The Performance of Publicly Managed Venture Capital Funds

Andrei Dubovik

Joep Steegmans

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Andrei Dubovik[a,b,*] and Joep Steegmans[c,*]

[a]CPB Netherlands Bureau for Economic Policy Analysis
[b]Erasmus University Rotterdam
[c]Utrecht University

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Abstract

Governments, when designing support for venture capital financing, face a choice to either sponsor existing private VC funds or organize and manage their own public VC funds. There is emerging evidence that syndicated financing by private and publicly *sponsored* VC funds is correlated with better exit performance. At the same time little research has been done into the effectiveness of publicly *managed* VC funds. We show that syndicated financing by private and publicly managed VC funds leads to a 5.1 percentage points smaller chance of a successful exit compared to purely private financing. This finding is robust to reputation and culture/distance effects.

Key Words: venture capital, public funds, ownership structure.

JEL Classification: G24, G28.

1 Introduction

Startup companies are often seen as contributors to innovation, employment, and economic growth (Buzzacchi et al., 2013; Brander et al., 2014; Colombo et al., 2016). Venture capital has become an important source of early stage financing for these companies, because venture capital helps to resolve information asymmetries through better screening and monitoring (see, e.g., Chemmanur et al. 2011, and Hellmann and Puri 2002 for the empirical evidence). However, the market failures associated with knowledge spillovers

and social returns to innovations remain. Governments have therefore become increasingly involved in the venture capital market. The objectives of governments reach further than solely profit maximization and also include social goals, for example, job creation, investment in green technology, and the development of preventive medicines.

Broadly speaking, governments have multiple options at their disposal to facilitate early-stage financing. Governments can increase the supply of venture capital funds or introduce a favourable tax regime. Governments can also intervene indirectly, for example, by improving stock markets and therefore decreasing the costs of exit for VC companies, or by making labour markets more fluid (Da Rin et al., 2006). In this paper we focus on the direct involvement when governments decide to increase the supply of venture capital funds.

There are two approaches to increase the supply of venture capital with public money. Governments can either supply public money to privately managed VC funds or actively manage public money by establishing their own public VC funds. Both types of VC funds—publicly *sponsored* and publicly *managed*—exist in practice. Indeed, according to Brander et al. (2014), about 22% of all enterprises worldwide receive funding from publicly sponsored VC funds and about 4% receive funding from publicly managed VC funds.[1]

To the best of our knowledge, the only paper that touches on the effects of publicly managed VC funding is Brander et al. (2014). While not the main focus of their research, they show in their robustness checks that receiving funding from publicly managed VC funds results in worse exit performance, although the effect is not statistically significant. We ask the same question. Namely, what is the effect of receiving publicly managed VC funding on the exit performance of companies? In contrast to Brander et al., we make this question the central point of our analysis, and we use a different dataset. By emphasizing the difference between publicly sponsored and publicly managed VC funding we aim to contribute to both the academic discussion and to provide an evaluation that may be used by policy makers.

We analyze exit performance of companies that have received VC financing in 2010–2016 using the VentureSource dataset from Dow Jones. Very few companies receive funding solely from publicly managed VC funds and most such funding is syndicated with private funding. After controlling for industry, country and cohort fixed effects, as well as for reputation and cultural/distance effects, we find that syndicated private and publicly managed funding impacts exit probability negatively. The effect that we find is both statistically and economically significant: an involvement of a publicly *managed* fund reduces exit probability by, on average, 5.1 p.p.

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[1]According to our data about 1.8% of funding is publicly managed.

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compared to purely private funding. The results remain significant if we use semi-parametric duration analysis instead of a linear probability model.

