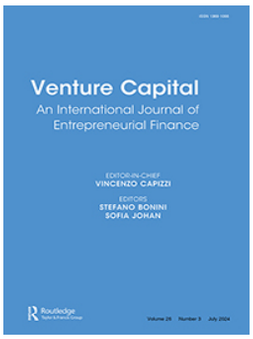

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Governmental venture capital policies are not all alike: design features in 11 European Countries

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ABSTRACT

This descriptive study aims at examining to which extent, and by which means governments intervene in the private venture capital market. To do so, we present original primary data, hand-collected from the annual reports of 128 national and sub-national government agencies located in 11 European countries, and their 392 Government Venture Capital (GVC) programmes run over the 2007–2021 period. Our data confirms the importance of governments in the supply of VC, accounting for 30.9% of the total euro-amount of VC investments. It also documents a great deal of variation in the design features of GVC agencies (their ownership, experience, geographical focus, stated objectives and policy mix used) and their means of intervention (general investment approach, involvement of the private investors, budget organization and size, investment selection criteria), which was neglected by previous studies. We argue that the marked differences across GVC policies may explain why the existent evidence on whether GVC policies are effective is not clear-cut. We draw on existing literature discussing government intervention in entrepreneurial finance to reason on how each design feature might influence GVC effectiveness, and put forward several propositions calling for future empirical research to test them.

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Goverment intervention; public policy; design feature; goverment venture capital

1. Introduction

High-growth innovative companies are critical to economic development, making disproportionate contributions to employment, innovation, exporting and productivity (Acs et al. 2011). The role of venture capital (VC) in supporting these companies is widely recognised in the economic and management literature. Venture capitalists can identify promising innovative companies and contribute to their development by providing not only finance, but also management expertise and business connections. VC speeds the development of young innovative companies, enabling them to transform ideas quickly into marketable products (e.g., Kortum and Lerner, 2000). As a consequence, VC-backed companies grow significantly faster than their peers (Hellman and Puri, 2000; amongst others). In an effort to address possible market

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failures in the provision of risk capital, mostly due to information asymmetries and positive externalities that the private investors cannot appropriate (Lerner 2002), policy-makers around the globe have intervened in the private VC market providing their own financial resources, thus increasing the supply of VC, especially in neglected geographical areas and sectors (Colombo, Cumming, and Vismara 2016). Typically, governments intervene by setting up funds managed by government-affiliated agencies. Such Governmental Venture Capital (GVC) agencies can either directly inject capital into the ventures (direct GVC approach), or they can invest indirectly, acting as limited partners of privately managed VC funds (indirect GVC approach). Together, direct and indirect initiatives are generally referred to as GVC initiatives.

Based on original hand-collected primary data on GVC agencies and their direct and indirect GVC initiatives in 11 European countries, this descriptive paper aims: 1) to assess the relevance of their investments in the national VC markets; 2) to display the high heterogeneity across initiatives in terms of various design features and 3) drawing on theoretical and empirical literature on government intervention in entrepreneurial finance, to discuss the implications of each design feature for their effectiveness, thus putting forward propositions and calling for future research to empirically test them.

By doing so, we aim to contribute to the ongoing debate on the effectiveness of GVC investments, which continues to be controversial. Early studies argued that GVC initiatives might potentially crowd out, rather than complement private VC investments (Armour and Cumming 2006; Leleux and Surlemont 2003), although recent empirical evidence points towards an additive effect of GVC on national and sub-national VC ecosystems (Bertoni, Colombo, and Quas 2019; Kovner and Lerner 2015). Moreover, empirical research has found little impact associated with GVC initiatives on the performance of target companies (Breschi, Johnstone, and Menon 2021). Abundant evidence shows that direct GVC initiatives, if unable to attract private VC as syndication partners, exert a negligible effect in terms of portfolio companies' growth (Engberg, Tingvall, and Halvarsson 2021; Grilli and Murtinu 2014, 2015), innovation (Bertoni and Tykvová 2015), efficiency (Alperovych, Hübner, and Lobet 2015) and the likelihood of a successful exit (Brander, Du, and Hellmann 2015; Cumming, Grilli, and Murtinu 2017; Zhang and Mayes 2018). Part of the underperformance of some GVC initiatives can be attributed to the socio-economic objectives of government agencies, which may differ from the pure economic/financial ones of private VC firms, and in turn may result in different investment patterns (Bertoni, Colombo, and Quas 2015; Zhang 2018). Other scholars have, instead, attributed the underperformance of GVC schemes to the "political nature" of government agencies. Being mostly, if not entirely, funded with public money, such schemes might be exposed to political pressures, rent-seeking behaviour, and general bureaucratic inefficiency (Brander, Du, and Hellmann 2015) since politicians and/or their representatives sit and sometimes even hold the majority in their investment committees (Jääskeläinen, Maula, and Murray 2007).

However, the success or failure of a given policy depends on how it is implemented (Arshed, Carter, and Mason 2014),[1] and GVC initiatives have highly heterogeneous design features. Such heterogeneity is likely to affect the extent to which these initiatives are exposed to political interferences and bureaucratic inefficiencies, and ultimately their effectiveness in pursuing their public purpose of spurring innovation and economic growth (Lerner 2002). Empirical studies that neglect such heterogeneity might give

a potentially misleading indication of the effectiveness of GVC policies and, in turn, may misinform policymakers.

So far, very few studies have addressed the issue of GVC heterogeneous design. A useful review is provided by Callagher, Smith, and Ruscoe (2015). Some studies have analysed single initiatives around the world, highlighting the traits of the most successful schemes and providing guidelines on how government intervention in entrepreneurial finance should be designed. The analyzed initiatives include the US Advanced Technology Program, the US Small Business Innovation Research programme (Lerner 2002), the US Small Business Innovation Company, the Israeli Yozma funds (Lerner 2010), the Australian Pre-Seed GVCs (Cumming and Johan 2009), the Canadian Innovation Investment Funds (Cumming 2007), and the UK government hybrid venture capital fund programs[2] (Baldock and North 2015; Murray 2021). Owen, North, and Mac an Bhaird (2019) provide interesting insights from an analysis of GVC in the United Kingdom (the Enterprise Capital Fund, the UK Innovation Investment Fund and the Angel co-investment Fund). Other scholars have taken a more comparative perspective and have analysed how objectives or design features influence the effectiveness of such programmes. Brander, Du, and Hellmann (2015) and Alperovych, Quas, and Standaert (2018) compare direct and indirect GVCs. Some empirical studies tackle direct GVC heterogeneity with a focus on a single dimension, such as GVC missions (Bertoni and Tykvová 2015), regional focus (Munari and Toschi 2015)[3] and syndication practices (e.g., Grilli and Murtinu 2014; Cumming et al. 2017). Alperovych, Groh, and Quas (2020) simultaneously consider syndication, location and co-location choices and industry specialization of European GVC.

In this paper we contribute to this literature by providing that GVC heterogeneity goes well beyond these characteristics. Specifically, we focus on the highly heterogeneous European context, where institutional differences, such as entrepreneurship culture, the functioning of the financial system and labour market regulations, resulted in different policy choices in terms of design of GVC initiatives across countries and regions. Europe represents, therefore, an ideal setting to analyse different GVC design features, which is a first essential step to provide policy insights on how to correctly implement future policies.

We focus on GVC agencies and initiatives implemented in Austria, Belgium, Denmark, Finland, France, Germany, Italy, Ireland, the Netherlands, Spain and Sweden. Our descriptive evidence showcases the importance of opening up the wealth of data locked in the vaults of European GVC agencies and encourages future research 1) to extend the analysis to the remaining EU countries and 2) to empirically test our conjectures on how GVC design features influence the initiatives effectiveness.

Our analysis is based on detailed information on 392 GVC initiatives, implemented by 128 governmental agencies in the eleven countries. The data collection followed two steps. First, we identified governmental agencies managing GVCs starting from the list of regional and national promotional institutions in the selected countries, including those supported by the European Regional Development Funds, and cross-checked using secondary datasets such as Thomson One (now EIKON) and Dealroom. Second, for each of the 128 identified GVC agencies, we identified 392 GVC-like initiatives that they implemented in the 2007–2021 time period, and systematically collected information on their design features from the historical annual reports and websites. Where necessary, national experts were contacted to validate the information collected. Third, we built

a database in which each initiative is observed between the latest of 2007 or its launch year, and the earliest of 2021 or its close year, and systematically collected the yearly amounts of the investments made, when available.

A first fundamental contribution of this paper is that it precisely quantifies the relative importance of the investments made by GVC agencies in the VC industry. Based on our estimates, we find that GVC amount invested accounted for 30.8% of total VC investments (as reported by Invest Europe) in the 2007–2021 period, with high variations across countries, and increasing incidence especially in the 2010–2014 period. Distinguishing between direct and indirect GVC investments, we estimate that on average the share of direct GVC investment on the total VC investment is 14.2%, whereas the share of indirect GVC is 12.7% (the remaining initiatives have a mixed direct/indirect investment approach). Such data is consistent with previous evidence on the importance of the government support to the VC industry (Alperovych, Quas, and Standaert 2018), but it has the advantage of being based on more reliable (primary rather than secondary sources) and precise (amounts invested rather than number of supported investments) information.

The second contribution is that we provide a more nuanced view on how the resources were allocated, based on the design features of the GVC agencies and initiatives. GVC agencies are set up at regional, and national level, and differ in terms of corporate governance (e.g., public ownership), experience (i.e., years since foundation), stated public purpose (e.g., support entrepreneurship, growth or venture capital industry) and policy mix used to achieve such purpose. GVC initiatives differ in terms of general investment approach (i.e., direct vs indirect), involvement of the private sector (e.g., syndication choices or delegated management), size and organization of the budget and investment selection criteria (in terms of geography, stage and industry).

Third, for each of these design features, besides providing relative importance in terms of number of agencies, initiatives and amount invested for each category, we build on existing theoretical and empirical academic literature to discuss how they can influence GVC effectiveness. We also develop some formal propositions on the most effective configurations of GVCs whose empirically testing goes beyond the scope of this paper, and calls for future academic research for which the varied European context represents an ideal testbed.

These contributions are not only relevant in the field of government intervention in entrepreneurial finance, and in particular in the rising discussion on GVC design choices, but also to the broader debate on the implementation choices of public policies managed by national and subnational national promotional institutions (De Aghion 1999).

The paper is organized as follows. Section 2 describes our extensive GVC agency-level and initiative-level data collection process. Section 3 shows aggregate data on GVC investments and documents to what extent the European venture capital industry is underpinned by the government. Sections 4 and 5 describes the heterogeneous characteristics of GVC agencies, and GVC initiatives, respectively. The last section concludes by discussing the provided evidence and looking at future research challenges.

2. Data collection

This study is focused on 11 European countries: Austria, Belgium, Denmark, France, Finland, Germany, Ireland, Italy, the Netherlands, Spain, Sweden. These countries

represent the largest national VC markets within the European Union according to Invest Europe, together accounting for more than 90% of the market (2022 data).[4] We illustrate the characteristics of both GVC agencies and GVC initiatives in these countries for the period 2007–2021. Our data collection is unusually ambitious and hopefully influential, and therefore worth describing in detail.

2.1. Identification and selection on GVC agencies

As there is no official database on GVC initiatives in Europe, our first task was to populate a list of GVC agencies in our selected European countries. We define a GVC agency as a government-owned legal entity having a public mandate from either a local, a regional, or a national authority to provide equity capital to innovative ventures (i.e., a GVC initiative), moved by a "public purpose", i.e., the aim to benefit the society (Ehnts 2020). GVC agencies in our sample must have executed at least one GVC initiative in the period 2007–2021.

To identify the GVC agencies we run a systematic desk research screening. We started from the European Commission Joint Research Center "Research and Innovation" (R&I) policy repository, which includes a list of documents describing innovation policies in each Member state.[5] Second, we analysed the public lists of EU-level, national and sub-national promotional banks and institutions that received EU support,[6] focussing especially on the national and regional (sub-national) agencies supported by the European Regional Development Fund (ERDF). Next, we considered the list of governmental VC published by the OECD (the same used in Breschi, Johnstone, and Menon 2021). Lastly, we also consulted VC lists from commercial VC data providers, including EIKON Refinitive and Dealroom, bearing in mind that in these databases classification of investors in private and public VC is often incorrect (Bertoni, Colombo, and Quas 2015). Most of this work was done in subsequent stages to improve our data collection. Intense desk research was also used to collect information from official sources (annual reports, national documentation, press releases, ad-hoc studies published on the websites of GVC agencies) to identify and characterize typologies of GVC initiatives at national and subnational levels.

