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Direct And Indirect Government Venture Capital Investments In Europe

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Abstract

This paper provides evidence of the broad government presence in the European venture capital industry. Two forms of intervention are considered: first, direct stand-alone government venture capital funds and, second, indirect private funds to which governments commit funds as limited partners. The overall government presence seems to be much more important than previously documented, as we find that the government intervenes, on average, in 42.2% of venture capital investments in Europe. We also show that European countries are heterogeneous in their use of these two channels, and we consider possible early explanations for this choice of policy mix. Lastly, we provide some evidence on the consequences of these policies in terms of SME's perceived access to financing.

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1 Introduction

This paper provides a bird's eye view of the policy mix used in several European countries to support the national venture capital (VC) industry. Specifically, we focus on public VC investments made through two distinct channels. The first channel is that of direct investments, which are usually implemented by a stand-alone government-owned venture capital firm or fund (GVC) that invests in portfolio companies alone or in syndication with a private partner. Alternatively, governments can also channel funds to start-ups indirectly by acting as a limited partner (LP) in privately managed venture capital funds (we call these initiatives GLPs).

Public policies for VC have sparked an active theoretical and empirical debate. First of all, do governments actually need to intervene in the VC market in the first place? Lerner (2002, 1999) argued that government intervention can be justified by the presence of the so-called "equity gap". This gap emerges from the lack of funding for entrepreneurs, whose projects are fraught with informational opaqueness and potential moral hazard issues. As a consequence, traditional fund providers such as banks refrain from financing such endeavors. Private venture capital (PVC), in this sense, can be seen as a solution. However, PVC investors have limited resources, implying that only a handful of entrepreneurial projects would eventually receive financing (Berger and Udell 1998). Therefore, a considerable number of potentially promising ventures may remain unfunded, and the shortage of capital may constrain their development and growth. McCahery et al. (2015) estimate that the equity gap for several European economies – as a percentage of GDP – ranges between 0.7% (for the Netherlands) and 13.05% (for Romania). It is therefore natural for government authorities to address this market failure (Brander et al. 2015; Colombo et al. 2016), either by investing in companies that are adversely affected by the equity gap (as in the case of GVC), or by pumping more financial resources into the PVC market (as in the case of GLP).

Extant literature has devoted substantial attention to the implications of GVC initiatives for both the VC industry as a whole and for portfolio companies. Regarding the former, the findings are mixed. Leleux and Surlemont (2003) and Brander et al. (2015) find that GVC improves the supply side of the market and complements PVC, while Cumming and MacIntosh (2006) present evidence consistent with the argument that GVC outbids and crowds out PVC investors. A few studies have also revealed that GVC initiatives are able to attract PVC investments towards target companies that private VC usually neglects (Bertoni et al. 2018; Guerini and Quas 2016; Kovner and Lerner 2015). Additionally, the abundant literature that focuses on the impact of GVC on portfolio companies demonstrates the superior performance of the firms backed by either PVC alone or by syndicates of private and public funds vis-à-vis purely GVC-backed firms (Alperovych et al. 2015; Bertoni and Tykvová 2015; Cumming et al. 2017; Grilli and Murtinu 2014).

Several recent contributions have also analyzed the implications of the GLP form of public intervention. From a theoretical perspective, Jääskeläinen et al. (2007) analyze the profit distribution and compensation structures of GLP initiatives, concluding that they offer only a limited resolution of the equity gap market failure. The empirical literature has mainly focused on individual GLP initiatives, such as the European Investment Fund (Buzzacchi et al. 2013), the Australian Innovation Investment Funds (Cumming 2007; Cumming and Johan 2009) and the Flemish ARKimedes fund (Standaert and Manigart 2017); or on single countries, namely the United Kingdom (Munari and Toschi 2015) and South Korea (Lim and Kim 2015).