The effect that we find contrasts sharply with the effect of publicly *sponsored* VC funding that has been documented in the literature. While there are still too few studies to arrive at a general conclusion, most evidence suggests a positive effect: syndicated private and publicly sponsored VC funding improves exit performance of companies.[2] Brander et al. (2014) study US, European and Asian venture capital markets and find that government sponsored funding tends to attract more private funding, which in turn results in better exit performance of the entrepreneurial companies. Buzzacchi et al. (2013) study European companies that indirectly receive funding from the European Investment Fund. They find that a larger share of public funding is associated with fewer incidents of write-offs (bankruptcies).

Cumming et al. (2014) analyze the European venture capital market and find that syndicated funding results in better exit performance than solely private funding, but the difference is not significant. However, there is also country specific research that finds a negative impact. Cumming and Johan (2008) focus on the Canadian market and find that receiving funding from government subsidized labour-sponsored venture capital corporations (LSVCCs) results in worse exit performance. Cumming and Johan attribute this negative effect to inefficient statutory covenants of LSVCCs.

We find that publicly managed funding has a negative effect on exit performance, while Brander et al. (2014), Buzzacchi et al. (2013), and Cumming et al. (2014) document a positive effect of publicly sponsored funding on exit performance. Giving public money to private VC funds thus seems to achieve better results than publicly managing this money. Differences in social objectives and differences in organization structures may be part of the explanation for this finding.

The rest of the paper is organized as follows. Section 2 introduces our dataset, Section 3 formulates and tests our main hypothesis, we test a number of alternative specifications in Section 4. We conclude briefly in Section 5.

2   Data and Descriptive Statistics

We use VentureSource database from Dow Jones. These VC data are thus collected by a commercial party whose main goal is to provide actors in the venture capital market with information. Our sample covers all companies that have received venture capital funding and/or have had a successful exit in 2010–2016. Additionally, for all the companies in the sample we have their full funding history.

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[2]To stay objective, we should note that Colombo et al. (2016) summarize the overall evidence from the literature as mixed, which is contrary to our view on the literature.

Table 1: Descriptive Statistics

	Min	Max	Mean	SD
Company id	1	22494		
Country id	1	83		
Industry id	1	27		
Cohort year	2000	2016		
Successful exit	0	1	0.21	
Private funding	0	1	0.98	
Public funding	0	1	0.0012	
Syndicated funding	0	1	0.017	
Amount invested*	4.43	21.2	14.4	1.48
Number of investors	1	24	2.39	1.59
Reputation*	-20.8	-2.61	-6.96	2.28
Local investors	0	1	0.69	0.37

* Amounts invested and Reputation are given in log-form

In our analysis we focus on publicly managed VC funds, but both publicly sponsored and publicly managed funds are present in our data. For example, private VC fund Diamond Investment Ventures receives a part of its money through the Small Business Investment Company program of the US government. In the Netherlands, private VC fund HENQ Invest receives a part of its financing from the European Investment Fund. On the other hand, both the US and European governments, predominantly local governments, are also involved in managing own VC funds. Life Sciences Greenhouse of Central Pennsylvania is such a fund in the US, aimed at improving health care and economic wellbeing of Pennsylvanians. A European example is Brabant Development Agency of the Netherlands.

For many companies our dataset includes multiple rounds of VC funding. However, with each consecutive round of funding the prospects of a given company become clearer and that influences who invests in the company and how much. While we cannot fully exclude such effects of reverse causality, we aim to attenuate them by following Brander et al. (2014) and Chemmanur et al. (2011) and focusing only on the first round of VC funding.

In total, we have 22,494 company-level observations covering 83 countries, 27 industries, and 17 cohorts (i.e., the year of the first VC funding), see Table 1. The variables we use are described below.

Successful exit is a dummy indicating whether a company had an IPO, acquisition or private equity buyout. We do not count management buyouts as successful exits (the number of management buyouts is small). On average, 21% of the companies in our sample had a successful exit.

Funding channels are classified into three groups.

Public funding is a dummy indicating that only publicly managed venture capital funds were present as investors in the first round of VC funding.

