. Final Report. European Commission, Luxembourg: Publications Office of the European Union, 2024. doi:10.2889/698738

Gereben, A., Rop, A., Petricek, M., and Winkler, A. (2019). Do IFIs make a difference? The impact of EIB lending support for SMEs in Central and Eastern Europe during the global financial crisis. EIB Working Paper 2019/09, European Investment Bank

Gompers, P. A., Gornall, W., Kaplan, S. N., & Strebulaev, I. A. (2020). How do venture capitalists make decisions? *Journal of Financial Economics*, 135(1), 169-190.

Gompers P. and Lerner J. (2001). The venture capital revolution. *Journal of Economic Perspectives*, 15(2): 145-168.

Gornall, W., & Strebulaev, I. A. (2021). The economic impact of venture capital: Evidence from public companies. Available at SSRN:

Grilli, L., & Murtinu, S. (2014). Government, venture capital and the growth of European high-tech entrepreneurial firms. *Research Policy*, 43(9), 1523-1543.

Grilli, L., & Murtinu, S. (2015). New technology-based firms in Europe: market penetration, public venture capital, and timing of investment. *Industrial and corporate change*, 24(5), 1109-1148.

Guo, D., & Jiang, K. (2013). Venture capital investment and the performance of entrepreneurial firms: Evidence from China. *Journal of Corporate Finance*, 22, 375-395.

Han, G., & Mei, F. (2018). Empirical Analysis of Influence of Venture Capital on the Growth of Small and Medium-sized Enterprises. *Journal of Advanced Management Science* Vol, 6(1).

Hellman, T., & Puri, M. (2000). Venture Capital and the Professionalization of Start-up Firms: Empirical evidence. Working Paper Stanford University.

Hellmann, T., & Puri, M. (2002). Venture capital and the professionalisation of start-up firms: Empirical evidence. *The journal of finance*, 57(1), 169-197.

Hellmann, T., Lindsey, L., & Puri, M. (2008). Building relationships early: Banks in venture capital. *The Review of Financial Studies*, 21(2), 513-541.

Hallak, I. and Harasztosi, P. (2019). Job Creation in Europe: A firm-level analysis, EUR 29689 EN, Publications Office of the European Union, Luxembourg (ISBN 978-92-76-00775-3).

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

Hsu, D. H. (2006). Venture capitalists and cooperative start-up commercialisation strategy. *Management Science*, 52(2), 204-219.

Imai K., Kim I. S. and E. Wang (2019). Matching Methods for Causal Inference with Time-Series Cross-Sectional Data. Working paper. Harvard University

Invest Europe (2021). "Investing in Europe: Private Equity Activities 2021. Statistics on Fundraising, Investments, & Divestments". Invest Europe

Invest Europe (2023) "Highlights" Report. https://www.investeurope.eu/about-us/who-we-are/invest-europe-2023-highlights/

Jann, B. (2017). KMATCH: Stata module for multivariate-distance and propensity-score matching, including entropy balancing, inverse probability weighting, (coarsened) exact matching, and regression adjustment. Statistical Software Components S458346, Boston College Department of Economics. Revised 2020.

Kaplan, S. N., & Strömberg, P. (2003). Financial contracting theory meets the real world: An empirical analysis of venture capital contracts. *The review of economic studies*, 70(2), 281-315.

Kato, A. (2021). A Literature Review of Venture Capital Financing and Growth of SMEs in Emerging Economies and an Agenda for Future Research. *Academy of Entrepreneurship Journal*, 27(1), 1-17.

Kindleberger, C. P. (2015). A financial history of Western Europe. Routledge.

Klenow, P.J. and Li, H. (2020). Innovative Growth Accounting. NBER Chapters, in: *NBER Macroeconomics Annual 2020*, 35, 245-295, National Bureau of Economic Research, Inc.

Köppl S., Köppl-Turyna M., Christopoulos D. (2026). The performance of government-backed venture capital investments, *Research Policy*, 54 (8): 105270,

Kraemer-Eis, H., Signore, S. and Prencipe, D. (2016). The European venture capital landscape: an EIF perspective. Volume I: the impact of EIF on the VC ecosystem. EIF Working Paper 2016/34, EIF Research & Market Analysis.

Lahr, H., & Mina, A. (2016). Venture capital investments and the technological performance of portfolio firms. *Research Policy*, 45(1), 303-318.

Lerner, J. (1995). Venture capitalists and the oversight of private firms. *The Journal of Finance*, 50(1), 301-318.

Lerner, J. (1999). The Government as Venture Capitalist: The Long-Run Impact of the SBIR Program. *The Journal of Business*, 72(3): 285–318.

Luukkonen, T. & Maunula, M. (2007). Non-financial value-added of venture capital: A comparative study of different venture capital investors, ETLA Discussion Papers, No. 1067, The Research Institute of the Finnish Economy (ETLA), Helsinki

Luukkonen, T. Deschryvere M, Bertoni F. (2013). The value added by government venture capital funds compared with independent venture capital funds. *Technovation*, 33 (4-5): 154-162.

Paglia, J. K., & Harjoto, M. A. (2014). The effects of private equity and venture capital on sales and employment growth in small and medium-sized businesses. *Journal of banking & finance*, 47, 177-197.

Pavlova, E., & Signore, S. (2019). The European venture capital landscape: An EIF perspective. Volume V: The economic impact of VC investments supported by the EIF. EIF Working Paper 2019/55, EIF Research & Market Analysis. Luxembourg, April 2019.

Pavlova, E., & Signore, S. (2021). The European venture capital landscape: An EIF perspective. Volume VI: The impact of VC on the exit and innovation outcomes of EIF-backed start-ups. EIF Working Paper 2021/70, EIF Research & Market Analysis. Luxembourg, February 2021.

Rosenbaum, P. R. and Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1), pp. 41-55.

Rubin D.B. (1980). Bias reduction using Mahalanobis metric matching. *Biometrics*. 36:293–29

Sahlman, W. A. (1990). The structure and governance of venture-capital organisations. *Journal of financial economics*, 27(2), 473-521.

Sørensen, M. (2007). How smart is smart money? A two-sided matching model of venture capital. *The Journal of Finance*, 62(6), 2725-2762.

Spanish Presidency of the European Council (2023). Spain's National Office of Foresight and Strategy. Resilient EU2030. 2023. NIPO: 089-23-024-6 More information www.futuros.gob.es/en.

Standaert, T., & Manigart, S. (2018). Government as fund-of-fund and VC fund sponsors: effect on employment in portfolio companies. *Small Business Economics*, 50(2), 357-373.

Sun, W., Zhao, Y., & Sun, L. (2020). Big data analytics for venture capital application: towards innovation performance improvement. *International Journal of Information Management*, 50, 557-565.

Tykvova, T. (2006). How do investment patterns of independent and captive private equity funds differ? Evidence from Germany. *Financial Markets and Portfolio Management*, 20(4), 399-418.

Venditti, F., Caivano, M., Cova, P., Pallara, K., & Pisani, M. (2025). The economic impact of European capital market integration (No. 957). Bank of Italy, Economic Research and International Relations Area

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Appendix.docx