For each identified agency, we reviewed their annual reports in the period 2007–2021 and revised the latest version of their website,[7] to collect agency-level information, which we used to restrict our list to fit our definition of GVC agencies. First, we collected the information on the stakeholder composition of each agency, and we kept in our database only those where the public hand holds a majority share (>50%). Second, industry associations, workers unions, and other organizations were excluded, even if they had a non-for-profit or social mandate, because of their non-governmental nature. Third, we exclude public pension funds which invest solely with financial purposes and not moved by a public purpose. Fourth, we collected from the annual reports information on the equity instruments used by the agency, and excluded those public agencies that do not provide equity instruments to innovative ventures, neither directly nor indirectly. This applies to public bodies, public accelerators and incubators or other organizations that offer non-equity support in the form of grants, loans, R&D tax credit, credit guarantee, co-working spaces, prototyping, mentoring, and tax credits, etc. Similarly, we also excluded government agencies and internationalization programmes supporting companies to develop foreign countries, notably developing countries.[8] Albeit in exceptional cases,

they may have employed equity instruments to support national start-ups to expand internationally, these agencies do not run VC instruments on a regular basis nor have a dedicated budget.

Following this selection process, we identified 128 government agencies active in our 11 European countries, all of which fulfil the criteria mentioned above. For each of the 128 government agencies, we systematically collected the following information: 1) the public ownership and launch year of the agency; 2) the breath of the geographical mandate of the agency (regional, national, supranational); 3) the stated objective of the agency; 4) the "policy mix" used to finance companies (grants, loans, subsidies, etc.), besides the GVC initiatives; and 5) the list of all GVC initiatives carried out in the 2007–2021 period, ad further described below.

2.2. Data collection on GVC initiatives

For each GVC agency in our list, we revised the websites and the annual reports and identified all GVC initiatives that they supported in the 2007–2021 period. We found that in our sample GVC agencies have implemented or are still executing 392 GVC initiatives over the period 2007–2021.

The identified GVC initiatives include those managed and partly financed jointly by GVC agencies and EU-level institutions, such as the European Investment Fund (EIF) or the European Innovation Council (EIC). Examples include the German Future Fund/EIF growth facility (GFF/EIF growth facility) and the LfA-EIF facility in Germany, and the Dutch Future Fund (DFF) in the Netherlands.[9]

For each initiative, we also collected from the websites and the annual reports the available information on every potentially relevant design feature. Specifically, at GVC initiative level, the following information was collected: 1) investment approach (i.e., direct versus indirect form of government intervention); 2) involvement of private actors (i.e., delegated management or syndication policies); 3) the budget of the fund (or capital committed) in terms of organization and size; and 4) investment selection criteria (e.g., geographical focus, stage focus, industry focus). When possible (e.g., Austria, Belgium, France, Finland, Germany, and Italy), the information was also validated by national academic experts and managers of the GVC initiatives themselves.

Lastly, we built a database in which each GVC initiative is observed between 2007 (or the launch year, if more recent) and 2021 (or the close year, if less recent), obtaining 2,683 initiative-year observations. For each GVC initiative and each year we collected from the GVC agencies' annual reports the annual investment amounts, i.e., the actual disbursements to funds or companies (i.e., in venture capital terminology, the capital calls, not the committed capital). Unfortunately, the information on the amounts invested is not always explicitly reported for each initiative in the agencies' annual reports. Specifically, we were able to collect annual investments for 338 initiatives (86% of total) managed by 128 government agencies over a period of 15 years (2007–2021). For these initiatives we have information on yearly amounts invested for 72.0% of annual observations.

In our data collection, we used the information reported in the historical annual reports to track both changes in all of the characteristics of GVC agencies (e.g., changes in ownership structure), and changes in all of the characteristic GVC initiatives under scrutiny in the 2007–2021 period. The procedure allows assessing whether a given attribute of

GVC agencies or GVC initiatives evolves during the considered period. Moreover, thanks to this procedure, terminated agencies and initiatives can be included in the sample.[10]

3. The importance of governments in VC

As a first contribution of our study, we used our data on the annual amounts invested of GVC initiatives to estimate the extent to which the private VC market in the 11 European countries is underpinned by government. In total, our data indicates that 36.6 billion EUR were invested by GVC initiatives in the 2007–2021 period, with an annual average disbursement of 2.4 billion EUR. Because of missing information in the amount invested data for some initiatives in some years, this amount surely underestimates of total GVC investments. We used the information available to estimate the total amounts as follows: for each year, we compute the total estimated amount invested by GVC initiatives by multiplying the average amount invested by the initiatives for which we have the investment information by the total number of initiatives active in that year. By doing so, we obtain an estimate equal to 51.1 billion EUR of GVC investments in our 11 sample countries in the 2007–2021 period.

Figure 1 analyses the GVC investment value trends by year, showing both the collected data (filled bars) and the estimated data (dashed bar). The annual amount invested of GVC initiatives continued to grow in the 2007–2021 period, progressively increasing from around 1 billion EUR to over 7 billion EUR in 2021.

To assess the relative importance of GVC investments with respect to the national VC industries, we divide the amount of GVC investments by the total VC investment in our sample countries, retrieving the latter from Invest Europe database.[11] Invest Europe is the association representing Europe's Venture Capital and Private Equity Industry, sourced directly from affiliated VC investors, which provides to the best of our knowledge an unrivalled coverage of the European venture capital market. The total amount of venture

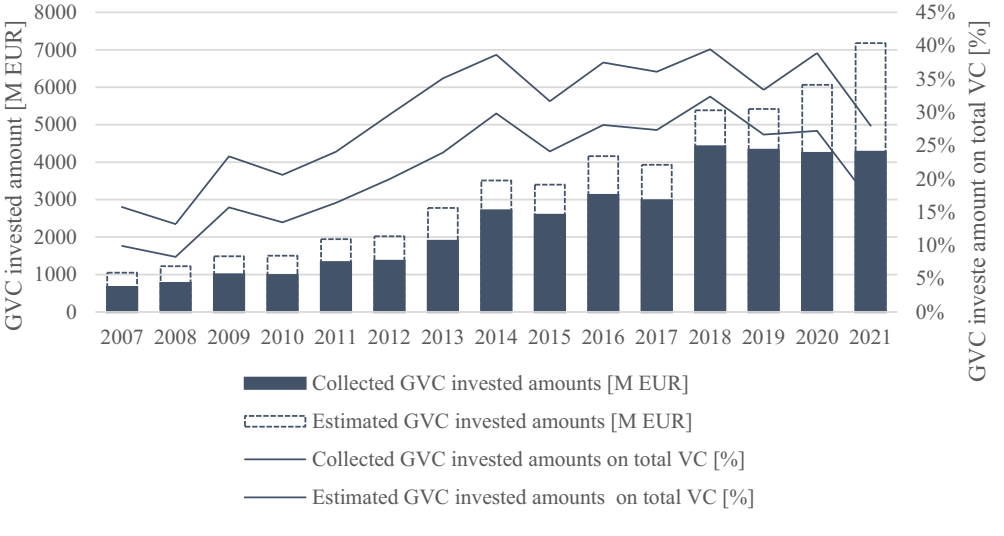

Figure 1. Trends in GVC invested amounts in absolute terms and as a percentage of total VC investment.

investments in our 11 sample countries in the 2007–2021 period is equal to 165.4 million EUR according to Invest Europe. In Figure 1, we show the share of GVC investments both looking at the data collected (solid line) and at the estimated amounts (dashed line).

Our data confirms the fundamental role played by GVC in the European VC industry. Out of the total VC investments in our 11 sample countries in the 2007–2021 period, the estimated amount of GVC investments accounts for 30.9% of total VC investment (the share is 22.2% if we only focus on the collected data). Figure 1 shows that the share of GVC on total VC investment increased progressively and considerably from 10% in 2007 to almost 40% in 2020, with a drop in 2021.

We then distinguish between the approach of the GVC initiatives. According to existing literature, we classify GVC initiatives in direct and indirect ones. We refer as *direct* GVC those measures where the agency is the general partner and supplies capital directly to investee firms. *Indirect* GVC encompasses all GVC measures where the agency does not invest directly into target firms itself. Examples of indirect GVC are funds-of-funds and co-investment funds in which governmental agencies are generally limited partners of private VC funds.

Our hand collected data indicate that 17 billion EUR was invested by direct GVC initiatives, while 14.6 billion EUR was invested by indirect GVC initiatives. Again, we estimate the direct and indirect GVC investments by multiplying the total number of initiatives active in a given year by the average annual amount invested by direct or indirect GVC initiatives for which we have investment data. According to the estimates, 23.4 billion EUR were invested by direct GVC initiatives in the 2007–2021 period, accounting for 14.2% of total VC investment (according to Invest Europe data), and 21.0 billion EUR was invested by indirect GVC initiatives, accounting for 12.7% of total VC (see Figure 2 and 3). It is worth noting here that few GVC initiatives allow for both direct and indirect investment: we estimate that these initiatives correspond to around 7.3 billion EUR in the 2007–2021 period (the collected amount is 4.7 billion EUR).

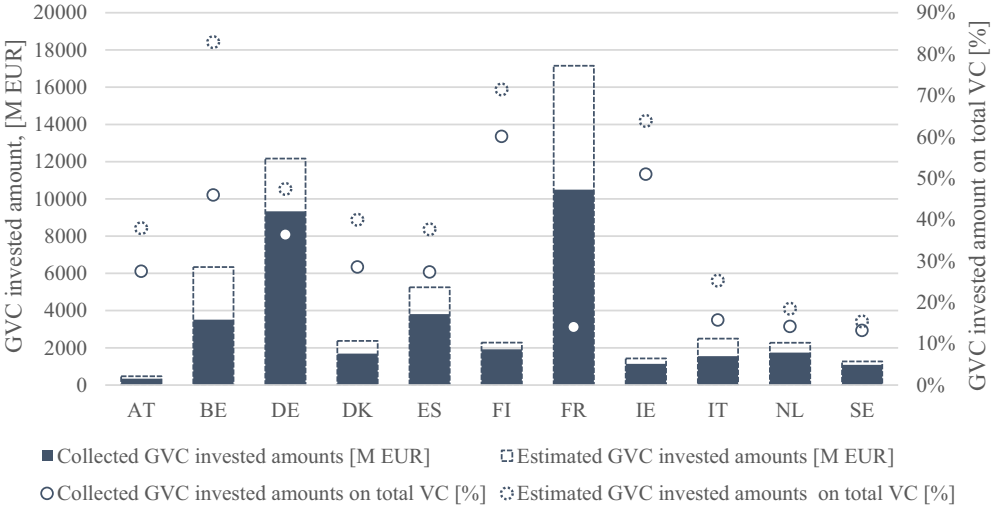

Figure 2. GVC invested amounts in absolute terms and as a percentage of total VC investment by country.

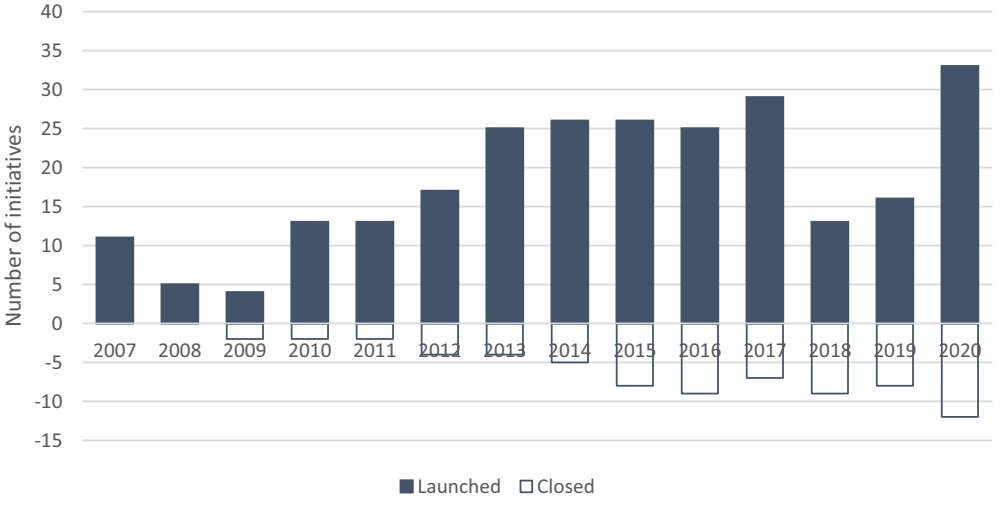

Figure 3. Number of government VC initiatives by launch year and close year.