In the present paper, we adopt a broader view of public intervention in the VC market. Unlike the papers mentioned above, we consider GVC and GLP initiatives simultaneously and adopt a macro perspective to study what factors influence the use of these channels in different European countries. Governmental agencies play a much more important role in Europe than in other well developed VC markets, such as the USA (Kelly 2011). Moreover, as we demonstrate in this paper, Europe exhibits high heterogeneity in the policy mix used to support the VC industry. It is thus worth studying what influences such a mix.

Taking inspiration from the literature that has studied which institutional factors influence the development of VC markets (Groh et al. 2010; Jeng and Wells 2000), in this paper, we study how economic factors and the quality of public institutions affect the use of GVC and GLP as policy initiatives. Moreover, we conduct a preliminary analysis to uncover which policy mix resulted in better financing conditions for European SMEs.

To the best of our knowledge, no other study provides such an overview of the use of the two channels of public intervention in the VC market and their consequences on access to finance. In undertaking this analysis, this paper benefits from a new and unique hand-collected sample of investments made by GVC and GLP funds across 25 European countries during 1997-2015.

The remainder of the paper is organized as follows. Section 2 presents the data and section 3 the model. Section 4 details the results. Section 5 concludes.

2 Data

To begin, we first identified a list of GVC programs and GLP funds operating in Europe. There is no single database that collects comprehensive information on any of those initiatives. Therefore, we used information derived from different sources.

For GVCs, we relied on four different databases: Thomson One, VICO, Capital IQ and PrivCo[1]. From Thomson One, we extracted a list of VC investors headquartered in European countries and classified as "Government Affiliated Programs". From VICO (www.vicoproject.org), which covers 7 European countries (Belgium, Finland, France, Germany, Spain, Italy and the United Kingdom), we selected VC investors classified as GVCs. Similarly to Brander et al. (2015), we identify GVC investors in Capital IQ as those European VC investors whose parent companies were owned by government entities. In PrivCo, we selected investors of the "Governmental" type that are located in Europe. We then merged the four lists of potential GVC investors and double-checked their governmental nature using information available on their websites. Overall, we identify 137 VC funds with governmental bodies as parents; we classify these funds as GVCs. They operate in 25 European countries.

Our main source of information for the identification of GLP funds was the questionnaire sent by the OECD to 34 member countries in 2012 regarding the supply of seed and early stage financing, regulatory challenges and demand-side actions (OECD 2013). We complement this information using yearly OECD scoreboard reports on the financing of SMEs and entrepreneurs, the European Investment Fund (EIF) website, and European Venture Fund Investors Network (EVFIN) documentation. These documents provided us with a list of 35 supranational, national or regional government LPs based in 27 European countries. Further, we

[1] While Thomson One represents a good starting point for identifying GVC investors, it has some well-known shortfalls, as some GVCs are misclassified (Bertoni et al. 2015; Da Gbadji et al. 2015; Ivanov and Xie 2010).

checked Capital IQ and scraped the websites[2] and annual reports of these government LPs for their fund commitments. We also directly contacted those government LPs for which we could not find reliable information online.[3] Lastly, we manually matched the GLP funds to funds in Thomson One based on the name and the nation of the fund. This gave us a list of 796 private VC funds that had received a commitment from at least one of the 35 government LPs.

With these data in hand, we returned to Thomson One and downloaded all recorded VC investments between Jan 1, 1997 and Dec. 31, 2015 (55,627 investments). We then classified investments into three categories. GVC investments are those in which the VC investor appears in our list of GVC investors (5,423 investments, 9.74% of total). GLP investments are those carried out by VC funds from our list of GLPs (10,738 investments, 19.30% of total). The remaining investments are classified as purely private VC investments (PVC, 39,466 investments).

We aggregate investment data at the fund nation-year level, obtaining the number of GVC, GLP and PVC investments in every nation and year. We exclude observations in which the number of both GLP and GVC investments was equal to 0 in the focal year and in all the previous years. With this procedure, we exclude Romania and Slovakia from our sample, as we could not retrieve information on GVC investments in these countries. Our final dataset is an unbalanced panel of 314 country-year observations, covering 25 countries during 19 years (1997-2015). The included countries are Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland and the United Kingdom. We use this dataset to perform our macro-level analysis.

