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Improving access to finance for young innovative enterprises with growth potential: evidence of impact on firms' outputs

Part 1. Equity instruments: lessons learned from policy evaluations

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Foreword

Drawing on available academic literature and policy evaluation studies, the report aims to identify the impact of public support through equity instruments on firm performance, measured by growth in employment, turnover and innovative activities. It also puts forward main lessons on policy design and implementation. It employs a mixed-method approach based on evaluation synthesis.

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Executive summary

Drawing on available academic literature and policy evaluation studies, the report aims to identify the impact of public support through equity instruments on firm performance, and puts forward main lessons on policy design and implementation. It employs a mixed-method approach based on evaluation synthesis (Edler et al. 2008).

Key findings

1. Outcomes

- ✓ **High-growth potential firms**, which receive public funding in the form of equity, experience stronger **increases in employment and turnover** compared to the control groups.
- ✓ The employment growth rate oscillates from 50% to 145% and turnover from 125 and 800% (post-treatment), both are significantly higher compared to the untreated groups.
- ✓ The firm **profitability** declines in the beginning, with progressive growth after 3-4 years.
- ✓ Most of the **available evidence** exists for **early stage investment** where public support is concentrated.
- ✓ The effects are **highly concentrated**, with the top 5-15% of supported firms absorbing the vast majority of generated returns.
- ✓ The majority of the national and regional equity measures achieve **medium to high** private investment **leverage** levels (2 to 3), with **minimal** or zero **crowding out** effects.
- ✓ **Equity is a good instrument** for firm growth but does **not** necessarily impact companies' **innovation performance**.
- ✓ Venture capital acts as a **facilitator for the commercialisation** of already developed innovations mainly through provision of finance, but also through partner networks and opening up of different channels of commercialisation.
- ✓ The outcomes are **heavily dependent** on the **number** and **quality** of **companies** available to invest in and therefore on the general **innovativeness** of the **regional** or **national economy**.

2. Design and implementation.

- ✓ **Syndication of funds** with a leading role of the private sector (as opposed to government funds only).
- ✓ Provision of **long-term investments** encompassing longer time spans and/or longer perspectives with less pressure on exits to achieve better outcomes in terms of employment and turnover growth.
- ✓ **Intervening both at the early and growth stages** while making the intervention **more flexible at the margins** (i.e. allowing for some investments just under/over the equity gap).
- ✓ **Delivering added value services** (e.g. networking and coaching) to the companies and ensuring that the fund is assisted by **skilled professionals**.
- ✓ **Flexible geographical boundaries together with larger size funds** to enable a diverse portfolio of investments and sufficient funding for follow up rounds of financing.
- ✓ **Extending the indicators of success**, beyond leverage effect, exits and fund profitability towards a closer examination of the effects on employment and turnover as well as the assessment of **larger socio-economic benefits**.

The measures reviewed in this report form only a **subset of a larger portfolio of policy measures** required to provide companies with a set of funding opportunities to adequately fund their innovative ideas (with an important role of private capital). A complementary set of **soft measures** include nurturing the entrepreneurship capacity of innovators, providing them with the necessary skills, and fostering contacts with academia and other networks.

1. Introduction

There has been a growing interest in policies supporting high-growth innovative enterprises (HGIEs) which are seen as important contributors to job creation and enhanced productivity growth (Hölzl 2016, Praag and Versloot 2008, Aghion et al. 2007). The recent years have seen the introduction of EU funding schemes supporting innovative firms through direct grants, loans, guarantees, and equity funding. The Start-up and Scale-up Initiative includes, among others, changes to venture capital regulations, the creation of a pan-European venture capital fund of funds, and technical assistance for the Member States in this area. The Horizon 2020 SME Instrument and the Fast Track to Innovation Pilot also aim at providing innovative firms a faster access to public funding.

There is evidence that innovative firms not only grow twice as much as their non-innovative counterparts in terms of employment and sales but also faster growing firms continue to innovate providing impulses to rejuvenate the economy (Nesta 2009). This may be, in part, due to their absorptive/learning capacity (Jovanovic 1982, among others) and intensive R&I activities (see, e.g., Acemoglu et al. 2013).

However, according to a recent study by the EIB (2016), a significant proportion of KETs (key emerging technologies) companies, including innovation leaders with a documented solid growth, find it hard to raise the capital needed to expand. Thus, while there is evidence that high-growth innovative firms can be catalysts for aggregate economic growth, their capacity to grow is highly dependent on the access to financial resources.

The JRC report *Improving access to finance: which schemes best support the emergence of high-growth innovative enterprises?* (Gampfer et al, 2016), of which this study is a follow up, gives a broad description of the set of strategies for external financing employed by high growth innovative enterprises. In brief, the HGIE rarely utilise internal financing given their financial constraints (Mas-Tur and Ribeiro Soriano 2014, Wang 2014), consequently seeking external financing in the form of debt and equity. Yet, the literature shows that young innovative companies are often denied access to bank loans due to a lack of collateral (Hall and Lerner 2009, Audretsch and Weigand 2005, Carpenter and Petersen 2002). The existence of information asymmetries, often because of their typically high technological profile, makes access to funding more difficult. Those companies therefore tend to seek more risky forms of finance, such as venture capital.

Public interventions therefore aim at facilitating the access to finance of young innovative firms through a number of instruments ranging from grants, loans and loan guarantees to equity instruments. However, questions arise as to the distinction between general innovation policies, SME policies that also target non-innovative SMEs, and industrial policies with a specific sectoral focus. HGIE policies are often at the intersection of the above. What is more, in the case of the supply of equity funding, the intervention is complementary to the existing services being provided by private actors.

In this report, we focus on equity instruments that are aimed specifically at young innovative companies with growth potential. We however understand that our study does not cover all the possibilities of external financing that are open to those companies. In fact only a very small percentage of companies look for equity as a source of financing. According to Puri and Zarutskie (2011) using US Census data only 0.11% of companies established between 1981 and 2005 were supported by venture capital, while other studies report similar proportions oscillating around 1% of companies. Yet, many studies claim that those companies account for a much higher share of employment. Puri and Zarutskie (2011) estimate them at 5.3%-7.3% of the share of total US employment. Importantly, equity is rarely the first choice of those companies, fitting better only those firms with higher R&D intensity and higher risk profiles (OECD 2015, Gampfer et al. 2016). Only about 6% of small firms use equity finance (European Commission 2015). Some studies (Amit et al 1990, Norton 1991) claim that VC funding may be a last resort and not the preferred choice as that would involve partial loss of control. Other studies stress the value adding services (e.g. expertise, contacts) behind the choice of VC over

bank funding (Ueda 2004, Hellman and Puri 2002). The literature, however, is not very forthcoming on the entrepreneurs' choice between different sources of funding.

The availability of funding for young innovative companies depends heavily on their stage of development. Public funding sources dominate at the conception/idea stage while private venture capital tends to target later stages of the companies' development as focusing on later-stage companies can be more cost-effective given the higher availability of information (De Prato, Nepelski, Piroli 2015, Kraemer-Eis et al 2016) leading to a private funding gap at the early stages of technology development. The second gap appears at the later stage where firms are preparing for growth. Recent surveys confirm that this gap is the biggest financial obstacle for start-ups to scale up in Europe (European Commission 2016). Recently, governments have responded to the market failure (funding gaps) by developing financial instruments aiming at the early stage and growth stage of companies through loan guarantees, public equity instruments, syndicated loans or capital market regulation provisions (see Figure 1).

Figure 1. Types of public support instruments.