The percentages capturing GVC relevance in the European VC industry are somehow lower with respect to the results indicated by Alperovych, Hübner, and Lobet (2015). Using macro-data over a period of 18 years (1997–2015), the authors find that European governments directly or indirectly supported 42% of the VC investments.[12] Specifically, direct GVC were responsible for 12.5% of the total number of VC investment in the average country-year, while 29.7% of private VC investments were carried out by VCs which were (at least partially) funded by government limited partners (what we call indirect GVC). However, our measure is different since it refers to the amount invested, rather than the number of VC investments carried out by direct GVC or supported by indirect GVC, and also it is built using primary information from the GVC agencies' annual reports, rather than secondary databases. As such, we believe that our measures could more meaningfully represent the importance of GVC in the European VC industry.[13]

We also analyse the absolute and relative importance of GVC invested amounts by country. Figure 2 shows the total amount of GVC investments (both collected and estimated data) per country, as well as the percentage of the total VC investments in each country (according to Invest Europe) over the 2007–2021 period. In absolute terms, GVC investors are more active in France (estimate of 17.1 billion EUR invested, of which 10.4 billion EUR are in our collected data) and Germany (12.2 billion EUR investment estimated, 9.3 billion EUR in the collected data). In relative terms, GVC investments represent larger percentage of the national VC industries in Finland (60.1%), Ireland (50.9%) and Belgium (45.9%). The estimated share of GVC on VC is 71.4% for Finland, 63.8% for Ireland, and 82.4% for Belgium.

4. GVC agencies characteristics

The second contribution of this work is to display the high heterogeneity across initiatives in terms of various design features. To this aim, in this section we provide more detailed information on the 128 GVC agencies in our sample, whose list is available in Table A1 in

Table 1. Distribution of GVC agencies, GVC initiatives and amount invested by country.

	Number of agencies		Number of initiatives		Average annual amount invested by initiative
GVC country	N	%	N	%	€, millions
Austria	7	5.5	20	5.1	5.2
Belgium	9	7.0	15	3.8	38.2
Denmark	2	1.6	9	2.3	42.4
Finland	4	3.1	17	4.3	22.8
France	9	7.0	39	9.9	72.4
Germany	33	25.8	106	27.0	18.4
Ireland	4	3.1	13	3.3	13.1
Italy	18	14.1	55	14.0	9.0
Netherlands	16	12.5	49	12.5	9.4
Spain	19	14.8	57	14.5	12.6
Sweden	7	5.5	12	3.1	14.9
Total	128	100.0	392	100.0	20.9

the Annex. Further, we draw on theoretical and empirical literature on government intervention in entrepreneurial finance to discuss the implications of each design feature for their effectiveness, and put forward propositions and calling for future research to empirically test them.

The country distribution of agencies, reported in Table 1, is the following: 33 agencies located in Germany, 19 in Spain, 18 in Italy, 16 in the Netherlands, 9 Belgium, and France, 7 in Austria, and Sweden, 4 in Finland and Ireland and 2 in Denmark. Table 1 also reports the number of initiatives and the average investment over the 2007–2021 period by those agencies.

Germany has the highest number of GVC agencies and GVC initiatives, mainly because of the country's more decentralized political structure. Spain and Italy have the same decentralised structure as Germany which may explain their higher number of GVC agencies and initiatives compared to other countries. Denmark has the lowest number of GVC agencies and initiatives. France has the highest annual amount invested by initiative (72.4 million EUR per year per initiative), followed by Denmark (42.4 million per year per initiative) and Belgium (38.2 million EUR per year per initiative).

4.1. GVC agencies' stated objectives

While the general rationale of GVC agencies' creation is to address market failure in the provision of finance, GVC agencies tend to have different objectives stated in their mandates. This is important because arguably GVC effectiveness should be defined and measured against those stated objectives.

Literature shows how the public purposes of state-owned enterprises and specifically development banks tend to be heterogeneous (De Luna-Martínez and Vicente 2012; Xu et al. 2021). The same applies to GVC agencies, which might use GVC initiatives to accomplish different purposes. Clearly, agencies with different public purposes might differ in their ability to achieve different outcomes. For instance, Bertoni and Tykvová (2015) distinguish between technology-oriented GVC initiatives, having an explicit objective of fostering innovation by supporting high-tech companies, and development-oriented ones, pursuing economic development as an investment objective. The authors find that the two types of initiatives have different impacts on the supported companies'

patenting activities when syndicating with private VCs, somehow coherently with their objectives: companies supported by development-oriented GVCs generate more patents, whereas those supported by technology-oriented GVCs generate more cited patents. Consequently, the authors conclude that the mandate to support invention and innovation is explicit for technology-oriented GVCs, while it is implicit for development-oriented GVCs, because invention and innovation contribute to economic development.

We collected information on each GVC agency mandate from their stated mission. In line with our expectations, we find that GVC agencies typically have multiple missions. Table 2 summarises the stated objectives of government agencies according to their mandate. In our sample, the vast majority of government agencies have as their main objectives to promote economic growth (89.8%) and innovation (85.1%). More than half aim to create jobs and support their investees in their internationalisation process (58.6% and 57.8%). A minority of agencies aim at stimulating social and environmental development (22.6% and 20.3% respectively), at fostering a VC industry (13.2%) and at reducing regional economic disparity (7.8%).

We also find evidence that GVC agencies mandate evolves over time. Indeed, in oldest agencies (such as the stock equity companies in Germany Mittelständische Beteiligungsgesellschaften, or MBGs) founded as regional development agencies by private actors and public banks to provide equity to SMEs in the 1970s and 1980s or 1990s the main mandate was to support the innovation activity of small and medium-sized companies. By contrast, the mandate of younger agencies includes sustainability issues to respond to the recent global social and environmental concerns.

The vast heterogeneity in the agencies mandate was largely neglected in the literature. We argue that GVC effectiveness should be evaluated against the stated policy objectives, in contrast with the general approach of analysing GVCs performance using homogeneous outcome variables, which are typically relevant for private VC investments (such as for instance the achievement of a successful exit). For instance, if GVC aim at spurring growth, than its effectiveness is best captured by the growth of the supported company or of the local economy. Instead, if the mission is to foster VC, more effective GVC agencies are the ones that crowd in private investors in their jurisdictions. We posit:

Proposition 0: The effectiveness of GVC initiatives is a multi-dimensional construct and should be assesses against their stated mission.

Moreover, the breadth of GVC public mission might influence the agencies effectiveness. Referring to development banks Erdem Türkelli (2020) explains that "the ever-expanding

Table 2. Distribution of GVC agencies and agencies' age by objectives in their mission.

	N	%	Mean age in 2023
Growth	115	89.8	25.1
Innovation	109	85.1	25.1
Employment	75	58.6	26.9
Internationalisation	74	57.8	24.4
Social objective	29	22.6	23.7
Environmental objective	26	20.3	23.0
Foster VC	17	13.2	24.9
Reduction of economic disparity across regions	10	7.8	23.3
Total	128	100.0	26.2

mission may result in the inappropriateness of the mission for the purposes of the organisation, the lack of resources to accomplish this expanding mission and issues linked to a lack of legitimacy to perform such mission" (Erdem Türkelli 2020, 256). As such, it would be interesting to study whether GVC agencies with multiple purposes less effective than GVC agencies with a narrower public purpose. We propose:

Proposition 1: The effectiveness of GVC initiatives depends on the breadth of GVC agencies' public mission.

4.2. Breath of geographic mandate of GVC agencies

A fundamental distinction among GVC agencies is related to the geographical focus of their activity. Governmental agencies active in the VC industries can either be funded by regional (sub-national), national or supranational (e.g., EU-level) governments. Such distinction is important because it determines the average geographical distance between the agency and the supported company. Research suggests that such distance matters for GVC investments. On the one hand, some studies suggest that geographic proximity between government agencies and investees can be harmful because it facilitates collusion between the parties. " . . . As geographical proximity makes it easier for companies to collaborate in research and innovation, so it makes it easier for companies or other agencies to collude in their supply of a critical input" (Akehurst 1987, 160). Given their political nature, regional development agencies may be more subject to such collusion and political interferences than national ones. The investment decisions of regional agencies are more likely to be distorted by political influences because they may favour entrepreneurs and ventures to which they have a relationship (Becker 1983; Peltzman 1976). Lerner (2002) highlights that one of the reasons why the Small Business Innovation Research programme (SBIR) programme is relatively effective is that the decision makers are highly dispersed. "In particular, the federal programme managers are scattered across many sub-agencies, and are responsible for many other tasks as well. Thus, the costs of identifying and influencing these decision makers is high. In programmes where a central group makes highly visible awards, the dangers of political distortions are likely to be higher" (cit., Lerner 2002, p. F79). Another argument against the regional approach is that GVC programmes focused and localized in underdeveloped regions can only pick from a very narrow pool of available investment opportunities (Mason and Harrison 2003). Moreover, their limited size limits their ability to attract skilled human capital, undermining GVCs' ability to both select the most promising companies and to effectively support them (Dimov and Shepherd 2005; Munari and Toschi 2015). At the same time, the geographic proximity between public agencies and supported companies implied by the regional GVC approach might be considered beneficial because it improves selection and monitoring efficiency in VC investments (Bernstein, Giroud, and Townsend 2016). Moreover, regional agencies are likely to know the local entrepreneurial ecosystem, and therefore might be able to provide complementary services to companies located in the region. The question on whether and to which extent the geographic focus of GVC agencies influences their effectiveness is fundamental. Moreover, regional government agencies can either be located in capitals and/or financial or innovation hubs, or in

peripheral regions neglected by private VC investors (Heger, Fier, and Murray 2006; Mason and Harrison 2003; Mason and Pierrakis 2013; Munari and Toschi 2015), which surely influences their effectiveness. Empirical evidence so far suggests that regionally focussed GVC initiatives on average underperform with respect to national GVC, especially when investing in less competitive regions (Alperovych, Groh, and Quas 2020; Munari and Toschi 2015).

Table 3 shows the distribution of sample GVC agencies, initiatives, average amounts invested, age and public ownership by their geographical mandate.

Our data includes 37 national agencies (28.9%) managing 133 initiatives (33.9%), and 91 regional agencies (71.1%) managing 259 initiatives (66.1%). National GVC agencies are larger, and invest more than regional GVC agencies on average (44.6 vs 9.7 million EUR per agency per year).

Agency age, defined as the current year (2023) minus the year of GVC agency's foundation, is a measure of accumulated experience and visibility of GVC programmes. Age varies considerably among GVC agencies, and national GVC agencies tend to be more recently established than regional ones. In Germany, for instance, most regional development agencies (Mittelstandische Beteiligungsgesellschaften or MBGs) were set up in the 1980s or 1990s to provide mainly loans, and guarantees to SMEs. Most of them have recently expanded their instruments from guarantees to include equity to support new technology firms. In other countries such as in Italy, the government-sponsored institution Cassa Depositi and Prestiti (CDP) created in 1980 has established its own venture capital firm in 2019, by acquiring the majority of Fondo Italiano Innovazione (previously Invitalia Ventures SGR, now CDP Venture Capital SGR).

In terms of public ownership, the vast majority of GVC agencies (all which have a public majority ownership) are wholly publicly owned. Regional GVC agencies tend to be less controlled by the public hand through majority ownership than national GVC agencies, on average. This is interesting, because it is expected that when private investors have a stake and a decision power (voting in board of directors and selection committees, etc.), there might be a greater emphasis on the financial performance, rather than the pure public purpose mission, of the public agency (Bruton et al. 2015). On the other hand, there is also evidence that public ownership in hybrid state-owned enterprises and development banks may mitigate potential political influences and is therefore possibly a good example of corporate governance for GVCs (Bernier, Florio, and Bance 2020).