We classify a fund as a publicly managed venture capital fund if either it is a "Public Sector Organization" according to VentureSource, or if its website ends in .gov, .gov.uk, etc.

Syndicated funding is a dummy indicating whether both private venture capital funds and publicly managed venture capital funds were present as investors in the first round of VC funding. Only 378 companies, or 1.7%, had syndicated funding in our sample.

If both Public funding and Syndicated funding dummies equal zero, then the funding is purely private.

Amount invested is the log of the total investments in the first round.

Number of investors is the number of investors that participated in the first round. Cumming et al. (2014) provide a brief overview of the literature that shows that syndication, in the sense of having more investors, can have a positive effect on the exit performance.

Reputation is the log of the average reputation of all participating investors, where the reputation of a given investor is the relative amount of funding he attracted in the prior 5 years.

An important distinction between venture capital funding and equity funding is the active role that venture capitalists play in monitoring the companies they invest in. Venture capitalist help design incentives in new startups by introducing, e.g., stock option plans, they also influence hiring decision for top positions (Hellmann and Puri, 2002). We can hypothesize that venture capitalists with better expertise develop good reputation and therefore attract more funding. Chemmanur et al. (2011), following Megginson and Weiss (1991), define reputation of a venture capital fund in a given year as the relative amount of funding it provided to companies in the preceding five years. They find that past reputation of venture capital funds predicts better total factor productivity growth for the funded companies.

We define reputation similarly to Chemmanur et al. (2011). In our sample the top 10% of venture capital investors provide more than 70% of all funding, i.e. there is a relatively small number of venture capitalists with high reputation. Additionally, all these venture capitalists are private funds. Therefore, it could be the case that private venture capital funds with the highest reputation and, supposedly, best expertise explain the difference in exit performance between purely private funding and syndicated private and publicly managed funding. To control for this possibility we include reputation as one of our regressors.

Local investors is the share of local investors, i.e. it is the number of investors located in the same country as the company, divided by the total number of investors.

Most publicly managed funding in a given country is directed towards companies in the same country.[3] In comparison, private funding has a sub-

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[3]Exceptions are rare but exist. For example, the UK Department of Energy and

stantial share of cross-border investments. Nahata et al. (2014) provide evidence that presence of local VC investors leads to better exit outcomes. For example, local investors have easier access to local networks and information. If that is so, then syndicated private and publicly managed funding can lead to better outcomes due to a larger presence of local investors. If we do not control for this effect, then we could be underestimating the negative impact of syndicated private and publicly managed funding.

In some cases *Amount invested*, *Number of investors*, *Reputation*, or *Local investors* are missing. We drop all such records. Alternatively, we have also tried imputing the missing variables with the sample means. The qualitative results do not change if we do so.

3   Analysis

We investigate whether the specific form of government involvement matters for exit performance of startup companies. Most of the literature has focused on publicly sponsored venture capital, i.e. when public money is managed by private VC funds. In contrast, we focus on publicly managed venture capital and we begin with the following hypothesis: government involvement results in worse exit performance due to government's objective being different from pure profit maximization.

Table 2 presents our main findings. Columns (1) through (4) are linear probability models, Column (5) shows the average marginal effects from a logit model. In Columns (1) and (2) we adhere to the same specifications as in Brander et al. (2014),[4] in Column (3) we add additional control variables: reputation and share of local investors. Column (4) omits industry fixed effects.

In the most complete specification (Column 3), receiving purely public funding lowers the exit probability by 12.6 p.p. compared to the reference category of obtaining purely private funding. Receiving syndicated (private and public) funding lowers the exit probability by 5.1 p.p. relative to purely private funding. For comparison, the unconditional exit probability is 21%. Thus, we find that the involvement of publicly managed funds leads to a lower chance of a successful exit. The effect is most pronounced when the funding is purely public and less pronounced when public funding is syndicated with private funding. Both effects are economically significant.