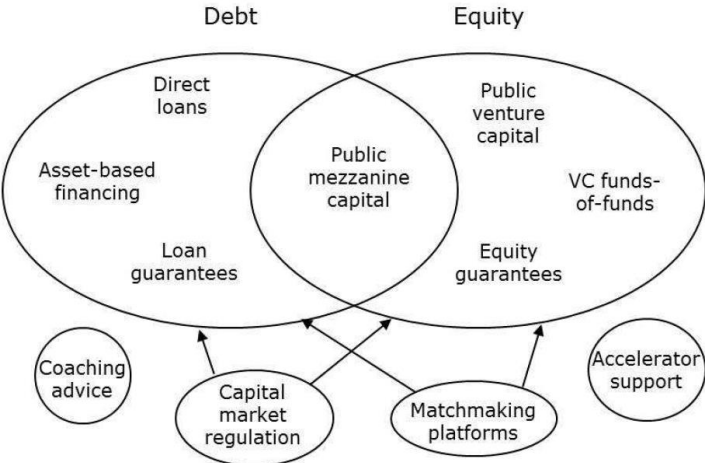


Figure 1 After Gampfer et al, 2016

Those policies aim to respond to the supply side of the issue by ensuring that the companies have access to capital through equity markets. However, in order to see the full funding escalator that HGIE companies utilise, i.e. access to finance at all stages of company development (Nesta 2009), there is a need to look at the wider spectrum of instruments that also support the emergence of those companies bringing them to the growth stage. These complementary instruments are analysed in the forthcoming JRC reports on tax incentives for young companies and the use of grants aimed at growth and internationalisation.

With respect to government VC support (the main focus of this study), this report distinguishes between several types of policy measures - tax credits to VC firms, matching/co-investment/hybrid funds that increase capital commitments such as fund-of-funds (indirect funding) and direct government ownership of VC funds (direct funding).

This report examines the output additionality (i.e., share of the firms' output that can be attributed to the public support, measured by firms' growth in terms of employment, turnover or innovative activities) of public equity instruments for young innovative companies with growth potential in 8 EU Member States that have a relatively advanced public support system: Austria, Belgium, Denmark, Ireland, the Netherlands, Finland, Germany, and the United Kingdom.

This study is an elaboration and expansion of the [JRC study](#) on equity public policies published in 2016 (Gampfer et al. 2016). Using the most relevant and recent literature, the study investigates the impact of those policy measures on companies' performance and derives lessons learnt from the evaluations.

The project is part of a larger project exploring HGIE and scale-up company access to funding carried out jointly by JRC's Unit for Finance, Innovation and Growth, and the Units for Territorial Development and Digital Economy.

After a brief discussion of the conceptual background for this study, Section 2 introduces our methodological approach and discusses some of the limitations of our research. Section 3 elaborates on the results of academic literature and policy evaluations. Finally, section 4 formulates some key takeaways and section 5 discusses policy implications.

1.1 Equity support instruments – definitions and classification

Equity finance is a means to raise capital by issuing "shares" in one form or another, i.e. investors acquire an ownership interest in the company. Equity can be raised from a variety of sources, which generally differ according to the size of the individual investments: from informal business angels who contribute a few thousand euros, over more professional business angel networks, venture capital firms and funds, large private equity investors, to initial public offerings (IPOs) on stock markets.

The types of public policy instruments available on the equity side include:

- Direct provision of venture capital:
 - **Public venture capital funds directly investing in companies** (i.e. investment decisions are made by public officials), usually alongside a private co-investor. The private co-investors might be granted preferential tax treatment on their capital gains or they could be protected from losses through downside guarantees.
- Indirect provision of venture capital:
 - **Public funds invested in private VC funds (hybrid VC).**
The term "hybrid fund" has been used in the literature to describe equity investment schemes that are government backed. Public funding is only used to leverage private investment. The investment decisions are taken by the private actors but the government sector may influence private funds' actions through guidelines or conditions governing investment criteria or individual deals. Public officials sit in the management boards of the private funds. One of the most common vehicles of indirect support is the **fund-of-funds** instrument whereby public funds-of-funds invest in private VC funds.
- **Equity guarantees or government-backed loans** to finance VC:
 - Governments loan money to private financial intermediaries (funds or banks) to finance their VC investments, or issue guarantee such investments by covering potential losses to a certain extent and up to a defined limit.

2. Methodological Framework

2.1 Research Design

The empirical research for this study comprises 34 academic articles and policy evaluation reports of public equity instruments implemented in 8 countries with an advanced public support system over the last twenty years. In this report we adopted Edler et al. (2008)'s approach of *evaluation synthesis*. It predominately relies on qualitative analysis of existing impact evaluations and interpreting the research findings taking into account differences in policy contexts and methods. The key aim of this useful framework of analysis is to address issues of validity and to enhance the robustness and the quality of the research.

2.2 Research Methods

Policy evaluations are most often the assessments of a single instrument in a specific context of implementation. Yet, by combining insights from several evaluations it is possible to go beyond the specificity of the case study and derive more general lessons learnt as previously done in R&I policy (Edler et al, 2008; Gök and Edler, 2012) as well as in other areas (e.g. education, development aid or health). The growing literature is exploring the dispersed yet valuable body of evidence available in policy evaluations in order to analyse the impact of public policies (Edler et al, 2012; Gok and Edler, 2012, NESTA Compendium of Evidence of Impact with particular reference to Ramlogan and Rigby, 2013).

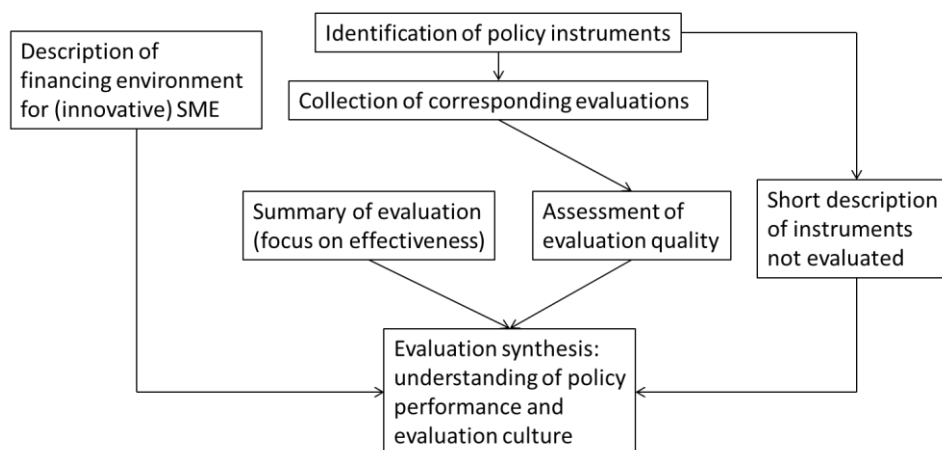


Figure 2 Methodological approach of the study

Our identification of policy instruments was based on Scopus database searches, contacts with national experts in each country (members of the [Research and Innovation Observatory network](#)), our own desk research and the use of the [SIPER database](#).

The policy measures in all Member States were identified and classified according to the type of interventions, investment stage and beneficiaries. In order to gauge the effectiveness of each of policy measure, we collected the evaluation studies along the "output additionality" dimension, rather than the "input" or "behavioural additionality". The "output additionality" approach addresses the effects of policy measures on the output of firms, measured by innovation activities, employment growth and firm performance.

2.3 Research Limitations

Given the ex-post definition of high-growth firms and difficulties with their sampling, in this report we refer to the group of "young innovative companies with growth potential" to depict a heterogeneous, dynamic and yet recognisable group of innovative SMEs. The majority of R&I schemes target innovative SMEs, young innovative companies or fast growing firms with different inclusion criteria ranging from simple caps on revenue, through employment and age criteria, R&D intensity, growth stage and international market expansion to specific sector/technology focus. In our analysis we present those different targets showing the wide heterogeneity of policy options applied in the EU Member States.

The evaluations used in this study vary considerably in their design, nature and the input and output variables they use. The study is therefore limited in providing a robust comparison of their outputs. Firstly, the use of different output indicators and its subsequent reporting that differs in granularity makes it difficult to compare instruments; secondly, the instruments differ in the way they are being set up and implemented which further hinders comparability of results. Finally, most of the evaluations are not controlling for multiple simultaneous treatment effects and therefore the attribution of the effect is problematic. In the venture capital funding case where firms go through multiple rounds of funding coming from public and private funds, this is even more problematic.