Differences in budgets, experience and public ownership between national and regional GVC agencies are relevant because they may partially explain the differences in performance identified by previous literature (Alperovych, Groh, and Quas 2020; Munari

Table 3. Distribution of GVC agencies, GVC initiatives, amount invested, agencies' age and public ownership by geographic focus of the agency.

	Number of agencies		Number of initiatives		Average annual amount invested by initiative	Age in 2023		Public ownership in 2023	
	N	%	N	%	€, millions	Mean	Median	Mean	Median
National	37	28.9	133	33.9	44.6	18.7	14.5	95.6	100
Regional	91	71.1	259	66.1	9.7	27.1	27.0	87.8	100
Total	128	100.0	392	100.0	20.9	26.2	25.0	91.3	100

and Toschi 2015). To the best of our knowledge, existing literature has neglected such differences. We formulate the following:

Proposition 2: The differences in the effectiveness of GVC initiatives between regional and national GVC agencies can be explained by differences in budgets, experience and public ownership.

As Table 4 shows, there are important differences across countries in the geographical organisation of GVC agencies and in their activity. The table also shows the Composite spending autonomy indicator, derived from Dougherty and Phillips (2019), which captures the degree of decentralisation of a country by assessing and comparing its subnational spending power in five selected policy areas (education, long-term care, transport services, social housing, and health care). It takes value between 0 and 1 with a higher value associated with greater decentralisation. In more centralised countries like Denmark, Finland, and Ireland, government agencies operating regionally are scarce or non-existent, whilst in more decentralised countries such as Germany and Spain, there are numerous regional government agencies. Therefore, not surprisingly, the degree of decentralisation of institutional framework affects the geography of GVC agencies with a higher number of regional agencies in countries with a more decentralised structure.

4.3. Policy mix of GVC agencies

When analysing the effectiveness of GVC initiatives, it is important to recognise that GVC agencies are often responsible for a complex range of instruments and that GVC measures are frequently combined with other instruments, including guarantees and loans, and result in quite complex policy measures. Research encourages to reflect on the effectiveness of the "policy mix", rather than of the single policy, as different policies have interactions and interdependencies that affect the extent to which policy goals are realised (Flanagan, Uyarra, and Laranja 2011; Owen and Mason 2019). For example, Lerner (2002) argues that agencies handling R&D grants, such as the National Institute of Health or Department of Defense, might have

Table 4. Distribution of GVC agencies, GVC initiatives and amount invested in 2007–2021 by geographic focus of the agency and country.

	Number of agencies			Number of initiatives			Total amount invested			
	Total	Regional		Total	Regional		Total	Regional		Composite spending autonomy indicator
	N	N	%	N	N	%	€, millions	€, millions	%	
Austria	7	6	6.6	20	12	4.6	345	183	1.6	0.770
Belgium	9	7	7.7	15	13	5.0	3,516	2,094	18.0	0.864
Denmark	4	0	0.0	17	0	0.0	1,694	0	0.0	0.692
Finland	2	0	0.0	9	0	0.0	1,917	0	0.0	0.782
France	19	7	7.7	57	21	8.1	10,495	214	1.8	0.495
Germany	33	29	31.9	106	95	36.7	9,330	6,365	54.6	0.715
Ireland	9	1	1.1	39	1	0.4	1,143	38	0.3	0.239
Italy	4	12	13.2	13	29	11.2	1,554	463	4.0	0.635
Netherlands	18	13	14.3	55	45	17.4	1,746	1,374	11.8	0.553
Spain	16	14	15.4	49	40	15.4	3,812	795	6.8	0.753
Sweden	7	2	2.2	12	3	1.2	1,150	132	1.1	-
Total	128	91	100.0	392	259	100.0	36,703	11,658	100.0	-

Table 5. Distribution of GVC agencies by policy mix.

	N	%
Equity only	24	18.8
Equity and Grants	4	3.1
Equity and Loans	33	25.8
Equity, Grants and Loans	11	8.6
Equity, Grants, Loans and Guarantees	16	12.5
Equity and Guarantees	1	0.8
Equity, Loans and Guarantees	39	30.5
Total	128	100.0

considerable insight into the state of the art of emerging technology (e.g., biotechnology, advanced materials …), which might be put at use by other programmes too, including GVCs, for the selection of portfolio companies. R&D granting agency might have an established networks of scientists and engineers on which they can rely for awarding grants and for screening GVC deals. Lerner (2002) suggests that this might even give government agencies an advantage in company selection over private VC investors.[14]

In our database, we find that to stimulate economic growth, employment and innovation, many GVC agencies offer a combination of financial instruments. Given that government agencies are active in the early development phases of firm startups, the predominant instruments are equity, loans and guarantees. Only a minority of agencies provide more sophisticated, later stage financial instruments, such as mezzanine capital, which is offered only by four agencies out of which one exclusively dealing with mezzanine, or tax optimization services offered only by one Dutch agency.

As shown in Table 5, most GVC agencies providing equity at the same time provide grants, loans and guarantees. The agencies include these additional instruments to offer a more ad-hoc response to the specific needs of the firms to be supported, also depending on their stage of development. In some cases, public agencies initially originated in providing subsidized loans or offer governmental-backed guarantees and with time, they also included equity instruments in their offer. This is the case of Cassa Depositi and Prestiti in Italy, for instance, offering grants since 2004, guaranteed loans since 2009 and GVC instruments only in 2019. GVC agencies handling different financial instruments are arguably able to support their portfolio start-ups in different ways and through different stages of development, which can eventually improve performance. We expect that:

Proposition 3: The effectiveness of GVC initiatives depends on the variety of policy instruments offered by GVC agencies.

5. GVC initiatives' characteristics

Having discussed commonalities and difference of GVC agencies, in this section we examine the features of the 392 GVC initiatives that they manage.

We first analyse the initiatives' launch and close years. We observe that the yearly number of new GVC initiatives has increased over time, from less than 20 in 2018 to over

30 in 2020 (Figure 3). The number of new initiatives has exceeded those that have closed, so that the number of active initiatives has been rising over the years.

5.1. Investment approach

As mentioned early, we classify GVC initiatives in direct and indirect ones (see Callagher, Smith, and Ruscoe 2015, for a similar approach).

The success of direct GVC initiatives arguably depends on the GVC agencies' ability to rely on professional investment expertise, necessary to select and nurture the portfolio start-ups. Such skills might be hard to find in some specific regions where VC is not very well developed, and even difficult to attract, as often GVC contractual terms for investment managers are not performance-dependant, differently from those of private VCs (Jääskeläinen, Maula, and Murray 2007). Moreover, in direct GVC initiatives potential issues such as political influences and bureaucratic inefficiencies could influence the start-ups selection and nurturing activity. In indirect GVC, such activities are instead delegated to professional private VC funds. However, the potential inefficiencies linked with GVC political nature might interfere with the selection of private VC funds to support. Furthermore, as discussed by Wennberg and Mason (2018), the focus on financial returns of indirect GVC initiatives should be higher, because of the involvement of private VC funds which have purely financial objectives and more clearly defined investment and exit strategies.

While most of the academic literature is focused on direct GVC initiatives, few papers have considered both. Brander, Du, and Hellmann (2015) compare direct and indirect GVC, which they refer to as government-owned VCs and government-supported VCs, respectively. They find that start-ups backed by direct GVCs receive lower investment amounts (from both public and private sources) and have lower chances to go through a successful exit than indirect GVCs. Alperovych, Hübner, and Lobet (2015) analyse cross-country differences in the direct/indirect national GVC policy mix, finding that countries with better quality governments prefer the direct GVC approach, while in countries with lower-quality governments, indirect GVCs prevail. The authors also find that only the number of indirect GVC investments correlates with the country-level measures of companies' ease in accessing to finance, while no correlation is detected for direct GVC. Overall, these results suggest that the indirect GVC is a more effective policy tool than direct GVC.

Table 6 shows that out of the 392 initiatives in our sample, 288 (73%) are direct, 81 (21%) are indirect and 23 (6%) allow for both direct and indirect allocations to start-ups. We refer to these latter as "mixed" approached initiatives. The Table also reports the

Table 6. Distribution of GVC initiatives and amount invested by initiative investment approach.

	Number of initiatives		Average annual amount invested
	N	%	€, millions
Direct GVC initiatives	288	73.5	13
Indirect GVC initiatives	81	20.7	49
Mixed direct/indirect GVC initiatives	23	5.9	36
Total	392	100.0	21

average annual amount invested by initiative, clearly showing that indirect initiatives have typically much larger annual investments.

Figure 4 shows the relative importance of direct, indirect and mixed initiatives over the years, in terms of total amounts invested. In the early years of the analysis, direct GVC investments prevailed. Since the year 2013, there was a surge of indirect GVC investments, which in recent years account for about half of the total GVC investments. Mixed initiatives are gradually disappearing.

Figure 5 shows the distribution of GVC approach by country. The indirect approach clearly prevails in Denmark, Spain, Finland, France and Ireland, while Germany, Italy and Sweden prefer the direct approach. In Austria, Belgium and the Netherlands the incidence of mixed approach is much larger than in other countries.

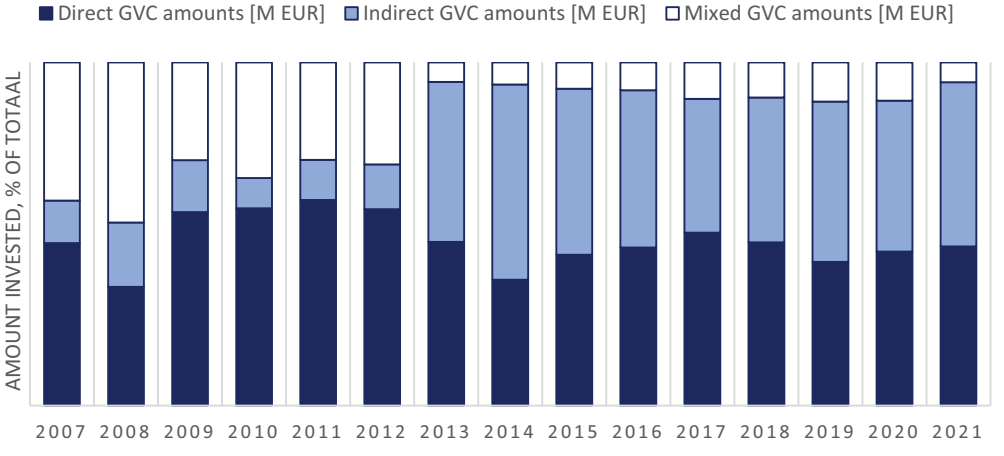

Figure 4. Total GVC investments by type of initiative and year.

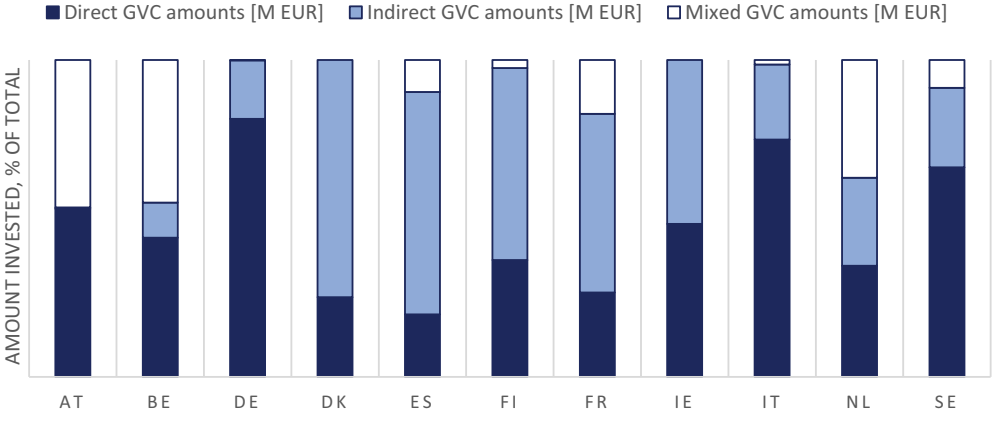

Figure 5. Total GVC investments by type of initiative and country.

5.2. Involvement of private actors

Whatever the form of the initiative, either direct or indirect, GVC initiatives may vary in their involvement of private partners. We provide further evidence on this source of heterogeneity in the following sections.