All control variables are statistically significant and have the expected positive sign. Notably, while reputation is significant, the effect is moderate in size. A private investor with top reputation (see Table 1) yields a 1.5 p.p. higher chance of a successful exit in comparison with an investor with average

Climate Change has provided VC funding to a Dutch start-up.

[4]See Table VIII on p. 599.

Table 2: Regression Results for Successful Exit

	(1)	(2)	(3)	(4)	(5)
Syndicated funding=1	-0.0437*	-0.0499**	-0.0512**	-0.0682***	-0.0466**
	(0.0171)	(0.0172)	(0.0173)	(0.0173)	(0.0171)
Public funding=1	-0.166***	-0.125***	-0.126***	-0.131***	-0.146**
	(0.0356)	(0.0365)	(0.0369)	(0.0373)	(0.0526)
Amount invested		0.0210***	0.0203***	0.0169***	0.0226***
		(0.00171)	(0.00176)	(0.00175)	(0.00198)
Number of investors		0.00619***	0.00541***	0.00548***	0.00560***
		(0.00159)	(0.00162)	(0.00163)	(0.00165)
Reputation			0.00356**	0.00478***	0.00488***
			(0.00125)	(0.00125)	(0.00143)
Local investors			0.0320***	0.0330***	0.0392***
			(0.00737)	(0.00740)	(0.00804)
Country f.e.	Yes	Yes	Yes	Yes	Yes
Cohort f.e.	Yes	Yes	Yes	Yes	Yes
Industry f.e.	Yes	Yes	Yes	No	Yes
(Pseudo) R^2	0.248	0.255	0.255	0.245	0.264
Observations	22,494	22,494	22,494	22,494	22,210

Notes: the dependent variable is Successful exit. Columns (1) through (4) are linear probability models, Column (5) shows the marginal effects from a logit model. *, **, and *** denote significance at 5%, 1%, and 0.1% respectively. Robust standard errors are in parenthesis.

reputation.[5] Potentially, a negative effect of publicly managed funding could have been due to a small number of private investors with high expertise and reputation, but we can see that this possibility is not supported by the results.

Local funding has a higher chance of attaining a successful exit than non-local funding. Ceteris paribus, this effect makes public funding more effective than private funding, because public funding is almost always local whereas a private investor is local in only about 70% of cases. However, the overall effect, when we substitute the average private investor with the average public investor, is very moderate: 0.96 p.p.[6]

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[5] $1.5 \approx 100 \cdot 0.00356 \cdot (-2.61 - (-6.96))$, where 0.00356 is the effect of reputation on exit probability (Table 2, Column 3), -2.61 is the maximum possible value for reputation, and -6.96 is the average value for reputation (Table 1).

[6] $0.96 \approx 100 \cdot 0.032 \cdot (1 - 0.7)$, where 0.032 is the effect of local funding on exit probability (Table 2, Column 3), 1 is the share of local funding among public funding, and 0.7 is the share of local funding among private investors.

Table 3: Regression Results per Industry Group

Industry group	Syndicated funding	Public funding
Business & Financial Services	-0.020 [1.000]	-0.212* [0.027]
Consumer Goods Group	-0.103 [0.074]	-0.094 [0.255]
Consumer Services Group	0.004 [1.000]	-0.019 [1.000]
Energy & Utilities Group	0.083 [1.000]	– –
Healthcare Group	-0.095** [0.009]	-0.055 [1.000]
Industrial Goods & Materials Group	-0.064 [1.000]	-0.106 [0.231]
Information Technology Group	-0.029 [1.000]	-0.204*** [0.000]

Notes: the dependent variable is Successful exit. *, **, and *** denote significance at 5%, 1%, and 0.1% respectively. Holm-Bonferroni adjusted p-values are in square brackets.