3 Variables

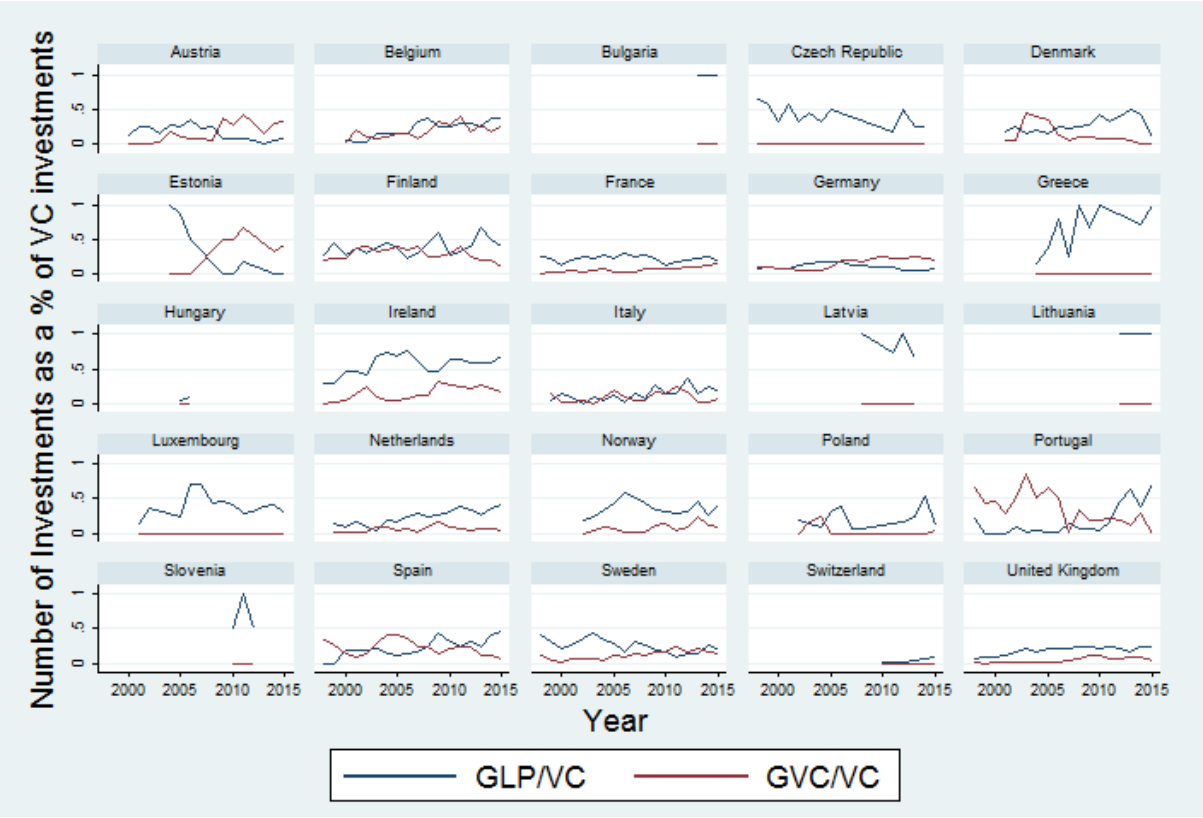
To study the determinants of the policy mix for supporting the VC industry, we used as dependent variables three measures of the flow of public investments into the VC industry, derived from Thomson One investment data. The first one, denoted "(GLP+GVC)/VC", reports the number of direct (GVC) and indirect (GLP) government investments divided by the total number of VC investments in a given country-year.[4] The two individual components "GLP/VC" and "GVC/VC" measure the proportion of investments made in a given country-year via each channel separately. In an average year, European GVC and GLP funds make approximately 42.2% (median 36.1%) of investments in our sample countries. There is, however, a substantial difference between these channels. GVCs account, on average, for 12.5% (median 7.9%) of VC investments, while GLPs are involved, on average, in 29.7% (median 24.8%) of VC investments. The univariate t-tests indicate that this difference is statistically significant and at the 1% level (t-stat = 9.844).