Still, given the scarcity of literature on the impact of government-backed venture capital policies, the existing evaluations provide an interesting and valuable material to study and to attempt to come up with some policy implications.

3. Results

In our study we have focused on measures that have been sufficiently studied to be able to draw robust conclusions on their impact. As the policy arena is quite dynamic, a few of the measures examined have been modified and no longer exist in the same form or with the same name.

There is an administrative difficulty in targeting high growth innovative companies given that their growth can only be defined ex-post and current growth (given its non-linear curve) is not a good predictor of future growth. Yet the equity measures explicitly target companies motivated to grow and with growth potential and therefore by definition are targeting potential high growth companies usually from innovative sectors.

Nevertheless, there is not a large body of evidence demonstrating in a systematic way that the targeted support is delivering results therefore our study is aimed at filling this gap by examining a large sample of equity support policies.

Our evidence base comprises of 34 sources, including 16 academic articles and 18 evaluation reports using mixed methods.

Table 1 Evidence base of the study

	Comparison between public and private	Public instruments
Academic articles	7	9
Evaluation reports		18

Therefore the results section focuses on the effects of equity and is presented in several sub-sections focused on investigating the impact of those instruments on firm employment, sales and innovation (measured most often by patent applications or patent counts but also by patent citation). In each sub-section, we provide evidence from both academic and policy evaluation studies addressing the question: what are the effects of policy instruments aimed at supporting high-growth firms on a set of output variables: employment, innovation, and high-growth firm performance?

The methodology applied uses a systematic review of empirical evidence on high-growth innovative firm output additionality. We then focus the comparison of the effects of government-backed versus private venture capital on companies' growth and innovative activities as it is often contested whether government-backed VC can deliver the same results as independent (private) VC. Finally, we look at the available evidence on regional VC funds and their effectiveness compared to less geographically restricted support.

The below subsections present studies using both econometric methods exploring the effects on firm output (such studies are quite rare) and other studies investigating these effects using descriptive statistics and qualitative methods (interviews, case studies, etc.).

The recent literature (Helleman et al. 2017 and overview of literature by Da Rin et al. 2011) points to the dearth of studies exploring the role of government policies supporting venture and more broadly equity investments beyond comparing the independent venture capital (IVC) and government-backed venture capital (GVC) efficiency. Most of the literature explores the impact on exits, IPO and leverage effects whereas studies looking at output effects on companies such as growth and employment are still rare. There is therefore a need to explore the limited evidence available from the evaluation of existing measures. Whereas there seems to be a consensus that a syndication of independent and government investments has positive effects both on exits and sales growth and that government is an indispensable actor to set out a vibrant venture capital market (Lerner 2009), there are other lessons learnt from the policy evaluations that could help to design good instruments of government-backed VC instruments.

3.1 Impact of public equity support on employment

All of the evaluated public equity support policy instruments in our sample of countries have a **positive impact on job creation**. The only exception is the Austrian AWS SME Fund where a mixed effect on employment was observed (between a reduction by one quarter and an increase by one quarter of employees).

The exact effect on job creation varies across specific instruments but in general, in the cases when studies compare the employment effect of equity measures to a control group, the increase of employment is much higher for the supported firms than for the reference group (Table 2). For example, the evaluation of the Flemish Business Angels Networks the BAN-backed companies created on average 0.52 full-time equivalent (FTE) per year compared to a loss of 0.18 FTE per year for the companies not backed by BAN.

The difference in employment growth rates between the treatment and the control group in the studies we examined varies between 22% for the German High-Tech Gründerfonds and 400% for the Enterprise Capital Funds in the UK.

Other evaluations simply report the total number of new jobs created and/or maintained or the rate of total employment growth which varies between 10% and 100% (Table 3).

As far as the cost-benefit analysis is concerned, based on the information provided in some evaluation studies on total instrument budgets and total number of jobs created, we computed the costs of the instrument per job created or maintained. The range

reported is between 38,000 (FII in Finland) and 75,000 euros (DGF equity investments in Denmark).

Some evaluations (BIS 2011) point out the uneven distribution of employment growth within the group of supported firms. This skewed distribution has impact on the way we interpret the data, given that analysing the average outputs may be misleading. For example, while the overall growth rate for UKHTF supported companies is 10%, two businesses funded by UKHTF cited an increase of over 100 employees. It is therefore of paramount importance to look into those most successful examples to understand better under which conditions the schemes bring the positive and very high results.

Those strong results should also be cautioned by the fact that the investments were made in very early stage ventures so that the employment started from a very low base. Indeed, when comparing two Austrian schemes, the one targeted at start-ups (AWS Start-Up Fund) exhibits a much more pronounced job creation effect than the scheme targeted to more established SMEs (AWS SME Fund).

One evaluation in the UK (Baldock and Mason 2015) points out an important spillover effect which is not always accounted for when estimating the total employment effects of equity support measures, namely the considerable generation of contract employment.

Finally, tax incentives for VC (Venture Capital Trusts and Enterprise Investment Scheme in the UK) seem to have the least pronounced employment promotion effect.

Table 2 Effect of public equity instruments on firm employment: evidence from studies using control groups

Study	Methodology	Country	Programme/instrument	Investment size	Investment stage	Type of equity	Employment growth rate
Baldock (2016)	Survey, interviews, performance indicators	UK	Enterprise Capital Funds	Sub-£2m	Early stage	Hybrid VC	85% increase (control group: 22%)
Forfas (2012)	Desk research (review of application files), interviews	IE	Innovative High Potential Start-Ups Fund	Max €1m	Early stage	Hybrid VC	Between 50 and 145% increase per supported plant (control group: decrease of 10.9%)
Technopolis (2016)	Comparison of survey results from funded firms with a control group of applicant firms that did not accept funding	DE	High-Tech Gründerfonds	€0.5 – 2m	Early stage	Hybrid VC	Average annual growth rate 50% (control group: 41%)
ZEW (2016)	Survey (comparison of matched control groups), interviews	DE	INVEST	Max €1m per year per company	Early stage	Tax incentive for BAs	Difference of +0.27 with the control group
Cowling et al. (2008)	Quantitative panel analysis	UK	Venture Capital Trusts and Enterprise Investment Scheme	£200k – £1m	Early stage	Tax incentive for VC	Negligible effect on job creation (regression coefficient $3e^{-7}$)
Collewaert et al. (2010)	Regression analysis	BE	Direct subsidy to Business Angels Networks in Flanders	€150k per deal	Early stage	Direct subsidy for BAs (50% of operating costs)	0.52 FTE per year compared to the control group of non-BA backed companies -0.18 FTE.

Table 3 Effect of public equity instruments on firm employment: evidence from policy evaluations without a control group

Study	Methodology	Country	Instrument	Investment size	Investment stage	Type of equity	Employment growth rate	Funding per job created and/or maintained
DAMVAD (2013)	Input-output tables, survey, interviews	DK	Danish Growth Fund direct and indirect investments	€0.5 - 5m (early stage) €5 - 25m (late stage) €25- 65m (buyout stage)	Early and growth stage	Direct VC, hybrid VC /FoF	7,236 new jobs (2000-2012)	€75 000
Vækstfonden (2015)	Descriptive statistics, interviews	DK	DGF Syndicated Loans	€1m	Early stage	Syndicated loans	502 new jobs (2011-2014)	€40 000
Ramboll (2011)	Survey, quantitative panel analysis	DE	ERP Start Fund	€0.5 - 5 m	Early stage	Hybrid VC	8 new jobs created and 10 existing jobs secured per company (2006-2010)	€42 000 - €55 000
Saarikoski et al. (2014)	Interviews, performance indicators	FI	Finnish Industry Investment	€0.5- 5m (early stage) €5- 15m (growth stage)	Early and growth stage	Direct VC and hybrid VC/FoF	3,834 new jobs (2008-2012)	€38 000
Technopolis (2013)	Interviews, focus groups, performance indicators	NL	Technopartner Seed Facility	€100k - 2.5m	Early stage	Subordinated loans to private VC	2,144 FTE jobs created	€50 000
BIS (2011)	Desk research (review of programme documentation), interviews	UK	UK High Technology Fund	£7m on average	Early and growth stage	Fund of funds	10% growth	