We speculate that governments have different objectives from those of private venture capital funds. One consequence, but not necessarily the only one, is that governments choose different industries to invest in. To test this we assume that private funds choose industries that maximize exit chances. Then, if we exclude industry fixed effects, we should observe relatively worse performance of public funds. As can be seen from Column (4) in comparison with Column (3), this is precisely what we find, however the difference with the earlier results is not statistically significant.

The linear probability model makes it straightforward to interpret the coefficients but it is not conceptually correct. As a robustness check we also estimate the logit model and present the resulting average marginal effects (Column 5). All marginal effects are similar to the OLS estimates shown in Column 3.

To further assess if there are specific industries where public funding is most damaging for exit performance, we run Specification (3) individually for seven industry groups. The results are presented in Table 3. Given that we are aiming to pick up a specific industry out of several using hypothesis testing, we face a multiple comparisons problem. To address it, we use Holm-Bonferroni adjusted p-values. As can be seen from the table, the negative effect of syndicated funding is statistically significant for healthcare ventures, and the negative effect of public funding is statistically significant

for business and financial services, and for information technologies.

4   Robustness Checks

The estimates presented earlier could potentially be biased due to left truncation and right censoring. We start observing successful exits from 2010 onwards but about 27% of the companies in our dataset received their first VC funding earlier than 2010, sometimes as early as 2000. These companies are present in our data conditional on the fact that they had no successful exit prior to 2010. Depending on the hazard rate function, we might be overestimating or underestimating the baseline chances of a successful exit.

Furthermore, we also include companies that received their first funding as late as 2016. If it takes time for a successful exit, we might be underestimating its chances. So, depending which of the early or late entrants to our dataset are privately financed and which received syndicated private and public financing, we might be overestimating or underestimating the impact of syndicated public and private funding on exit.

Table 4, Column (1) shows the results from estimating our dataset using duration analysis (namely, the Cox model). For comparison purposes, Column (2) gives the results from a linear probability model. The coefficients from the Cox model are hazard ratios (i.e., they are presented in the exponentiated form).

When using duration analysis we find that all the regressors have the same qualitative impact on a successful exit as when we use the linear probability model, further all the estimates remain significant. The smoothed hazard rate estimate is given in Fig. 1. The hazard rate peaks around 4–5 years after the first VC funding and then starts to gradually decline. This finding can be contrasted to the hazard rate estimate in Cumming et al. (2014), who find the peak at about 10–13 years (Cumming et al. use the data for seven European Countries whereas we use worldwide data).

Potentially, there can be a lot of cross country heterogeneity when speaking of the objectives and efficiency of publicly managed VC funding. In our main results we group all countries together and look at general effects. To test whether our results are robust to a specific geographic region, we also run our preferred regression separately for the US, Europe, and the rest of the world—see Table 5.

Our main results continue to hold for the US and partially for Europe. In Europe, purely public funding has a negative and significant effect, while the effect from syndicated funding is close to zero. For the rest of the world we find no significant effects of public involvement on exit performance. Importantly, the difference in the effect of syndicated funding between the US and Europe is statistically significant. We therefore conclude that our main results are primarily driven by the US data and only partially by the

Table 4: Duration Analysis of a Successful Exit

|	(1)	(2)
Syndicated funding	0.717**	-0.0512**
	(0.0918)	(0.0173)
Public funding	0.205	-0.126***
	(0.196)	(0.0369)
Amount invested	1.150***	0.0203***
	(0.0154)	(0.00176)
Number of investors	1.029**	0.00541***
	(0.0101)	(0.00162)
Reputation	1.038***	0.00356**
	(0.00966)	(0.00125)
Local investors	1.309***	0.0320***
	(0.0678)	(0.00737)
Country f.e.	Yes	Yes
Cohort f.e.	Yes	Yes
Industry f.e.	Yes	Yes
Observations	22,409	22,494

Notes: the failure event is Successful exit. Column (1) is a Cox model, Column (2) is a linear probability model. Coefficients in Column (1) are given in the exponentiated form. *, **, and *** denote significance at 5%, 1%, and 0.1% respectively. Robust standard errors are in parenthesis.