The graphical representation of these patterns, reported in Figure 1 below, suggests a substantial within-country heterogeneity. Some countries rely on GLP only (e.g., the Société National de Crédit et d'Investissement in Luxembourg), while in other countries, both channels are used

[2] We also used the Wayback Machine (http://archive.org/web) to check historical web pages.
[3] Eventually, we recovered fund commitments for all the listed GLPs, with the one exception of Caixa Capital, located in Portugal.
[4] We use the number of investments, as the amounts invested are not accurately reported in Thomson One.

in parallel.[5] In the latter case, some nations use these initiatives as substitutes (e.g., Denmark or Portugal), i.e., in years when GVC activity is stronger, GLP activity is weaker, and vice-versa. Other countries resort to both types of intervention simultaneously, as complements (e.g., Belgium, Italy, France, Germany and the United Kingdom).

Figure 1: GLP and GVC activity by nation and year



The high heterogeneity in the use of GVC and GLP across countries and years could be related to the economic settings and quality of public institutions that make decisions on the policy mix used to support the VC industry in these countries. To verify these conjectures, we relied on a set of independent variables.

To account for the general extent of development of the VC market, we used the variable "VC/GDP", measured as the number of VC investments (source: Thomson One) divided by national GDP (source: World Bank). We control for the real interest rates in the given country-year ("Interest rate", source: World Bank), which have been found to influence VC activity (Bellavitis 2016). VC financing can potentially be substituted by bank loans. Whether banks are more or less willing to provide loans to entrepreneurs seems to be related to the structure and competition of the banking industry (Black and Strahan 2002; Rice and Strahan 2010).

[5] The Czech Republic launched its first GVC program, the Fondseed (www.fondseed.cz), in 2013. However, the program was abandoned before it could make its first investment (see http://www.business-info.cz/cs/clanky/pozastaveni-projektu-seed-fond-50051.html, last accessed on 12/12/2017).

Accordingly, we include the variable "Bank concentration", measured by the time-varying national C3 concentration index available from the World Bank.[6] The intensity of entrepreneurship in a given country-year is proxied by the general unemployment levels, assuming that greater unemployment would trigger an increase in the supply of entrepreneurs and an appropriate government response. We use the variable "Unemployment %", i.e., percentage of unemployed in the total labor force in every country and year, also from the World Bank. We control for other forms of governmental support with variables capturing the national government expenditures relative to GDP ("Government consumption/GDP", source: World Bank) and the subsidies and other transfers as a percentage of governmental expense ("Public subsidies", source: World Bank). Lastly, we include a "Crisis dummy" to isolate the years 2009 to 2011.[7]

To assess the impact of the quality of government institutions on the policy mix for supporting VC, we use the variable "Quality of Public institutions", which corresponds to the Public institutions pillar of the Global Competitiveness Indicator, developed yearly by the World Economic Forum (WEF 2016).

Arguably, the reason for governments to intervene in the VC industry is to solve the equity gap problem (Lerner 2002). We therefore also conduct a preliminary analysis on the consequences of the policy mix for supporting the VC industry on the availability of finance for companies. In order to do so, we rely on data extracted from the Survey on the access to finance of enterprises (SAFE) surveys, conducted by the European Central Bank and the European Commission with European SMEs since 2009. SAFE respondents are asked to express their opinion about whether financing conditions deteriorated, remained unchanged or improved in the last 6 months. Specifically, we used as dependent variables the answers related to four conditions: the "Availability of Equity", the "General Economy", the availability of "Public Finance" and the "Willingness of Investors" to invest in their companies. Answers were aggregated at nation-year level, for a total of 117 observations. Positive values of the variables imply that conditions overall improved, and vice-versa for negative values. We then regress these four dependent variables against "GLP/VC" and "GVC/VC", as main independent variables, and the usual set of controls.