Baldock and Mason (2015)	Survey, interviews	UK	Enterprise Capital Funds	Sub-£2m	Early stage	Hybrid VC	More than 100% growth Considerable contract employment generation – 203 jobs since funding, majority of the jobs in the UK	
			Angel Co-Investment Fund		Early stage	Syndicated investments with Business Angels	100% growth (in 2 years' time) Parallel growth in contract labour	
Nesta (2009)	Desk research, interviews	UK	Overview of several university and regional funds (EGF, RVCF, SEF, UCF, WF)	Mostly under £200k	Early stage	Direct and hybrid VC	1,407 additional jobs (1.8 extra jobs per firm)	
PWC and ZSI (2017)	Desk research (review of application files), survey, interviews	AT	AWS Business Start-Up Fund	€100k – 3m	Early stage	Hybrid VC	33% growth	
			AWS SME Fund	€300k – €5m	Early and growth stage		Fluctuating between 25% growth and 25% decline	

3.2 Impact of public equity instruments on firm performance

One of the primary goals of equity support instruments is to foster the economic performance of beneficiary companies in terms of turnover/revenue growth¹. According to the examined evaluation reports, **all but two support instruments led to high turnover growth** - Germany's INVEST programme where supported companies were found to have a lower turnover than the reference group and UK's Regional Venture Capital Fund where a decrease in sales by an average of £0.5m was observed.

A thorough comparison of the economic performance effect of the policy measures is difficult to make since various evaluation reports apply different indicators (total revenue growth, turnover per employee growth, implied share of revenue growth) and focus on time periods with different length (1 to 5 years). Nevertheless, in the few cases where turnover growth is expressed in percentages and is compared to a control group, one can notice a significant difference between supported and non-supported companies (Table 4) except in the case of the German High-tech Gründerfonds where the growth rates of the two groups are similar and very high (800%). This is due to the control group construction approach – the control group comprises companies which were approved for Gründerfonds funding but instead chose to seek funding elsewhere.

As far as the magnitudes of turnover growth are concerned, they are in all cases quite high, indicating that indeed equity financing is geared towards companies with high growth potential.

What stands out in the evaluation literature is the observed **concentration of impact** on economic performance. For example, for the Irish High Potential Start-Ups Fund 10-15% of all firms deliver the vast majority of returns. Similarly, the Finnish Industry Investment direct equity investments evaluation points out that the growth impact is highly polarised - growth is coming from the top-5 companies in the sample. This is in line with the literature providing evidence of the high risk of venture capital investments and the heavy tailed distribution of revenue (Ghosh and Nanda, 2010). Even if it is not uncommon for the public support schemes that the outcomes are skewed towards a handful of high performers, two implications should be made. First, that the results should be studied in more detail since the averages are not very meaningful, secondly the use of case studies of those highly affected and unaffected firms can give a good understanding of conditions for the success of a given measure.

In addition, an Austrian evaluation (PWC and ZSI, 2017) distinguishes the results between start-ups and SMEs in the expansion phase showing that the turnover growth of younger beneficiary companies (supported by the Start-up Fund) is four times higher per annum than the turnover growth of expanding SMEs (supported by the SME Fund). The BIS (2011) evaluation of UK High Technology Fund of Funds (UKHTF) and the Bridges Fund (the programmes targeted the existing equity gap in high tech and improving access to finance in deprived areas respectively) also reports positive impact on turnover but the findings should be read with caution given the high proportion of start-ups and early stage businesses. Still, it should be noted that the investments in businesses at more mature stages delivered higher turnover increases in absolute terms. The study attributes part of the lack of turnover growth for some of the companies funded by UKHTF to the early stage technology development (still very far from the market) and effects of the 2009 recession. What is more, the Bridges impact on turnover is characterised by high attribution (the proportion of the effect on the company that can be attributed to the instrument effect) given low availability of other investment possibilities. The UKHTF is characterised by lower attribution given the fact that the companies went through several funding rounds after and/or before the UKHTF funding.

¹ Alternatively, in times of economic difficulty, or in regions affected by economic downturn, it may be intended as a mean to promote firm survival through provision of finance.

As far as sales growth is concerned, the UK evaluation of BIS equity funds brings differentiated results with the Regional Venture Capital Funds resulting in contraction of sales on average by £0.5m and the other instruments – UK High Technology Fund and the Venture Capital Trust bringing sales increases of £1.4m and £4.6m respectively.

As mentioned already above, the problem of attribution in case of venture capital is acute. The evaluation of the VCT suggests that the large increases may be due to firms receiving other co-investments at the same time (Cowling et al. 2008) and cannot be attributed fully to the VCT. Moreover, a separate evaluation of the VCT finds that the independent effect of the VC tax incentive on sales turnover is relatively small (Cowling et al. 2008).

In terms of profitability, the studies find that it is often negative in the beginning (right after the support) but then it progressively increases, usually after 3-4 years (Nesta 2009, Cowling et al. 2008). A similar observation is made about the Austrian AWS SME Fund where there is a slight decline in EBITDA of the beneficiary companies. The reason for the initial decrease in profits lies within the firms' growth process itself – an expansion is accompanied by higher capital expenditure (CAPEX) i.e. high investment costs into (new) products or services which decrease the firms' profitability in the short run (PWC and ZSI, 2017). Finally, the results of the evaluation of the Flemish subsidy for Business Angels Networks show similar story but using the return on assets indicator. The companies backed by BANs showed negative ROA till the fourth year after backing, contrary to non-backed companies whose ROA was positive.

Table 4 Effect of public equity instruments on beneficiary firm's economic performance: evidence from studies using control group

Study	Methodology	Country	Programme/instrument	Investment size	Investment stage	Type of equity	Turnover/revenue/sales growth/return on assets
Baldock (2016)	Survey, interviews, performance indicators	UK	Enterprise Capital Funds	Sub-£2m	Early stage	Hybrid VC	170% increase of total turnover from the time of investment until 2014 (control group: 43% increase)
Forfas (2012)	Desk research (review of application files), interviews	IE	Innovative High Potential Start-Ups Fund (HPSU)	Max €1m	Early stage	Hybrid VC	125% of total turnover increase (2005-2010) 114.8% turnover per employee increase in supported firms vs 8.4% in all Irish firms surveyed (2004-2010)
Technopolis (2016)	Survey, interviews	DE	High-Tech Gründerfonds	€0.5 – 2m	Early stage	Hybrid VC	The same growth rate of both portfolio companies and control group (800%)
Collewaert et al. (2010)	Regression analysis	BE	Direct subsidy to Business Angels Networks in Flanders	€867 741k in 1999-2004, 50% of operating costs, €148000 per deal	Early stage: Business Angels	Business Angels Direct subsidy for BAN	ROA of backed companies is negative till 4 th year while a control group positive, ROA of companies backed through other channels also negative

Table 5 Effect of public equity instruments on beneficiary firm's economic performance: evidence from other studies