European data.

5   Concluding Remarks

If a government decides to support venture capital funding, it can either adopt a sponsoring role and give public money to privately managed venture capital funds, or it can adopt a more active role and start managing a venture capital fund itself. There is growing evidence in the literature that the former intervention is beneficial for exit performance of entrepreneurial companies. We focus instead on the latter intervention. Controlling for various fixed effects as well as for reputation, we find that publicly managed venture capital funding is detrimental to exit performance when compared to purely private funding. Our findings are robust across a number of alternative model specifications. The effect we find is both economically larger and statistically more significant in the US than in Europe, however that can be partially attributed to the relatively smaller European venture capital market.

Figure 1: Hazard Rate for Successful Exits
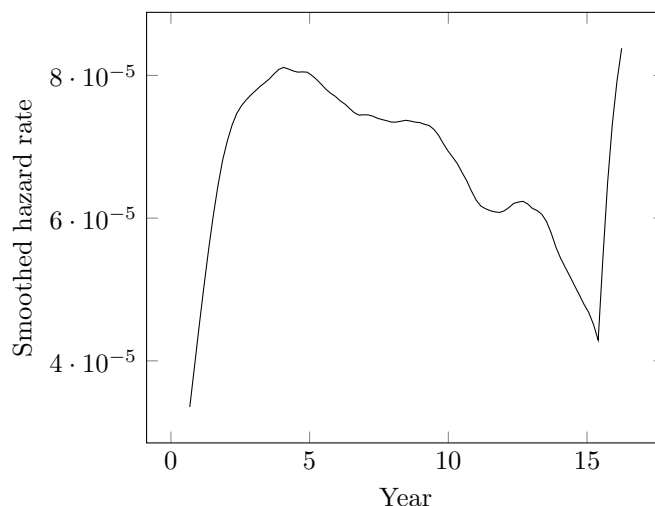
Notes: the noisy behaviour of the function at around 15 years is due to very few data points that are available at that duration.

We find some indication that worse performance of publicly managed funds could be due to different objectives in comparison with privately managed funds. However, we cannot exclude the possibility that publicly managed funds are simply less efficient at screening and monitoring than privately managed funds are. In light of our findings, we can say that opting for publicly managed venture capital funding rather than publicly sponsored funding might not be an unambiguously successful policy and such decisions should probably be scrutinized more carefully.

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Table 5: Regional Analysis

	World	US	EU	RoW
Syndicated funding	-0.0512**	-0.113***	-0.0228	0.0334
	(0.0173)	(0.0303)	(0.0245)	(0.0377)
Public funding	-0.126***	-0.159*	-0.0952	-0.0718*
	(0.0369)	(0.0693)	(0.0535)	(0.0361)
Amount invested	0.0203***	0.0164***	0.0377***	0.0126***
	(0.00176)	(0.00259)	(0.00390)	(0.00295)
Number of investors	0.00541***	0.00492*	-0.00555	0.00558
	(0.00162)	(0.00209)	(0.00388)	(0.00354)
Reputation	0.00356**	0.00585**	0.00241	0.000752
	(0.00125)	(0.00194)	(0.00239)	(0.00214)
Local investors	0.0320***	0.0582***	-0.0120	0.0233
	(0.00737)	(0.0113)	(0.0155)	(0.0125)
Country f.e.	Yes	Yes	Yes	Yes
Cohort f.e.	Yes	Yes	Yes	Yes
Industry f.e.	Yes	Yes	Yes	Yes
R^2	0.255	0.233	0.295	0.313
Observations	22,494	11,709	4,942	5,843

Notes: the dependent variable is Successful exit. All columns are linear probability models. *, **, and *** denote significance at 5%, 1%, and 0.1% respectively. Robust standard errors are in parenthesis.

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