Whenever appropriate, independent variables are one-year lagged with respect to the focal observation year. Descriptive statistics are reported in Table I.[8]

Table I: Descriptive statistics

Variable	N	Mean	SD	Median	Min	Max
(GLP+GVC)/VC	314	0.422	0.234	0.361	0.005	1.000
GLP/VC	314	0.297	0.235	0.248	0.000	1.000
GVC/VC	314	0.125	0.143	0.079	0.000	0.853
VC/GDP, lagged	314	0.264	0.268	0.190	0.003	1.756

(continued next page)

[6] As a robustness check, we use the domestic bank credit to the private sector over GDP as an alternative measure of debt availability (source: World Bank). The results are unchanged and available upon request.
[7] We do not include the year dummies in these models, as our panels are largely unbalanced. We did, however, run an additional robustness test that included the year or period dummies in all models, and we found the results to be unchanged. These results are available from the authors upon request.
[8] To save space, the correlation matrix is not reported but is available from the authors upon request.

(continued)

Variable	N	Mean	SD	Median	Min	Max
Interest rate, lagged	314	3.715	2.922	3.571	-7.674	14.727
Banks concentration, lagged	314	72.946	18.025	75.800	29.440	100.000
Unemployment %, lagged	314	8.216	4.328	7.548	1.805	27.466
Crisis dummy	314	0.115	0.319	0.000	0.000	1.000
Government consumption/GDP, lagged	314	20.196	3.119	19.799	10.665	27.935
Public subsidies, lagged	314	60.784	22.301	62.238	14.476	138.381
Quality of Public Institutions, lagged	314	4.942	0.791	5.096	3.081	6.177
Availability of Equity	117	-0.002	0.168	0.016	-0.714	0.500
General Economy	117	-0.192	0.283	-0.211	-0.769	0.489
Public Finance	117	-0.199	0.189	-0.158	-0.762	0.163
Willingness of Investors	117	-0.008	0.182	0.029	-0.644	0.333

4 Results

To analyze the relationships between the three main dependent variables (GLP+GVC)/VC, GLP/VC, and GVC/VC and the economic and institutional characteristics of European countries, we resort to fixed and random effects panel estimators. Fixed effect estimators remove the problem of unobserved heterogeneity, which may bias the results in the presence of endogenous unobservable variables. At the same time, unobserved country heterogeneity is probably also an important driver of the patterns of GLP and GVC investments. Random effects models allow this to be captured directly during the estimation. In all cases, we adjust the standard errors for the possible presence of heteroscedasticity using the White-robust estimate of the covariance matrix. The results are reported in Table II.[9]

The first three specifications correspond to the random effects models, while the last three represent the fixed effect estimation. Specifications (I) and (IV) relate the general government intervention in the VC market (both GVC and GLP investments) to the various countries' economic characteristics and to the quality of public institutions variable. In both cases, we find that the real interest rates, the unemployment, the amount of government expenditures, and the amount of public subsidies statistically significantly affect the overall (direct and indirect) proportion of government investments in the VC industry. Interest rates load negatively and at 1% significance levels in both the random and fixed effects models. Unemployment rate loads positively at 5% significance level in both models. Government expenditures load positively at the 1% and 5% significance levels in random and fixed effects models, respectively. Finally, the Public subsidies load positively at 5% significance level.

Specifications (II), (III), (V), and (VI) offer an interesting and more nuanced view. It appears that the real interest rates have a negative effect on GLP and positive but insignificant effect on the GVC activities. In particular, a one-standard-deviation increase in real interest rates translates into approximately a 5.0% reduction in GLP investments (−0.017 ×2.92), and this effect is significant at the 1% level (specifications II and V). Government consumption seems to matter only for the GVC investment channel across models (III) and (VI). A one standard

[9] In the unreported robustness checks, we also estimated a Tobit model to take into consideration the fact that our dependent variable is truncated between 0 and 1. Furthermore, we also used a Seemingly Unrelated Regression (SUREG) to take into account the correlation between our dependent variables GLP/VC, and GVC/VC. Results remained robust and available from the authors upon request.

deviation increase in "Government Consumption/GDP" leads to a 2.8%-4.7% increase in GVC activity. On the contrary, unemployment positively affects only GLP activity (models II and V). A one-standard-deviation increase in "Unemployment %" leads to a 3.46% increase in GLP activity in both the fixed and random effects models, although this effect seems to be only marginally significant (at 10% precisely).