Study	Methodology	Country	Programme/instrument	Investment size	Investment stage	Type of equity	Turnover/revenue/sales growth
Vækstfonden (2015)	Descriptive statistics, interviews	DK	DGF Syndicated loans	€1m	Early stage	Syndicated loans	€23 million of total revenue increase (2011-2014)
Saarikoski et al. (2014)	Interviews, performance indicators	FI	Finnish Industry Investment	€0.5-5m (early stage) €5-15m (growth stage)	Early and growth stage	Direct VC and hybrid VC/FoF	€657 million implied share of revenues (2008-2012)
Technopolis (2013)	Interviews, focus groups, performance indicators	NL	Technopartner Seed Facility	€100k-2.5m	Early stage	Subordinated loans to private VC	€188 million of total turnover increase (2003-2011)
PWC and ZSI (2017)	Desk research (review of application files), survey, interviews	AT	AWS equity instruments	€100k - 5m	Early and growth stage	Hybrid VC	Varies between +4%-10% turnover growth per annum for the SME fund and +31%-44% per annum for the Start-up fund
Cowling et al. (2008)	Quantitative panel analysis	UK	VCT and EIS	£200k- £1m	Early stage	Tax incentive for VC	Small effect on turnover (regression coefficients between $4.8e^{-8}$ and $8.6e^{-8}$)
Baldock and Mason (2015)	Survey, interviews	UK	Angel Co-Investment Fund		Early stage	Syndicated investments with Business Angels	Aggregate turnover increasing by 60% since receiving funding in the previous 2 years
BIS (2011)	Desk research (review of programme documentation, interviews)	UK	UKHTF	£7m on average	Early and growth stage	Fund of funds	Increase in sales by an average of £1.4m
			VCT	£200k - £1m	Early stage	Tax incentive for VC	Increase in sales by an average of £4.6m
			RVCF	Max. £500k	Early stage	Syndicated investment	Decrease in sales by an average of £0.5m

3.3 Impact of public equity support on firms' innovation activities

The policy evaluations of equity support measures **do not always consider the impact of the incentives** on company **innovativeness** but in the cases that they do, they find that beneficiaries have **a high share of R&I activities, including R&D spending, patents, product and process innovations**. For example, between 50% and 93% of the beneficiaries of studied programmes introduced some form of product or process innovation (Table 6). In a Finnish accelerator scheme, only three supported firms had not introduced any new products or services (Autio et al. 2013).

The qualitative review of UKHTF and the Bridges Fund (BIS 2011) also supports the observation of a positive impact of VC investment on innovation, with a higher proportion of UKTF-funded companies attributing the introduction of new and improved products or services to the received funding (based on NAO survey from 2009 it was 75%). The Bridges Fund, having an objective of investing in disadvantaged communities, has been financing 'consumer champion' businesses i.e. offering value for money products and therefore has less impact on technology driven innovation, which is in line with the purpose of the fund – easing access to finance of entrepreneurs from disadvantaged communities.

The often observed technology focus of the support schemes means that the share of these innovative products or services in the total sales is high (e.g. 67% for the beneficiaries of the VC Technology Fund Berlin).

Comparative evidence with a control group is however largely missing from the policy evaluation literature. One exception is a Dutch evaluation (Ecorys 2016) which, by employing an econometric estimation, finds that funded firms are more likely by 1.6% to be innovative than non-funded firms. This difference is not very high and the observation is lent support by the evaluation of the German VC Technology Fund Berlin which notes that the percentage of supported companies that introduced new or improved products or services is only marginally higher than the German average.

However, the academic literature sheds more light on the impact of VC on firms' innovative activities, often using sophisticated econometric approaches (Table 7). Kortum and Lerner (2000), looking at a panel of 20 US manufacturing industries over thirty years, found that increases in venture capital activity in an industry are associated with significantly higher patenting rates. Their results suggest also that the VC impact on patenting has been higher than internal R&D funding. Popov and Roosenboom (2009) using the same methodology for European countries with an 18-country panel covering the period 1991-2004, estimate that private equity accounts for as much as 12% of industrial innovation. Da Rin et al. (2011) based on their literature review suggests that the highly selective process of VC has impact on the future innovative performance of companies and the funding helps them to commercialise their ideas. Yet, the impact is less prominent on the generation of further innovation than on the exploitation of ideas that lead to the investment decisions. Rigby and Ramlogan (2013) conclude that the link between venture capital and innovation cannot be established based on the evidence available and stress the need of exploring the effects on the commercialisation of innovation rather than on spurring innovation.

Table 6 Effect of public equity instruments on innovation: evidence from the evaluation studies

Study	Methodology	Country	Programme/instrument	Type of equity	Innovation performance
Baldock (2016)	Survey, interviews, performance indicators	UK	Enterprise Capital Funds	Hybrid VC	93% of funded firms introduced product or process innovations
Ecorys (2016)	Survey, interviews, performance indicators, econometric analysis	NL	Regional Development Agencies Capital Funds	Direct and indirect equity	Funded firms are more likely by 1.6% to be innovative than non-funded firms
ZEW (2016)	Survey, interviews	DE	INVEST	Tax incentive for BAs	Beneficiaries have a higher share of R&D activities (difference: 0.21) and a higher propensity to develop new products or processes
Meyer et al. 2013	Survey, interviews, performance indicators	DE	VC Technology Fund Berlin	Hybrid VC/mezzanine funding	Around 40% of funded companies introduced new or improved products or services (the German average is 39%)
Autio et al. 2013	Survey, interviews	FI	Vigo Accelerators	Accelerators	Only 3 supported firms haven't introduced any new products or services
Baldock and Mason (2015)	Survey, interviews	UK	Enterprise Capital Funds	Hybrid VC	75% of companies introducing new products, services, marketing and processes
			Angel Co-Investment Fund	Syndicated investments with BAs	50% introduced new or improved patents and copyrights

Table 7 Academic literature: impact of venture capital on companies' innovative activities

Study	Methodology	Country	Main results
Kortum and Lerner (2000)	reduced form regression, 20 manufacturing industries in the US	US	Venture capital accounts for 8% of industrial innovation in 1983-1992
Popov and Roosenboom (2009)	A panel of 21 countries (1991-2004) reduced form regression	EU	Private equity accounts for between 8% and 12% of industrial innovation since the early 1990s
Rigby and Ramlogan (2013)	Literature review	Worldwide	The link between venture capital and innovation cannot be established based on the evidence available.

3.4 Comparison of impact of government-backed and private venture capital on companies' growth and innovative activities

In the previous sections we found that government-backed VC investments have a positive effect on firm growth. In this section we provide evidence from the academic literature on the **comparison of the effects of government-backed and independent (private) venture capital investments** as it is an often discussed topic in the literature on financing high growth innovative companies.

Brander et al. (2010) discuss the difference in performance between government-supported VC firms (GVCs henceforth) and other types of i. GVCs are associated with lower performance, but when government invests alongside other VCs as a minority investor the effect becomes positive. Brander et al.'s (2015) international comparison shows that exit outcomes are better for mixed funding than purely private funding and when public finance and private venture capital are both present, total investment is higher. Interestingly, they also find that pure GVC enterprises have a higher rate of successful exit in Europe than in the USA. They also find that the relative performance of pure GVC investments is better in countries with relatively less developed VC markets.

Grilli and Martinu (2014), using the VICO database and a sample of young high tech companies from seven European countries (BE, FI, FR, DE, IT, ES, and UK) confirm the view that syndicated investments from GVC and independent venture capital (IVC) have a positive effect on firm sales growth while GVC funds deliver similar results to the non-backed companies.

Some studies suggest that the lower effectiveness of direct GVC may be due to lower investment skills and expertise of government venture capital fund managers (Bottazzi et al. 2008). The literature also identifies several other reasons for the better performance of IVC - lack of administrative regulations (public funds impose caps on size of investments, use of different clauses, need of co-investments, restricted geographical scope of intervention), possibility of negotiating the rules between partners, focus on financial gains instead of other objectives that may divert the focus of investors and finally value-added skills of seasoned investors and fund managers.

Luukkonen, Deschryvere, Berton (2013), based on a survey of young high-tech VC backed companies from seven European Countries (BE, DE, FI, FR, IT, ES, UK), explored the hypothesis of differences in added-value behaviours of independent and government venture capital vehicles. They show that the IVC firms were more advanced in professionalization activities such as changing the management team and finding board members and exit strategies. They do not however differ statistically significantly in the overall evaluation of added value of advice from experienced venture capitalists.

Cumming, Grilli, Murtinu (2017) show that private IVC-backed companies have better exit performances than purely government-backed companies. Yet, the performance of a mix of independent and governmental VC investors brings more positive results than public venture capital. The positive impact for the syndicated public-private funds is slightly higher on the likelihood of exits than IVC

Finally, Bertoni, Tykvova (2015), based on a sample of young biotech companies in Europe, show that GVCs as stand-alone investors have no impact on invention (measured by patent stock) and innovation (by citation-weighted patent stock), whereas if complemented by IVCs they can act as a good support instrument.