5.2.1. The syndication policies of direct GVC initiatives

In direct GVC initiatives, GVC agencies can involve private venture capital investors in mixed syndicated deals. Syndication in VC is beneficial for investment success (Bubna, Das, and Prabhala 2019; Hochberg, Ljungqvist, and Lu 2007; Lerner 1994), because it allows to benefit from a "second opinion" from a more reputed and experienced co-investment partner (Casamatta and Haritchabalet 2007) and to reduce investment risks (Manigart et al. 2006). Literature provides abundant evidence on the overperformance of mixed GVC-private VC syndicates with respect to investments in which GVC invest alone, in terms of innovation and invention (Bertoni and Tykvová 2015) and growth (Grilli and Murtinu 2014) of the target company, as well as better exit prospects (Cumming et al. 2014). Moreover, syndicating with private investors may not only influence the success of a focal deal but also the way in which GVCs invest in the future. In fact, syndication provides GVCs' funds managers with the opportunity to learn from their partners (Clarysse, Bobelyn, and Del Palacio Aguirre 2013; Lerner 2002). In addition, by syndicating with private investors, GVCs may enhance their networks of contacts, which should be beneficial for subsequent investments (Alperovych, Groh, and Quas 2020).

Syndication is so fundamental that some GVC initiatives are designed to invest only in partnership with private VCs (sometimes these initiatives are called "matching funds"). Sometimes, private VC syndication with GVC is encouraged, for instance, through the use of asymmetric profit distribution contracts, in which the public agency accepts worse profit distribution terms than private investors to encourage private co-investment.

In our database, we categorize direct GVC initiatives according to their syndication policies. Table 7 shows that 42.0% of our GVC initiatives can decide to invest alone or to syndicate with private partners. The remaining 58% of GVC investments are required to systematically syndicate with a private VC. In the latter case, the target company sometimes needs to prove the commitments of a private partner (VC or BA) to secure the GVC funds. GVC initiatives with the obligation to co-invest are much larger in terms of amounts invested.

While previously cited existing literature has focused on the relevance of syndication of GVC at deal level, we show that GVC initiatives might not have a choice on whether they should syndicate or not in a given deal as syndication if often a requirement for investment. Initiatives that cannot invest if a PVC partner is not involved necessarily cannot address the most serious instances of market failure, i.e., invest in those companies that

Table 7. Distribution of direct GVC initiatives and amount invested by syndication policies.

	Number of initiatives		Average annual amount invested
	N	%	€, millions
Syndication is allowed	121	42.0	3
Syndication is required	167	58.0	15
Total	288	100.0	13

despite government participation are not attractive for private investors because of the highest information asymmetries or positive externalities. This might be the case of companies located in the most peripheral regions or operating in emerging high-risk industries. In these cases, mandatory syndication might hamper GVC effectiveness in achieving some of their stated objectives (e.g., reducing economic disparity across regions) while boosting their effectiveness in achieving others (e.g., seeding the VC industry). We state:

Proposition 4: The effectiveness of GVC initiatives depends on whether they are required to syndicate with private investors

5.2.2. Indirect GVC initiatives: funds of funds and co-investment funds

Indirect GVC initiatives are GVC funds that do not invest directly in start-ups, but rather in private VC funds. In our sample, this intervention takes two main forms. First, "Co-investment funds" are funds where government VC finance invest alongside private limited partners (such as pension funds) in private VC funds, and they are typically responsible for the fundraising process, ensuring that the fund reaches its target size. For example, in Germany the ERP/EIF growth facility, with a committed capital of €500 million, was established as co-investment funds alongside private investors.[15] Second, in the "Funds of funds" approach, a layer of intermediation is added. Funds of funds are typically public funds that invest in private VC funds. In Germany the federal government also invest in young innovative, technology-oriented companies indirectly via funds of funds such as the ERP/EIF fund of funds or the ERP venture capital fund investment programme of KfW Capital.[16] A characteristics of these instruments is that government-affiliated agencies, by pooling their resources in selected VC funds, can gain access to a diversified portfolio of funds and take advantage of the contacts and skills of the specialized intermediaries (Harris et al. 2018). In addition, since these funds often require a significant private sector investment contribution, for regulatory reasons and in accordance with European competition/state aid law, they are able to broaden the financing basis of the venture capital market.

Table 8 shows statistics related to our sample. Amongst indirect GVC initiatives, the most common approach is to invest exclusively in other funds through fund of funds, accounting for 83% in terms of initiatives and investing much larger amounts annually. The average annual investments of GVC funds of funds is €53 million over the period considered, while the average size of co-investment funds is €18 million.

The preference of funds-of funds suggests the government tendency to delegate the decisions on which VC funds to invest to other private funds, and in more in general is in line with the idea that government intervention relies on private investors, better able to

Table 8. Distribution of indirect GVC initiatives and amount invested by investment approach.

	Number of initiatives		Average annual amount invested
Indirect GVC initiatives	N	%	€, millions
Public funds of funds	67	82.7	53
Co-investment funds	14	17.3	18
Total	81	100.0	49

handle information asymmetries not only at the level of the start-up, but also at the level of the VC general partner.

To the best of our knowledge, the two forms of indirect GVC initiatives were never compared in terms of effectiveness. We formulate:

Proposition 5: The effectiveness of indirect GVC initiatives is expected to be higher for funds of funds than for co-investment funds.

5.2.3. Delegated management

To the best of our knowledge, the research on GVC has not considered the fact that some GVC might actually delegate the investment decisions to external VC investors. It is well known that private VC investors value added depends on the investment managers' ability to select good quality companies and to monitor and nurture them after the investment (e.g., Hellmann and Puri 2002), and on the VC firm network and reputation (Atanasov, Ivanov, and Litvak 2012; Lindsey 2008). GVC investors might decide to delegate their VC investment decisions to private investors because of the difficulties to develop such knowledge and networks in house. Moreover, the cost of hiring experienced financial professionals might be prohibitive for most GVC agencies. In our sample, we find that 91% of direct GVC initiatives are managed by government agencies, while 8.7% are managed by private investors (Table 9). For indirect GVC initiatives, the tendency to delegate externally is much larger and around 35%. We also find some initiatives which are managed by EU-level agencies, which arguably have the scale to develop the necessary selection and nurturing skills "in house".

Nord France Amorquage is a good example of a GVC fund that invest directly in high-growth companies, and managed by an independent private equity specialist. It is a fund created in February 2013 of €36 million and 100% owned by the Hauts-de-France Region, which mobilizes ERDF funds of up to €21.5 million to provide equity to innovative regional companies.[17] It is managed by the management company Siparex Group. The fund invests between €50,00 to €800,000 for a first investment and capacity, and it operates

Table 9. Distribution of GVC initiatives and amount invested by delegated management policies.

	Number of initiatives		Average annual amount invested
	N	%	€, millions
All GVC initiatives			
Managed by GVC agencies	295	79.9	21.16
Managed by EU-level agency	21	5.7	19.45
Managed by external private (VC) firms	53	14.4	11.81
Total	369	100.0	19.61
Direct GVC initiatives			
Managed by GVC agencies	262	91.0	14.02
Managed by EU-level agency	1	0.3	12.50
Managed by external private (VC) firms	25	8.7	3.57
Total	288	100.0	12.92
Indirect GVC initiatives			
Managed by GVC agencies	33	40.7	9.26
Managed by EU-level agency	20	24.7	1.97
Managed by external private (VC) firms	28	34.6	2.16
Total	81	100.0	4.86

Mixed direct/indirect initiatives are not reported in the table for the sake of synthesis.

on a pari passu basis with private investors. In Ireland, since 1994, the Irish government, through Enterprise Ireland, has invested in four Seed & Venture Capital Schemes, which are VC funds independently managed by private investors, to increase the supply of venture capital for start-ups and address market failures in Ireland. Enterprise Ireland invests in such funds on a *pari-passu* basis with the private sector equally sharing the risk and reward. In the Netherlands, in 2013, two regional development companies (the East Netherlands Development Agency – Oost NV and the Brabant Development Agency – BOM NV) launched together with the EIF the Dutch Venture Initiative, and created the DVI-I and the DVI-II funds, aimed to boost equity investments into innovative and/or high-tech early and development stage enterprises in the Netherlands. Both funds are managed by the EIF.

External management can be beneficial for GVC initiatives because it implies that they are carried out by professionals that are active in the private sector or, as in the case of initiatives managed by the EIF, that have developed substantial investment experience before. Moreover, delegated management might insulate GVC initiatives from the presumed inefficiencies of the local GVC agencies due to their public nature. We posit:

Proposition 6: The effectiveness of GVC initiatives is expected to depend on whether their management is delegated.

5.3. GVC initiatives' budget

5.3.1. Budget organization: evergreen vs closed-end funds

GVC initiatives vary with the size of the budget and the way the budget is organised. While the vast majority of VC funds are organized as closed-end funds, in some cases VCs operate like evergreen or rolling funds.[18] "Closed-end" funds have a fixed, predetermined budget and lifetime, both of which can be extended if foreseen in the fund's mandate. At the end of the lifetime, unused budget and any proceeding returns to the investors of the fund. In an "evergreen" structure, sometimes called "rolling fund", funds administrators are endowed with an initial amount of funding, which they can use to make investments and whose proceeds (i.e., the profits they realize and the resources that are released after exits) can be reinvested. Contrary to closed-end funds, evergreen funds cannot raise regularly new capital. One advantage is that evergreen funds can make longer-term investments and be more patient investors (Mulcahy, Weeks, and Bradley 2012).

There are few studies discussing the choice of organisational forms for GVC initiatives. Lerner (2010) and Baldock and Mason (2015) suggest that the evergreen design not only facilitates larger initial investment rounds but has the timescale and capacity to provide subsequent follow-on funding. The evergreen design allows portfolio companies to fully mature, avoiding early sales or potential share value dilution. This has become highly pertinent with post–global financial crisis as exits have taken longer (Pierrakis, 2010) and particularly as the investment "plums" take longest to ripen (Wiltbank, 2005). On the other hand, Murray, Hyytinen and Maula (2009) found that evergreen funds might be more prone to a shift of mission and to a lack of dynamism, which leads to long-term support for poorer performing portfolio companies. From our own interview of the manager of an

evergreen fund, we also understood how evergreen funds need to be much more selective in the provision of funds than closed-end funds.[19]

Across our sample of 392 GVC initiatives, almost 80.7% of them are closed-end funds and 19.3% of them are "evergreen". The distribution is similar across direct and indirect GVC initiatives (Table 10). We also find that a handful of initiatives that involve the use of structured calls where companies and private VC firms can apply for funds. The Innovative HPSU Fund (Equity) is a good example of programme where the government agency "Enterprise Ireland" make its investment allocation on a competitive basis. The fund is open for applications several times throughout the year with special calls made for specific sectors such as digital media and aviation. In Austria, the promotional bank of the Austrian federal government (the aws) supports the provision of venture capital funding through the aws Venture Capital initiative which is organised as a "call-based funds", where only qualified fund managers can apply. All expressions of interests are assessed and evaluated by an evaluation team against different criteria, including investment strategy, investment experience and record, previous co-investment experience, governance, ability to close a fund in a timely manner.

Closed-end funds on average have a lifetime of about 8 years (values range min = 1; max = 21), suggesting that they are not particularly patient (the average private VC fund has a lifetime of 10 years, with the possibility to expand by 2 years). However, on average, indirect GVC initiatives (the average is 8.3; values range min = 1 and max = 21) are on average more patient than direct GVC initiatives (the average is 7.6; values range min = 1 and max = 17). The reader should note that we have information on the closed year for only 55% of closed-end GVC initiatives.

Building on the arguments presented above, we propose:

Proposition 7: The effectiveness of indirect GVC initiatives is expected to depend on the length of the initiative lifetime, and on whether they are organized as evergreen funds.

5.3.2. Amount of the GVC initiatives budgets (committed capital)

One of the main policy concerns is the appropriate size for government VC initiatives, since with smaller-sized programmes, it is very unlikely that policymakers can reach their

Table 10. Distribution of GVC initiatives and amount invested by budget organization type.