Table 8 Academic literature: Comparison of impact of private venture and public venture capital on companies' innovative activities and growth

Study	Methodology	Country	Main results
Brander et al. 2010	Regression analysis	International	A modest amount of GVC finance improves the performance of entrepreneurial ventures relative to private venture capitalists (PVCs). High levels of support from GVCs are associated with weaker performance (IPOs, acquisitions)
Brander et al. 2015	Regression analysis	International	Mixed funding has the highest investment level and better exit prospects as compared to pure PVC funding or pure GVC funding
Grilli and Martinu (2014)	VICO dataset, regression analysis	7 European countries	Syndicated/hybrid investments from GVC and independent venture capital (IVC) have a positive effect on firm sales growth while GVC funds deliver similar results to the non-backed companies
Bottazzi et al. 2008	A collected sample of venture capital deals, survey data, regression analysis	17 European countries	Investor activism is shown to be positively related to the success of portfolio companies, with IVC more active than government owned firms.
Luukkonen, Deschryvere, Berton (2013)	VICO dataset, regression analysis	7 European countries	Contributions of IVC funds prove to be significantly higher than those of GVC funds as regards the development of the business idea, professionalisation and exit orientation.
Cumming, Grilli, Murtinu (2017)	VICO dataset	7 European countries	IVC-backed companies have better exit performance than government-backed companies; mixed-syndicates of private-independent and governmental VC investors give rise to a higher (but not statistically different) likelihood of positive exits than that of IVC-only backing
Bertoni, Tykvova (2015)	Regression analysis (young biotech and pharmaceutical companies)	7 European countries	Companies financed by syndicates and by private VC investors have a greater increase in innovation output (patents) than comparable non VC-backed companies. Results are best for hybrid/syndicated investments led by a private investor

3.5 Impact of public VC funds with a regional focus

In this section we examine the evidence of **geographical boundaries** on **public venture capital** impact.

The impact of public VC funds with a regional focus has been explored in the literature as many Member States have responded to regional equity gaps. Based on a sample of more than 600 VC backed companies (first round backing from either public or private VC fund) between 1998-2007 Munari and Toschi (2015) measured the exit rates and the capacity for attracting additional VC funding differentiating between regions based on their innovation intensity. They found that the regional funds are least efficient in leading their investee companies to an IPO or acquisition (17% less likely than private VCs) while national programmes are 10% less likely than private ones. Portfolio companies backed for the first time by the public sector also obtain fewer financing rounds and fewer syndicated investors. What is more, the ability to attract private capital acts as a 'certification signal' only in more innovative regions. The last conclusion supports the literature on the general positive impact of public funding on VC investments (see Lerner 1999 on the positive impact of the US SBIR grants but higher effect in VC intensive regions).

The literature underlines the necessity for a sufficiently high quality deal flow (stream of companies available for investment and being able to generate revenue) for successful VC operations and its concentration in internationally competitive knowledge hubs (e.g. De Prato, G., Nepelski, D., & Piroli, G. 2015).

The literature review shows that VC investments cannot function properly in areas of little or no innovative activity and therefore are not a good instrument of regional development policy. The evidence therefore argues against the use of small sized regionally-bound public venture funds.

Table 9 Academic literature: Impact of regional funds

Study	Methodology	Country	Main results
Munari and Toschi (2015)	Firm level data, regression analysis	UK	Public VC funds, especially those with a specific regional focus, might be less effective forms of intervention because of the distortions their tight geographic constraints introduce
Lerner (1999)	Firm level data, regression analysis	US	SBIR awards (grants) had a strong positive impact on firms' employment and sales growth but only in locations with important VC activity

4. Lessons learnt and key takeaways

4.1 Design and implementation of the policy measures

- *SYNDICATION: government or syndicated investments – direct or indirect investment*

The academic and the policy literature tend to converge on the **negative lessons learnt from government-only venture capital** funds and on the positive role of syndicated investments with government as a minority shareholder or investing indirectly through funds-of-funds (see section 3.4). The evaluation of the Finnish Industry Investment (FII) scheme (Saarikoski et al., 2014), which offers both direct and indirect equity investments, points out that as a result of the FII indirect equity investments the target companies have grown faster than their peers. At the same time for the FII direct equity investments the portfolio of companies on average have not been financially profitable. What is more, the growth impact of the FII direct investments cannot be considered satisfactory and is highly polarised, i.e. the top five companies account for most of revenue growth. The Danish Growth Fund experience (DAMVAD 2014) also points out the limited effectiveness of direct investments given the small deal flow (few companies being invested in) and the lower than expected company performance.

Based on the literature, this may be due to lower diversification of the portfolio companies than can be achieved across multiple private funds which reduces the overall risk. Secondly, the non-specialised funds may have problems in acquiring deep knowledge of different sectors, whereas in specialised funds, portfolio managers have more experience in selecting promising companies in their specific field (Gampfer et al., 2016). Thirdly, fully public funds are less effective in the provision of coaching and mentoring for investee companies (Cumming 2013). Finally, direct public investment in businesses might crowd out private investment (Cumming and McIntosh 2006) while the reviewed policy literature on indirect equity measures finds zero or minimal crowding out effects (Baldock 2016, DAMVAD 2013, Technopolis 2016).

Indeed our overview of the policy instruments and some recent evaluations (e.g. Baldock, 2016) note the shift of government-backed VC from direct funding which might require private matching² (e.g. Finnish Industry Investment) to private VC-led hybrid co-funding (e.g. the ECFs in the UK) or fund-of-fund structures (which now exist in a number of EU Member States). A number of evaluations (Technopolis 2013, Ramboll 2011) claim that the main advantage of the reviewed schemes is the delegation of investment decisions to private parties i.e. the government provides co-financing only if there is a private lead investor (e.g. a VC company) which applies strict selection criteria and provides management support to the target firms.

- *SCOPE: regional focus and geographical boundaries*

The evidence in the academic literature (see section 3.5) points to **negative experiences with regionally-bound public venture funds** and advises against strict geographical boundaries. What is more, the **venture capital instruments are judged less effective in areas with low innovation activity** given the low supply of companies worth investing in. Our analysis confirms that in the case of Austria for example the funds were suffering from a limited supply of companies to invest in and the recent decision of the German High-Tech Gründerfonds to invest also in companies

² Almost all public VC funds require a private co-investor for their deals, with 50% being the maximum public investment.

head-quartered in other countries may point to a change in the policy. According to the evaluation of the regional Risk Capital Fund in Baden-Württemberg, investment by both federal and state level funds gives beneficiary firms access to several and wider networks of potential advisers, partners and investors (Bötel et al. 2013).

The **regional venture capital experience is largely negative** given their smaller size and the limited deal flow in the regions with lower innovation capacity (Cowling 2012). Nevertheless, **some regional funds evaluations** (Hood 2000, BIS 2011) show **positive impact** albeit the result should be taken with caution since the evaluations are based on methodologies without a counterfactual and in the case of Scotland the fund has gone through several changes through time going from strict development goals to supporting high tech ventures at an early stage.

- **GOALS:**
 - *other objectives than financial returns – regional development, access to finance for specific groups*

The regional scope of the fund is often in line with **implementing broader socio-economic goals**. The case of Bridges Fund I investing in deprived areas provided evidence of its positive impact on employment and turnover (albeit based on a qualitative study without a control group). These investments helped to create the market where the private investors were not active due to lower profitability. The UK Aspire Fund invested in women-led businesses in order to increase the number of those businesses in the UK. Overall, the potential of equity finance for promoting economic development including targeting deprived areas or underserved communities is a topic underexplored in the reviewed policy evaluation literature and merits further investigation.

The academic literature highlights the **issue of divergent objectives** (private sector looking for returns whereas public investors seeking to have more vibrant regional economy, facilitating women's access to finance, promoting investments in businesses with a longer term profitability perspective) which may have a negative impact on the funds' sustainability. The question is whether those funds should have to perform on equal footing with private funds or if the state accepts them being not sustainable or less profitable.

- *creating private markets*

As a primary goal, many of the schemes studied aim to support the creation of a vibrant private equity market through guarantees for private investors, tax incentives and/or the provision of direct capital that is matched with the private investors' money in order to increase funding volumes and deepen the market. This objective is usually measured through the **leverage effect**. Most of the public equity instruments in our sample of evaluations were found to have a medium to high leverage effect. This usually varies between 1 and 5, i.e. for each euro of public money spent, the private sector added 1 (ECF, Vigo Accelerators) to 5 euros (UKHTF, Finnish Industry Investment). The most often reported leverage rate is between 2 and 3 (SVCP, Danish Growth Fund, AWS equity funds).

Creating sustainable private markets also relates to the issue of **follow-up funding** to maintain the growth process and to enable portfolio companies to reach their optimal exit size. Several evaluation reports mention the issue of the limited availability of follow-on funding and new market gaps appearing in the later stage after the introduction of the policy measure (Technopolis 2013, Baldock and Mason 2015). Since the majority of the policy instruments examined here are actually targeting the seed and early stage market gap (below €2.5m), an important observation that is also supported by the academic literature (e.g. Aernoudt 2017) is that a second- and third-round

financing gap has emerged in Europe. The evaluations of the UK Enterprise Capital Funds and the German High-tech Gründerfonds recommend that the size of the fund investments be increased to €5m and in the case of the High-tech Gründerfonds to increase the age limit of the target beneficiaries from 1 to 3 years.

- *investing with longer-term perspective*

Another goal may be to provide so called **patient capital aimed at investments with a profitability that requires more time** which is difficult to obtain in the private market. However, most of the public and public-private funds are set up within the standard 10 years life span (Durufle et al., 2017).

- SPECIALISATION: investing in specific sectors

The academic literature points to the relative **specialisation of venture capital in high-tech industries** with most of the investments targeted at ICT, biotech and life sciences. This specialization is strongly confirmed within our sample of evaluations. This typical focus of venture capital investment poses a problem of underinvestment in other sectors with longer time scales for the development of profitable business or with more risky profiles. An important policy question is whether the policy makers should, as some literature suggests, fill the financing gaps (where the private VC does not have interest) or intervene where the venture capital markets already exist and therefore there is a good chance of building a strong market.

According to the evaluation of the Dutch Technopartner Seed Facility, **different sectors have different capital needs**, which means that funding ceilings should be more flexible, and that the balance between being 'market-led' and the 'checked and targeted' use of public money is a central question of instrument design.

- SIZE: *size of the funds*

According to Baldock and Mason (2015), the current size of the Enterprise Capital Funds (between £30m and £90m) is insufficient to adequately meet the current and forecast strong demand for high levels of follow-up funding. The average size of hybrid VC funds in Denmark is €250m which is larger than in the UK, the Netherlands and Germany, measured by fund size relative to GDP (DAMVAD 2013). In Finland, the size variation in supported funds is high. Most of the funds are between €50-200m and only seven exceed €200m but represent 57% of total commitments (Saarikoski et al. 2014). To address the later-stage equity funding gap where financing volumes need to be bigger, the need for increasing the size of the funds is therefore an important consideration. According to Invest Europe, the **average size** of a European VC fund is €65m in 2015 which is **too small** to absorb the investments that big global institutional investors (pension funds and insurers) can make.

- STAGE: *early stage and growth phase gap - creating new equity gaps?*

According to the examined evaluations, there are **two equity funding gaps**: one in the early seed stage and one in the scale-up / later growth phase. While government-backed venture capital appears to be an effective instrument for addressing the early stage funding gap faced by young high-growth enterprises (Baldock, 2016; Technopolis, 2013), studies on the financing context in Finland, Austria and the UK identify a clear gap in funding at the scale-up stage – between the start-up phase well-supported by public programmes and the pre-IPO/merger phase where private VC funds are strongly engaged since expected returns for investments in this phase are higher (Gill and Parnell, 2014; Saarikoski et al., 2014). Existing financial support instruments often seem

to fail to reduce this later stage gap which remains an important shortcoming (Gampfer et al., 2016).

- *SKILLS*

Several evaluations (Technopolis 2013, Bötzel et al. 2013, BIS 2014) in line with the academic literature on private funds (Bottazzi et al. 2008 and Luukkonen, Deschryvere, Berton 2013) insist on the added value of a coaching and advice layer that is delivered with the funding. The advice and coaching has significant (albeit measured only through subjective opinions of beneficiaries) impact on the outcomes of the funded projects. This result complements those reported in the academic literature on value added of VC funds beyond alleviating financial constraints. It corroborates with the literature evidence of **added value of equity** in terms of impact on **professionalization** of companies and **importance of networks** (as opposed to debt instruments). The literature also notes the importance of skills of venture capital managers. Similar findings were identified for the direct R&D support for firms (see Cunningham, P.N., Gök, A. and Larédo, P. (2015).

One example of a good practice is the High Tech Gründerfonds where large companies are also involved as investors in the Fund. This has the advantage of their expertise and networks and also fosters corporate venturing.

- *TIMING*

Some evaluations, when explaining policy shortcomings, refer to the **poor timing of the intervention** (for example, the UK High Technology Fund was set up when the private equity market had sufficient liquidity to serve the funding needs of companies without public intervention (BIS 2011). Timing is therefore crucial to achieve additionality of the support instruments and to avoid wasting public money.

- *LEVEL OF RISK*

The Dutch Growth Facility evaluation discusses the issue of **due diligence of private equity funds** which receive public support. For the implementation of the Growth facility, a rather heavy assessment procedure (by a special committee) was set up to assess excessive risk. Some interviewees found the whole process of accreditation and granting too burdensome (a "chicken and egg" situation in relation to the requirements of professionalism for newly established VC firms) but according to the evaluation this was done for the purpose of prudent spending of public money so the evaluators support the scheme design.

4.2 Evaluation design and quality

- *time needed for a proper evaluation of results*

Most of the evaluations take a short term perspective in order to evaluate the results of the schemes, although we have also reviewed evaluations that analyse longer time spans (5-10 years of data). The literature also agrees that **early evaluations may produce negative findings** (see the evidence in section 3.2 of declining profitability in the first 3-4 years after investment due to focus on expanding markets, implementation of new services/products, etc.). The investment impact on firms can only be properly examined after at least five years as in the short post-investment term firms are going through significant changes in their organisation and processes that may actually have negative impact on their turnover or profitability (Nesta 2009).

- *evaluating the alignment with the broader instrument goals versus the financial performance only*

The private venture capital funds are **mostly evaluated on their financial performance and the ability of the companies to exit or perform IPOs**. Nevertheless, the public programmes often aim at a larger set of goals including stimulation of regional or national entrepreneurship, fostering job creation or diminishing financial constraints of companies. The indicators used to evaluate the programme should therefore be aligned with the initial goals set by the policy makers in order to be able to assess the success of the instrument. The academic literature tends to be largely in favour of focusing on financial returns to escape the issue of moral hazard (i.e. to align the objectives of private investors and public fund managers). Yet, the financial performance of the fund should not be the sole indicator of the intervention success and ex-post evaluation should also bring the answer on how the instrument is answering to the high level policy goals (impact on employment, competitiveness of the economy, etc.).

- *looking at direct results for beneficiary firms more often than broader socio-economic impact*

The other indicator used to assess the effectiveness of the public measure is the impact on the beneficiaries which provides more information about the optimal funding choices of the fund. If the rationale of investing in young innovative companies is based on their importance for the economy and their larger impact, the intervention should also seek to measure the **positive spillovers and broader social benefits** of those schemes. Only one policy evaluation report, that of the Danish Growth Fund, estimates the broader impact of the equity measures on Danish GDP. Findings from the NESTA compendium (Nesta 2013) tend to support the view that most evaluations look at the "success" (delivery, management, etc.) of the scheme rather than its actual impact on the broader innovation and socio-economic environment.