	Number of initiatives		Average annual amount invested
	N	%	€, millions
All GVC initiatives			
Closed-end funds	292	80.7	19.64
Evergreen funds	70	19.3	20.56
Total	362	100.0	19.89
Direct GVC initiatives			
Closed-end funds	224	79.7	10.95
Evergreen funds	57	20.3	18.06
Total	281	100.0	13.00
Indirect GVC initiatives			
Closed-end funds	68	84.0	52.43
Evergreen funds	13	16.0	34.47
Total	81	100.0	48.55

Mixed direct/indirect initiatives are not reported in the table for the sake of synthesis.

multiple objectives, whilst with larger-sized programmes, it is difficult to manage the programme effectively (Lerner 2010). It is therefore important to analyse the size of GVC initiatives.

For closed-end GVC initiatives, size is measured by the total committed capital, which is the total amount of capital allocated by government agencies to each initiative over the latter's lifetime. For evergreen GVC initiatives, we consider the initial endowments.

Our data (Table 11) show that there are differences in fund size across the two types of government intervention, with substantially lower budgets for direct initiatives (average of 95.4 million EUR) with respect to indirect ones (average of 254 million EUR). Moreover, among indirect GVC measures, closed-end GVC initiatives are larger, with average budgets of €260 million, against an average initial endowment of €142 million for evergreen initiatives. Among direct GVC measures, the average size is significantly larger for evergreen initiatives (€174 million vs €83 million).

We argue that budged sizes might have different impact on GVC effectiveness for closed-end and evergreen funds. Larger closed-end funds might have pressure to spend their budgets as soon as possible in order to avoid their budgets to be cut in the next programming period in case of underspending. As such, they might be less selective in the provision of resources, which might reduce their effectiveness in achieving their policy goals. Evergreen funds do not have pressures to use their initial endowments, and therefore larger endowments might actually help them to finance their carefully selected companies through different rounds of financing, possibly with better investment outcomes.

Proposition 8: The effectiveness of closed-end GVC initiatives is expected to decrease with the size of their budget. Instead, the effectiveness of evergreen GVC initiatives is expected to increase with the size of their budget.

5.4. Initiatives investment selection criteria

Often GC initiatives have predefined selection criteria, in terms of their geographical focus, stage focus, and industries of the portfolio companies. In VC investing, specialized

Table 11. Descriptive statistics on the size of the budget of GVC initiatives, 2007–2021.

		Size of fund			
Type of GVC initiatives	Obs.	Median	Mean	Min	Max
GVC initiatives					
Closed-end	237	45,000,000	128,000,000	1,650,000	2,500,000,000
Evergreen	30	31,500,000	171,000,000	1,000,000	3,360,000,000
Total	267	40,100,000	133,000,000	1,000,000	3,360,000,000
Direct GVC initiatives					
Closed-end	177	32,000,000	83,400,000	1,650,000	1,300,000,000
Evergreen	27	30,000,000	174,000,000	1,000,000	3,360,000,000
Total	204	32,000,000	95,400,000	1,000,000	3,360,000,000
Indirect GVC initiatives					
Closed-end	60	117,000,000	260,000,000	8,000,000	2,500,000,000
Evergreen	3	84,000,000	142,000,000	31,000,000	312,000,000
Total	63	104,000,000	254,000,000	8,000,000	2,500,000,000

Mixed direct/indirect initiatives are not reported in the table for the sake of synthesis.

investment skills are necessary to successfully select and nurture start-ups in different stages, industries and geographical areas. While discussing how to best design subsidy programmes, Lerner (2010) discourages the definition of narrow selection criteria for GVCs. He notes, "government programs should eschew such efforts to micromanage the entrepreneurial process. While it is natural to expect that firms and groups receiving subsidies will retain a local presence or continue to target the local region for investments, these requirements should be as minimal as possible". In other terms, the definition of too narrow investment selection criteria might hamper the effectiveness of GVC initiatives which already very often, by definition, have a narrow geographic scope.

5.4.1. Geographical focus

A fundamental dimension along which the investment selection criteria of GVC initiatives are typically restricted is indeed the initiative's geographical focus. In fact, as one important rationale of government intervention in VC markets is to address financial supply gaps and market failures that may exist in certain geographical regions. Since private VC market is geographically concentrated in few financial hubs (London, Paris, Stockholm, etc.), policymakers may decide to promote VC funds in economically lagging regions so as to stimulate and support the activity of small and innovative firms in such areas (see Chen et al. 2010; Mason and Harrison, 1991, 2002; Martin et al. 2005). Such regional focus is mostly used among regional GVC agencies which typically invest in the areas under their jurisdictions. However often even national or EU-level GVC agencies might allocate part of their budget (i.e., create specific initiatives) to specific regions. Specifically, in line with the aim of correcting economic imbalance between European regions, the European Commission ERDF instrument aims to ensure that all companies, wherever they are located, could access the finance they need. In our sample, about 18% of our GVC initiatives have received ERDF funds and the average size of funding is € 20.6 million.

Very few studies compared the "centralized" vs "regional" systems of venture capital support. Alperovych et al. (2020) find that European GVC that invest locally are less effective in attracting private VC investors in their deals, especially if they are located in less developed regions. Similar results are found by Munari and Toschi (2015) in the UK. According to these studies, the regional system of VC support is less effective than the national one, partly because that regional public officials are not skilled in identifying promising start-ups. In response to this problem, Lerner (2010) highlights the importance of universities and their technology transfer departments in supporting the local entrepreneurial activity.

Table 12 shows that in our sample, almost 33% of GVC initiatives have a national focus, and 64% of GVC initiatives have a regional focus. GVC initiatives with a supra-regional focus are below 2%, and those with a supranational focus are below 1%.

When considering the geographical focus of the agencies as well as the initiatives, we find that, as expected, most regional GVC agencies adopt a regional approach for their initiatives. However, some exceptions are specifically related to indirect GVC measures: in these cases, regional GVC agencies typically fund private VCs on the condition that a minimum amount of the contributed capital (50–60%) is allocated to their regions. This allows to maintain a regional focus without limited the deal flow opportunities of private VCs too much. For example, the Creation 4 Fund (8.2 million euros) is a seed capital fund created in 2015 by the Bourgogne-Franche-Comté Region and managed by the

Table 12. Distribution of GVC initiatives by geographical focus and GVC agencies' location.

	Total		Regional GVC agencies		National GVC agencies	
Number of initiatives	N	%	N	%	N	%
Supranational	3	0.8	2	0.8	1	0.8
National	129	32.9	7	2.7	122	91.7
Supraregional	7	1.8	4	1.5	3	2.3
Regional	253	64.5	246	95.0	7	5.3
Total	392	100.0	259	100.0	133	100.0

management company UI Investissement. So far, the Region has invested 4.1 million euros in this Fund, which operates on a pari passu basis, i.e., in co-investment with a minimum of 50% private funds (Technopolis 2021).

5.4.2. Stage focus

Innovative companies typically need a series of funding rounds, increasing exponentially in terms of amounts, to reach their full potential and become large corporations (Mason 2016). Market imperfections can give rise to shortages of equity capital needed by innovative start-ups to survive through the seed and early-growth phases (the so-called "first" or "small" equity gap) and also to grow and scale-up to become established businesses (the "second" or "scale-up" equity gap).

The scientific literature had discussed the first equity gap for at least 20 years (Lerner, 2002). The rationale for government intervention there is justified by the lack of track record, small size, and high uncertainty characterizing very early-stage companies (typically pre-profits and pre-sales), which lead to market failures in the provision of seed financing. More recently, governments have turned their attention to the second equity gap, due to the fact start-ups that survived through the "valley of death" of the early stages and with a high growth potential, might still need government support to find the high financial resources needed to scale-up. While information asymmetries are arguably stronger at the earliest stages of development when less information is available on the venture, even start-ups with few years of track record to show might suffer from them, especially in emergent industries in which the human skills necessary to gauge a business plan are difficult to find. Moreover, innovation externalities are relevant for both start-ups and scale-ups, and would lead to an under provision of innovative investments with respect to the social optimum. Lastly, scale-up companies are especially likely to suffer from coordination failures between early-stage investors and later stage investors (Murray, 1994). Preliminary evidence suggests that a scale-up financing gap might be present in Europe (Quas et al. 2022).

To the best of our knowledge, there is no evidence on the effectiveness of government intervention in the different stages of development. However, our data (Table 13) shows that while 58.3% of GVC initiatives do not have a specific stage focus, the remaining do. 26.3% invests in seed and early stage, of which 4.3% only in seed. An additional 11.7% have a specific focus on growth stages.

5.4.3. Industry focus

Lastly, we analyse the industry focus of GVC initiatives. VC financing is particularly relevant for high-technology companies, because their R&D intensity and innovative business

Table 13. Distribution of GVC initiatives and invested amount by stage of finance specialization.

	Number of initiatives		Average annual amount invested €, millions
	N	%	
All GVC initiatives			
Seed only	16	4.3	94
Seed and early stages	70	19.0	312
Early stages (only)	11	3.0	51
Early and growth stages	14	3.8	79
Growth stages only	43	11.7	173
All stages	215	58.3	921
Total	369	100.0	1630
Direct GVC initiatives			
Seed only	6	2.1	47
Seed and early stages	63	21.9	276
Early stages (only)	3	1.0	23
Early and growth stages	12	4.2	71
Growth stages only	21	7.3	89
All stages	183	63.5	818
Total	288	100.0	1324
Indirect GVC initiatives			
Seed only	10	12.3	47
Seed and early stages	7	8.6	36
Early stages (only)	8	9.9	28
Early and growth stages	2	2.5	8
Growth stages only	22	27.2	84
All stages	32	39.5	103
Total	81	100.0	306

Mixed direct/indirect initiatives are not reported in the table for the sake of synthesis.

models lead to difficulties to raise capital through the traditional financing channels, such as banks, due to the specialized skills needed to conduct the pre-investment due diligence (Bottazzi and Da Rin 2002).

Still, even within high-tech industries, VC investors differ in their industrial specialization. Academic literature suggests that high industry specialization is beneficial in VC investing, as generalists tend to suffer from inefficient allocation of funding across industries and poor selection of investments within industries (Gompers, Kovner, and Lerner 2009). Sørensen (2007) also asserts a positive relationship between the industry-specific experience of private VC fund managers and investment performance. However, looking at VC survival, Makarevich (2018) find that specialist and generalist firms have a survival advantage, compared to firms with a medium-low degree of specialization, but that generalism provides greater survival benefits than specialization because of the broader knowledge base and knowledge spillovers.

In the case of GVC, Lerner (2002) recommends that GVC investments be made in specific technology sectors. More precisely, he suggests that governments focus on "technologies which are not currently popular among private investors and provide follow-on capital to firms already funded by VCs during periods when venture inflows are falling" (Lerner 2002: pg. F80-F81). A typical recommendation is that GVC initiatives are designed to industries characterized by high R&D cost, which have high potential externalities (Lerner 2002), and yield higher growth and economic prosperity (Mason and Harrison 2003). However, empirical literature does not support this conjecture (Mason and Brown 2013), and public support programs (including GVC) which exclusively target high-tech sectors are therefore criticized (Brown, Mawson, and Mason 2017; Shane 2009).

GVC agencies are also called to act as "patient investors" and invest in industries with longer time-to-markets, unattractive to private VC who typically have an urgency to exit from their investments as soon as possible to realize a return for their limited partners (Bertoni, Colombo, and Quas 2015).

According to Table 14, out of our 369 GVC initiatives screened, 81% GVC initiatives do not have a specific industry focus. The remaining 19% had a mandate to invest in a specific sector, most typically biotechnology, digital technologies, energy, health-related technologies. Most thematic VC funds are found in central and northern European countries, particularly in the Netherlands and France, and are managed by specialist VC managers.

In recent years, we observe governments to raise funds targeting the support of "clean-tech" companies. In our sample, 3.4% of the GVC initiatives are green technology funds with a manifested mandate to speed the so-called "green transition". The typical green GVC initiatives is a public-private partnership[20] operating nationwide. There are some notable regional exceptions, as most of the nine Dutch Regional Development Agencies (ROMs) established their own green technology VC policies. The design of these funds clearly reflects a shift of approach to more direct forms of interventions where governments try to co-invest alongside private investors.

Overall, geographic, stage and industry specialization of GVC initiatives comes with both advantages and disadvantages, whose effect on the GVC effectiveness has remained largely understudied. Building on these considerations, we expect that:

Proposition 9: The effectiveness of GVC initiatives depends on their geographic, stage and industry specialization.