- *degree of attribution*

Another issue that has to be taken into account when designing a good evaluation of the public equity schemes is the fact that companies go through several rounds of funding that may have been obtained from different sources (public and private). The degree of the attribution of the effect of the funding under study may be therefore **difficult to quantify** and would require **more sophisticated methodologies** and better data collection. Most of the evaluations are not controlling for multiple simultaneous treatment effects and/or subsequent funding rounds and therefore the attribution of the effect is problematic. The reported effects may be due to accumulated funding and the share of a specific investment may be small. Yet, the public schemes can also be effective in signalling the company's value to private investors and can include soft measures (networking, advice) to assist the company in getting follow up funding. This attribution is however much more difficult to quantify and assess. Very few of the policy evaluations (e.g. Forfas 2012) tried to explore the evaluated measure with a more holistic approach, i.e. considering the level of complementarity between the examined programme and the other related programmes in the policy mix.

- *skewed distribution of outputs – concentration of impact in a handful of beneficiaries*

The **skewed distribution of impact of public schemes** and the acknowledged in the literature **high tail distribution of venture capital investments** has a lot of impact on the choice of methodologies for evaluations. Analysing the average outputs of firms may lead to superficial or even erroneous conclusions. The use of case studies and other forms of qualitative methods would therefore be beneficial to better understand the superior performance of the few beneficiaries and may help to distil the right conditions under which the instrument (or other forms of public intervention) can deliver those results to other beneficiaries.

- *considering alternative scenarios*

As discussed in the introduction, the innovative companies with growth potential can choose between different options of accessing finance and equity capital is only one and often not the first of their choices. Given the relative high cost of the equity measures, the evaluations are rarely set up to **compare treatment effects of different policy choices**. Very rarely an evaluation is designed as to include in assessing the impact of the scheme the context of the specific broader policy mix (with its framework conditions, availability of soft measures such as training/mentoring support etc.) which would provide much more fine-grained policy implications.

5. Conclusions and policy implications

Our findings based on the analysis of academic studies validate the hypothesis that **high-growth potential firms** which have received funding in the form of equity, experience **an increase in employment and turnover**, and **expand their innovation activities** more than those that have not received the support. The following table summarizes our key findings.

Table 10 Impact of public equity instruments on firm's growth

Equity instruments	
Employment	<ul style="list-style-type: none"> Equity instruments have a significant impact on employment. In the cases when studies compare the employment effect of the measures with a control group, the increase in employment is much higher for the supported firms than for the reference group. The range in terms of the size of impacts is however quite wide (by between 50% and 145%). Some studies provide estimations on the cost effectiveness of those instruments with respect to employment creation with ranges from €38,000 (Finland) to €75,000 per job (Denmark).
Turnover	<ul style="list-style-type: none"> The evidence on firms' turnover is also positive with around 125-800% of growth compared to pre-investment period whereas the control group in most cases exhibits only half of that growth rate. Yet, the evidence is limited to early stage investment where the usual low turnover base should advice caution in interpreting the results. Importantly, the effects on economic performance are highly concentrated, with the top 5-15% of supported firms delivering the vast majority of returns. In terms of profitability, the studies find that it is often negative in the beginning (right after the public support) but then it progressively increases (usually after 3-4 years).
Innovativeness	<ul style="list-style-type: none"> Equity instruments are less often evaluated on their impact on firms' innovation activities since the innovativeness of the company is often one of the selection criteria for venture capital. Indeed, the beneficiaries have a high share of R&I activities, including R&D spending, patents, product and process innovations but that share is not much higher than the comparable non-funded firms. This confirms the evidence from the academic literature pointing to the higher impact of venture capital on commercialisation of ideas rather than on innovation itself, with the contribution of venture capital to innovation being an indirect one, i.e. provision of networks of partners and opening to different channels of

	commercialisation.
Leverage, crowding-out effect, sectoral focus	<ul style="list-style-type: none"> • A medium to high leverage effect is observed (2-3 on average), i.e. public policies manage to attract private sector investments. • As for the crowding out effect of public investment, the literature finds minimal or zero crowding out effects. • Some evaluations underline the concentration of equity on specific sectors, such as ICT and biotechnology.

Public equity instruments are designed to target companies that are at the growth stage of their development and the evidence gathered in this report supports their having a positive impact on the beneficiaries' subsequent growth. Equity instruments offer the highest average amounts of funding ('deep pockets') directly aimed at growth (as compared to grants or loans) but also incur high costs given the high risk and operational costs of the schemes (e.g., demanding skilled fund managers, paying management fees, performing due diligence). Therefore there is a need to properly evaluate those measures taking into account their primary goals, be them private market creation, support for an innovative sector or regional growth.

The evaluations examined in this report give many insights on the design and implementation of the public equity schemes. The most important policy implications evidence is:

- in favour of the **syndication of the funds** with **leading role of the private sector**
- **against rigid geographical boundaries** considering that the regional funds appear to be less effective
- providing **more patient investment** with **longer time spans** and/or longer investment perspective with **less pressure on exits**
- in favour of **specialisation of the funds in specific sectors or flexible arrangements** allowing for the adaption of the size of the intervention and other design features to the specific demands of the given sector
- in **favour of larger size** funds to enable a diverse portfolio and sufficient follow up rounds
- in **favour of intervening both at the early and the growth stage** while making the intervention more flexible at the margins in order not to lose on good investment opportunities (when defining where the fund may or may not invest) but avoiding crowding-out of the private investment (where sufficiently provided)

- in **favour of providing added value services** (such as networking and coaching) to the companies and making sure that the fund is assisted by skilled professionals
- in **favour of the analysis of the timing of the intervention**, i.e. analysis of the supply of the private capital at the time of the intervention to reduce the risk of crowding out
- the **optimum level of risk taken** in case of syndicated / government intervention is **difficult to identify** with some literature suggesting targeting high risk ventures/ high risk sectors and some the middle ground.

The academic literature is **largely in favour of focusing on financial returns** rather than other goals (e.g. regional development) but the evaluations' evidence remains **inconclusive**. If funds are created with non-financial goals (and they usually are), this would call for a different way of evaluating their success, beyond leverage effect, exits and fund profitability towards **a closer examination of employment and turnover growth** as well as **larger socio-economic benefits of the intervention**.

It is also important to note that the measures reviewed here form only a subset of a larger portfolio of policy measures required to provide companies with a **funding escalator** to enable them to **fund their innovative ideas** (with an important role of private capital) and also to develop a sufficient quantity of young innovative companies that are able and ready to grow. There is a need for **a complementary set of soft measures** nurturing the entrepreneurship capacity of innovators, providing them with the necessary skills, contacts with academia and other networks, etc.

Another important implication stemming from the literature examined in this report is that **governments are now the biggest single investors in early stage VC** funds across Europe. Private institutional investors have moved away from investing in venture capital (especially at the early stage) (DAMVAD 2013) and public VC has increased its share of the VC market to about 40% in recent years (Aernoudt 2017). This observation is lent support by the evaluation of the High-tech Gründerfonds which notes the dominant position of HTGF as the most active early stage investor in Germany (40% market share) and the Finnish Industry Investment study, which indicates that FII has become a "gatekeeper" for new funds in Finland, i.e. it is regarded as a de-facto decision maker whether or not a new fund is launched in the country.

Last but not least, there is an inherent problem with equity markets, either private or public, that stems from their **tendency to concentrate in urban hubs, leading regions or countries**. This results in making the innovative companies move from regions and countries with less growth potential to those offering better opportunities thus further impeding the capacity of lagging regions to catch up with innovation leaders. Yet, the evidence from the regional funds points to the shortage of readily available "deal flow" of companies that the venture capital can invest in. In the case of catching up regions, it is therefore important to create those investment opportunities by fostering general innovation capacity of small firms via **grants and loans** as the success of more targeted and riskier instruments (such as equity) for those motivated to grow depend highly on the general innovativeness of the regional and/or national economy.

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