6. Discussions and conclusions

Motivated by the mixed evidence on GVC's performance and effectiveness, this paper starts from the assumption that the success or failure of a given policy depends on how it is implemented (Arshed, Carter, and Mason 2014) and provides a systematic descriptive

Table 14. Distribution of GVC initiatives and amount invested by industry specialization.

	Number of initiatives (1)		Amount invested €, millions
	N	%	
All GVC initiatives			
Generalist	300	81.3	18.99
Specialized	69	18.7	23.67
Total	369	100.0	19.61
Direct GVC initiatives			
Generalist	232	80.6	11.38
Specialized	56	19.4	22.68
Total	288	100.0	12.92
Indirect GVC initiatives			
Generalist	68	84.0	51.32
Specialized	13	16.0	28.49
Total	81	100.0	48.55

Mixed direct/indirect initiatives are not reported in the table for the sake of synthesis.

analysis of how GVC policies were implemented in eleven European countries: Austria, Belgium, Denmark, Germany, Finland, France, Ireland, Italy, Spain, the Netherlands, Sweden.

The paper is based on original, hand-collected data, and it is to our knowledge the most recent and comprehensive effort to map GVC initiatives in an international sample. To begin, we conceptually separate GVC agencies from GVC initiatives. GVC agencies are (majority) government-owned legal entity having a public mandate from either a local, a regional, or a national authority to provide equity capital to innovative ventures through GVC initiatives, moved by a "public purpose", i.e., to benefit the society. Next, as there is no official database on GVC agencies or initiatives in Europe, we identified GVC agencies, cross-checking several sources of information, including the public lists of EU-level, national and sub-national promotional banks and institutions; the list of national and regional (sub-national) agencies receiving support by the ERDF; the list of governmental VC published by the OECD and commercial VC data providers such as EIKON Refinitive and Dealroom. We end up with a list of 128 GVC agencies active in the period 2007–2021. For each identified GVC agency, we reviewed their websites and annual reports in the period 2007–2021, to identify all the GVC initiatives that they had supported during that period. We found that in our sample GVC agencies implemented 392 GVC initiatives.

We used the GVC agencies annual reports and websites to systematically collect the design features of GVC agencies and GVC initiatives. For each of the 128 government agencies, we collected information on: 1) the ownership and launch year of the agency, in terms of public share; 2) the breath of the geographical mandate of the agency (regional, national, supranational); 3) the stated objective of the agency; 4) the "policy mix" used to finance companies (grants, loans, subsidies, etc.), besides the GVC initiatives. For each of the 393 GVC initiatives, we collected information on: 1) investment approach; 2) involvement of private actors; 3) budget organization and size; and 4) investment selection criteria. Lastly, we built an initiative-year database of the volume of investments made by each initiative in each year, with a manageable incidence of missing values.

We use this database to contribute to the literature on GVC in three ways. First, we provide evidence on the vital role played by governments in the supply of venture capital. Specifically, we estimate that GVC investments account for 30.9% of total venture capital investment. We also find evidence of a decline in the share of GVC investments in the last most recent years. This is a signal that GVC might have had a significant leverage effect on the European VC industry, and that the private VC industry is now growing faster than the public resources. Still, on average the incidence of GVC is quite high, especially in some countries such as Belgium, Ireland and Finland.

Our second contribution is to shed light on a vast heterogeneity across GVC agencies and initiatives design features, which was vastly neglected by existing research. Our data on GVC agencies reveals that they differ in terms of geographic scope, objectives and policy mixes. Regional agencies represent the majority of our sample, not surprisingly they prevail in less centralized countries, and their average annual amounts invested tend to be smaller than the ones of the national agencies. In terms of objectives, most GVC agencies have a comprehensive mandate aimed at economic growth, innovation, employment creation and companies' internationalization. An emerging trend is to include social and environmental objectives in the public mission, as well as the reduction of economic disparity across regions. Most GVC agencies provide other financing

instruments besides GVC initiatives to companies, and one third of agencies include both equity, loans and guarantees in their policy mixes.

GVC initiatives vary considerably in terms of their investment approach, involvement of the private sector, budget and investment selection criteria. Most of GVC initiatives are direct and annually provide on average 13 million EUR resources directly to startups, while indirect GVC initiatives, in which GVC agencies provide resources to private VC funds, account for 20% of the sample, and provide much larger amounts (annual average of 49 million EUR). The incidence of indirect GVC initiatives increased in time, especially since 2013, and predominates in some countries such as Denmark, Spain, Finland and France. Most GVC initiatives require the involvement of private investors to some extent. In 58% of direct GVC initiative, a private VC syndication partner is required, while 17% of indirect initiative adopt a co-investment fund and raise funds which are only partially funded with public resources (as opposed to the more common fund-of-fund approach). Management is delegated to private firms or to the EIF in 20% of the initiatives. Regarding the budget organization, we find that 19% of funds are evergreen, while the others are close-end funds with a median lifetime of 7 years (surprisingly shorter than the well-known 10 years lifetime of private VC funds). Investment selection criteria of GVC initiatives often include geographic specialization (mostly coherently with the breadth of the geographic mandate of the GVC agencies) and investment stage specialization (mostly focussed on early stages). Instead, most of GVC initiatives do not concentrate on specific industries: only 19% of the GVC initiatives have industry specialisation, and they focus in areas of technology that are perceived to have great potential such as biotech, digital technologies, healthcare and energy.

Thirdly, we contribute to the literature by theoretically discussing how each of these design features might influence GVC effectiveness, formalizing our conjectures in propositions and calling for additional empirical work in the future to test them. As GVC agencies have different missions, future studies should evaluate their effectiveness against their stated policy objectives, or along different dimensions at the same time (e.g., employment creation, innovation, VC development or financial returns). In terms of design choices, besides the previously tested role of GVC initiatives' geographic scope or syndication patterns (Alperovych, Groh, and Quas 2020), future research may focus on the other features which we highlight in this paper. For instance, theoretical literature provides indication that GVC agencies with richer policy mixes and mixed public-private ownership might be more effective than others. Further, the performance of GVC initiatives might be higher if management is delegated to private VCs, or if GVC initiative have stage-specific or industry-specific knowledge acquired through specialization, while evergreen GVC funds might be more patient and effective than close-end GVC funds in pursuing GVC public mission. Testing these conjectures is fundamental to help inform policy makers in the design of future effective GVC instruments. By putting forward these ideas, we take a first step in this direction, shifting the academic attention from the question "are GVC effective in pursuing their public mission?" to the question "how can we implement GVC to be effective in pursuing their public mission?".

At the same time, we acknowledge some limitations for our study. Most importantly, the choice of the characteristics of GVC agencies and initiatives considered in this paper is limited by the availability of data on GVC agencies' websites. Further elements to consider might, for instance, include GVC agencies' recruiting policy and compensation schemes,

as well as GVC initiatives provision of non-financial value added and networking. The gathering of this information requires the use of different data collection techniques, including surveys to GVC agencies and portfolio firms, which are beyond the scope of this study. With respect to the generalizability of the results, as our sample countries represent more than 90% of the total VC market in the European Union according to Invest Europe, we are confident that our results are good descriptors of the general GVC phenomena in the area. Still, we acknowledge that GVC initiatives might differ depending on the development of the VC industry, and therefore GVC in the excluded Member countries might have a different distribution of design features with respect to those described in the paper. Future studies should extend our exercise to those smaller VC markets. Lastly, it is well known that the development of VC market is intertwined with several institutional characteristics, including the development of IPO markets (Black and Gilson 1998), pension fund regulation (Jeng and Wells 2000), capital gains taxation (Dimitrova and Sapnoti 2023; Edwards and Todtenhaupt 2020), labor market regulation (e.g., Gu et al. 2020), culture (Yong and Zahra 2012), or M&A activity (Phillips and Zhdanov 0000). Also the availability of other sources of capital for start-up companies will play a role, such as venture debt (Tykvová 2017) or crowd-funding (e.g., Butticè, Di Pietro, and Tenca 2020; Kaminski, Hopp, and Tykvová 2019). Future work should examine how the different institutional and regulatory frameworks influence the design features of GVC initiatives, and the effectiveness of GVC programs. ù.

Notes

1. In the European Union, Member States setting initiatives that promote risk capital investment in SMEs have to follow the conditions described in the Article 107 (1) of the Treaty on the Functioning of the European Union (TFEU) and the "Guidelines on State aid to promote risk finance investments" (EC 2014). Still, individual Member States have room for manoeuvre in terms of design and implementation of aid measures (Wilson and Silva 2013).
2. In their study, Baldock and North (2015) refer to three main government hybrid venture capital funds, i.e., the Enterprise Capital Funds, the Aspire Fund and the UK Innovation Investment Fund.
3. Lim and Kim (2015) considers industry specialization and performance-sensitive compensation schemes of both private and GVC schemes in South Korea.
4. We excluded from the analysis Luxembourg, which represented the 10th largest EU VC market covered by Invest Europe in 2022. Luxembourg enjoys a very favourable taxation policy making it disproportionally attractive for VC investors. Many "letterbox" companies (social site registered in a different place that their operations) and VCs are registered in Luxembourg solely for tax purposes. We think that including such a unique case in our sample may have distorted the analysis.
5. See https://data.jrc.ec.europa.eu/collection/id-0113.
6. See, for instance, https://europa.eu/youreurope/business/finance-funding/getting-funding/access-finance/search/.
7. The websites were visited between July and September 2022.
8. Examples of internationalization programmes include FMO in the Netherlands, GIZ in Germany, IFU in Denmark, FinnFund in Finland or Euromed programme of Finlombarda Gestioni SGR in Italy.
9. Launched by the German government and the EIF in 2021, the GFF/EIF growth facility aims to invest up to €3.5 billion in growth funds and larger-volume growth financing rounds for start-ups over a period of ten years. The financing volume of the facility is made available jointly by the future fund, the ERP special fund and is managed by the EIF. The LfA-EIF facility is a fund-

of-funds managed by the EIF on behalf of the LfA Förderbank Bayern (LfA). It invests in venture capital funds and co-invests with selected business angels in Bavaria under the European Angels Fund Germany. The Dutch Future Fund ("DFF") is a collaboration between the European Investment Fund, the Dutch Ministry of Economic Affairs and Invest-NL and makes capital available for innovative scale-ups based in the Netherlands. Investments are implemented and managed by EIF.

10. Examples of terminated agencies include agencies that changed their legal name, e.g., Tekes Venture Capital Ltd that became Business Finland Venture Capital Ltd in 2008, and EPIC OSEO that became BPI France in 2012. Examples of terminated initiatives include BPI France' InnoBio fund, which was launched in 2009 and ended in 2020, and Tesi FOF Growth II/KRR II fund of fund, whose investment period was 2014–2017.
11. Note that we limited our analysis to the period 2007–2021 because Invest Europe provides information on VC investments starting from 2007 (by then, it was called the European Venture Capital Association, EVCA). Note also that, reportedly, the rate of missing in Invest Europe database is around 10–15%.
12. The included countries in Alperovych, Hübner, and Lobet (2015) study are: are Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.
13. For robustness, we retrieved aggregate data on the VC total investment amount in seed and early stages in our 11 European sample from Pitchbook, a commercial data provider on venture capital financing. We found an aggregate amount of 145 million EUR, similar to the 165 million EUR reported by Invest Europe in the same period and countries. We also found a very similar trend of aggregate investment amounts per year in the two databases, with slightly larger amounts in Invest Europe till 2019 and larger amounts in Pitchbook in the most recent years. Using as a reference Pitchbook data, the incidence of the estimated GVC amounts on total VC investments in the whole period is 35.1%, dropping to 23.5% in 2021.
14. Johan, Schweizer, and Zhan (2014) show instead an example of interferences among different policy measures. Following a change in tax policy announced in Ontario in 2005, the Canadian GVC "labour-sponsored venture capital corporations" (LSVCCs) in that region substantially changed its investment behaviour. "As a result of the elimination of the tax credits, the removal of certain investment restrictions, and weaker corporate governance, LSVCCs drifted from their original mandate to invest in high-risk venture companies to investing in less risky public companies".
15. More precisely, the ERP special fund and the EIF joined forces with other successful venture capital investors to set up co-investments funds that invest in innovative growth companies. The level of participation in each respective co-investment fund was limited to a maximum of €60 million.
16. Specifically, under the ERP venture capital fund investments programme, KfW invest in selected German and European venture capital funds a maximum of €25 million per fund and a maximum of 19.9% of the fund volume and always on the same terms ("pari passu") as private investors.
17. Any company offering a technological innovation, service or use, all sectors of activity combined (health, digital, service, industry, etc.), and having its head office or a significant establishment in the Hauts-de-France region.
18. Mulcahy et al. (Mulcahy, Weeks, and Bradley 2012) discuss the advantages of evergreen funds over closed-end funds organization of private VC funds. Private closed-end VC funds have a predetermined size (the capital committed by limited partners) and a finite lifetime, usually around 10 years with the possibility of a 2-year extension. Typically, new investments are carried out during the first half of the fund's life, while in the second half only follow-on rounds can be financed. Proceedings from the funds (i.e., sales of the funds share of the companies though secondary markets or private transactions) are poured out to the investors and not re-invested. Private VC investors start to plan for the next round of fundraising towards the end of the previous fund. Therefore, established VC pursuit

a concatenation of "closed-end" funds. Contrary to closed-end funds, evergreen funds do not have to raise regularly new capital, nor to close assets at the end. The turnover of limited partners is possible because evergreen funds restructure every few years and investors can decide whether to continue investing or withdraw their investment. Most evergreen funds accept new investors, issuing additional shares and redeeming shares from shareholders who wish to sell. Investment proceedings are reinvested in the fund, which therefore can make longer-term investments and focus entirely on cash-on-cash returns. Because of this, evergreen funds are expected to deliver higher returns than closed-end funds.

19. We thank Mr. Alexander Schwarz, from the Styrian Economic Development Corporation, interviewed in February 2021.
20. According to the OECD definition, public-private-partnerships can be defined as "long term contractual arrangements between the government and a private partner whereby the latter delivers and funds public services using a capital asset, sharing the associated risks" (OECD 2012).

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Annex

Table A1. List of the 128 sample GVC agencies.

Country	GVC agency name	Foundation year	Regional agency	Direct GVC initiatives	Indirect GVC initiatives
Austria	Austria Wirtschaftsservice Gesellschaft mbH (aws)	2002	no	x	x
	Kärntner Betriebsansiedlungen & Beteiligungen (Babeg)	1981	yes	x	
	Kärntner Wirtschaftsförderungs Fonds (KWF)	1993	yes	x	
	OÖ HightechFonds GmbH	2011	yes	x	
	Steirische Wirtschaftsförderungsgesellschaft mbH (SFG)	1991	yes	x	
	Tecnet Equity NOE GmbH	2002	yes	x	
	Wirtschaftsagentur Burgenland GmbH	1994	yes	x	
Belgium	Finance.Brussels/Brustart	1998	yes	x	x
	Limburgse Investeringsmaatschappij LRM NV	1994	yes	x	x
	Noshaq EUROPE 3 S.A.	2017	yes	x	
	ParticipatieMaatschappij Vlaanderen NV (PMV)	1995	yes	x	x
	SFPI-FPIM & PMV (Belgian Growth Fund)	2018	no		x
	Société de Développement et de Participation du Bassin de Charleroi (SAMBRINVEST)	1985	yes	x	x
	Société Fédérale de Participations et d'Investissement (SFPI-FPIM)	2006	no	x	x
	Société Régionale d'Investissement de Wallonie (SRIW)	1979	yes	x	x
	Société wallonne de financement et de garantie des PME (SOWALFIN)	2002	yes	x	
Denmark	Innovationsfonden/Innovation Fund Denmark	2014	no	x	
	Vaekstfonden/The growth fund	1992	no	x	x
Finland	Sitra (The Finnish Innovation Fund Sitra)	1986	no	x	x
	Tekes/Business Finland Venture Capital Oy (BFVC)	2014	no		x
	TESI/Finnish Industry Investment Ltd (FII)	1995	no	x	x
	The Finnish Climate Fund (ex The Finnish State Development Company Vake)	2016	no	x	x
France	Bpifrance Participations	2013	no	x	x
	Nord France Amorcage SASU	2013	yes	x	
	Normandie Participations (subsidiary of AD Normandie)	2016	yes	x	x
	Région Bourgogne-Franche-Comté	1998/2004	yes	x	
	REGION BRETAGNE	2004	yes	x	
	Région Occitanie/Pyrénées-Méditerranée	1994	yes		x
	Région Sud Investissement (RSI)	1999	yes	x	
Germany	Bayern Kapital (subsidiary of LfA Förderbank Bayern)	1995	yes	x	
	Beteiligungsfonds Wirtschaftsfoerderung Mannheim GmbH (BWM)	2011	yes	x	
	BMT Beteiligungsmanagement Thüringen gmbh	2003	yes	x	
	Brandenburg-kapital	1993	yes	x	
	Coparion	2016	no	x	
	Hannoverimpuls GmbH (Hanover business promotion)	2003	yes	x	
	High-Tech Gründerfonds (HTGF)	2005	no	x	
	IBB Beteiligungsgesellschaft	1997	yes	x	
	IBG Beteiligungsgesellschaft Sachsen-Anhalt mbH	1991	yes	x	
	IFB Hamburg	1953	yes	x	
	Kapitalbeteiligungsgesellschaft NRW	1975	yes	x	
	KfW Capital (subsidiary of the KfW group)	2018	no	x	x
	Kreditanstalt für Wiederaufbau (KfW)	1948	no	x	x
	LBBW Venture Capital GmbH	1999	yes	x	
	LfA Förderbank Bayern	1951	yes		x
	LfA Gesellschaft für Vermögensverwaltung (subsidiary of LfA Förderbank Bayern)	1999	yes	x	x

(*Continued*)

Table A1. (Continued).

Country	GVC agency name	Foundation year	Regional agency	Direct GVC initiatives	Indirect GVC initiatives
	Mittelständische Beteiligungsgesellschaft (MBG) Bremen/Bürgschaftsbank Bremen	1998	yes	x	
	Mittelständische Beteiligungsgesellschaft (MBG) Baden-Württemberg	1972	yes	x	
	Mittelständische Beteiligungsgesellschaft (MBG) Berlin-Brandenburg mbH	1992	yes	x	
	Mittelständische Beteiligungsgesellschaft (MBG) Hamburg (BTG)/BTG Beteiligungsgesellschaft Hamburg mbH	1978	yes	x	
	Mittelständische Beteiligungsgesellschaft (MBG) Hessen/BmH Beteiligungs Managementgesellschaft Hessen mbH	2001	yes	x	
	Mittelständische Beteiligungsgesellschaft (MBG) Mecklenburg-Vorpommern	1993	yes	x	
	Mittelständische Beteiligungsgesellschaft (MBG) Niedersachsen	1991	yes	x	
	Mittelständische Beteiligungsgesellschaft (MBG) Rheinland Pfalz	1987	yes	x	
	Mittelständische Beteiligungsgesellschaft (MBG) Sachsen	1992	yes	x	
	Mittelständische Beteiligungsgesellschaft (MBG) Sachsen-Anhalt	1992	yes	x	
	Mittelständische Beteiligungsgesellschaft (MBG) Schleswig-Holstein mbH	1994	yes	x	
	Mittelständische Beteiligungsgesellschaft (MBG) Thüringen mbH	1993	yes	x	
	NRW Bank (Foerderbank NRW)	2002	yes	x	x
	Saarländische Investitionskreditbank AG	1951	yes	x	
	Sächsische Beteiligungsgesellschaft mbH	1997	yes	x	
	Technologiegründerfonds Sachsen Management GmbH & Co. KG	2008	yes	x	
	WMS Management GmbH & Co. KG	2005	yes	x	
Ireland	Dublin Business Innovation Centre (Dublin BIC)	1988	no	x	
	Enterprise Ireland	1998	no	x	x
	Ireland ubsidiar Investment Fund (ISIF)	2014	no	x	x
	Western Development Commission (WDC)	1977	yes	x	
Italy	CDP Venture Capital Sgr – Fondo Nazionale Innovazione	2019	no	x	x
	Finanziaria Regionale Abruzzese S.p.A (FI.R.A)	1987	yes	x	
	Fincalabra	2007	yes	x	
	Finlombarda Gestioni SGR	2001	yes	x	x
	Finpiemonte	2007	yes		x
	Fondo Italiano di Investimento (FII SGR)	2010	no	x	x
	Fondo Italiano per l'Efficienza Energetica SGR S.p.A.	2016	no	x	
	Fondo Strategico Italiano (FSI SGR)	2016	no	x	
	FVS SGR S.p.A (controllata interamente da Veneto Sviluppo)	2006	yes	x	
	Gepafin, Società finanziata dalla Regione Umbria	1987	yes	x	
	Invitalia	1999	no	x	
	Invitalia Venture	2015	no	x	
	Lazio Innova	2013	yes	x	x
	LigurCapital/Gruppo FILSE	1989	yes	x	
	Puglia Sviluppo	.	yes	x	
	Società Finanziaria Regione Sardegna S.p.A.	1993	yes	x	
	Sviluppo Basilicata	2016	yes	x	
	Veneto Sviluppo	1979	yes	x	
Nether-lands	Brabantse Ontwikkelings Maatschappij NV (BOM Brabant Ventures)	1983	yes	x	x
	Energiefonds Overijssel	2007	yes	x	

(*Continued*)

Table A1. (Continued).

Country	GVC agency name	Foundation year	Regional agency	Direct GVC initiatives	Indirect GVC initiatives
	Horizon Flevoland	1996	yes	x	
	Impulse Zeeland	2015	yes	x	
	Innovation Quarter (Participatiemaatschappij InnovationQuarter BV)	2014	yes	x	x
	Invest NL	2020	no	x	x
	LIOF NV (NV Industriebank Liof)	1975	yes	x	x
	Municipality of Amsterdam	2013	yes	x	
	NV NOM (Investment and development company for the Northern Netherland)	1975	yes	x	x
	Participatiemaatschappij Oost Nederland NV (PPM Osst)	2003	yes	x	x
	RVO	2014	no	x	x
	The Netherlands Investment Agency (NIA)	.	no		x
	The province of Fryslân	1996	yes	x	
	The Province of Limburg	2012	yes	x	
	The province of Noord-Holland	2007	yes	x	
	Utrecht ROM	2020	yes	x	
Spain	Agencia de Innovación y Desarrollo de Andalucía (IDEA) – Inversión, Gestión y Desarrollo de Capital Riesgo de Andalucía	1987	yes	x	x
	AXIS Participaciones Empresariales, S.G.E.I.C, S.A.	1986	no	x	x
	Centro para el Desarrollo Tecnologico Industrial (CDTI)	2015	no		x
	Compañía Española de Financiación del Desarrollo (COFIDES)	1991	no	x	
	Extremadura Avante Inversiones (antes Sociedad de Fomento Industrial de Extremadura)	2010	yes	x	
	Grupo SPRI, Gestión de Capital Riesgo del País Vasco, S.G.E.I.C, S.A.	1985	yes	x	
	INNVIERTE Economia Sostenible (ubsidiary of CDTI)	2012	no	x	x
	Institut Catala de Finances (ICF)	1985	yes	x	x
	Navarra tech Transfer	2017	yes	x	
	Seed Capital de Bizkaia, S.G.E.I.C, S.A.	1989	yes	x	
	SEPIDES Gestión SGEIC, S.A.	2005	no	x	
	Sociedad de Desarrollo de las Comarcas Mineras S.A (SODECO)	1988	yes	x	
	Sociedad de Desarrollo de Navarra, SA (SODENA)	2011	yes	x	x
	Sociedad de Desarrollo Económico de Canarias, S.A. (SODECAN)	1977	yes	x	
	Sociedad para el Desarrollo Industrial de Aragón, S.A.	1983	yes	x	
	Sociedad para el Desarrollo Industrial de Castilla-La Mancha S.A. (SODICAMAN)	1983	yes	x	
	Sociedad Regional de Promoción del Principado de Asturias, S.A. (SRP)	1984	yes	x	
	Start up Capital Navarra	2000	yes	x	
	XesGalicia, S.G.E.I.C, S.A.	1999	yes	x	x
Sweden	ALMI Invest AB	2009	no	x	
	Industrifonden	1979	no	x	
	Inlandsinnovation	2010	yes	x	x
	Partnerinvest Norr/owned by Almi Invest	2010	yes	x	
	Saminvest	2016	no	x	x
	Swedish Agency for Economic and Regional Growth	1994	no		x
	Vinnova (Swedish agency for innovation)	2001	no	x	