Table II: Determinants of the policy mix for supporting the VC industry

The table shows the coefficients and robust standard errors (in parentheses) of random effects and fixed effects models, whose dependent variables are indicated in the first row of the table. *Legend*: * p-value<10%, ** p-value<5%, *** p-value<1%.

	Random effects			Fixed effects		
	I	II	III	IV	V	VI
Dependent variable	GLP+GVC / VC	GLP / VC	GVC / VC	GLP+GVC / VC	GLP / VC	GVC / VC
VC/GDP, lagged	0.013	-0.034	0.041	0.025	-0.032	0.058
	(0.058)	(0.032)	(0.047)	(0.058)	(0.035)	(0.041)
Interest rate, lagged	-0.011 ***	-0.017 ***	0.005	-0.011 ***	-0.017 ***	0.007
	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)
Banks concentration, lagged	0.000	-0.001	0.001	0.000	-0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Unemployment %, lagged	0.006 **	0.008 *	-0.002	0.006 **	0.008 *	-0.002
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)
Crisis dummy	0.029	-0.013	0.047 *	0.017	-0.017	0.034
	(0.027)	(0.015)	(0.027)	(0.026)	(0.014)	(0.028)
Government consumption, lagged	0.022 ***	0.011	0.009 **	0.028 **	0.013	0.015 **
	(0.008)	(0.010)	(0.004)	(0.010)	(0.013)	(0.006)
Public subsidies, lagged	0.002 **	0.001	0.001	0.003 **	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)
Quality of Public Institutions, lagged	-0.052	-0.138 **	0.056 *	-0.019	-0.151 *	0.132 *
	(0.051)	(0.059)	(0.031)	(0.061)	(0.086)	(0.068)
Constant	0.166	0.846 **	-0.5 ***	-0.239	0.78	-1.018 **
	(0.347)	(0.407)	(0.148)	(0.430)	(0.596)	(0.399)
Number of countries	25	25	25	25	25	25
Number of observations	314	314	314	314	314	314
R^2 (overall)	0.012	0.05	0.071	0.001	0.035	0.054
χ^2 (8 d.o.f.)	27.317 ***	77.708 ***	71.717 ***			
F (7 d.o.f.)				4.036 ***	9.252 ***	9.839 ***

The quality of public institutions has no significant effect on the combined GVC and GLP activity. Taken separately, however, we observe that the quality of governments loads negatively on the GLP channel, with 5% and 10% significance levels in the random and fixed effects models, respectively. At the same time, government quality has a positive and 10% significant effect on GVC investments. This finding is intriguing. The message emerging from virtually all recent findings on GVC structures suggests that governments should always assume a passive role and work together with private partners (see for instance Jääskeläinen et al., 2007, for GLPs and Alperovych et al., 2015, for GVCs). We find that poorer quality governments are more likely to do exactly this and engage in GLP activity. This is especially true in Central and Eastern European countries, where GLP initiatives were initiated by the European Commission and the European Investment Bank through the JEREMIE program (EIF 2012). At the same time, good quality governments (namely Nordic countries) seem to adopt a more direct approach and invest through GVC channels (for a similar result, see Murray and Cowling, 2014). On balance, although various types of government intervention have been identified in the literature (Colombo et al. 2016), different governments seem to use them to different extents.

To further examine the implications of the quality of public authorities on the VC funding channels they prefer, we decompose the Quality of Public Institution index into its components. The results are reported in Table III.

Table III: Determinants of the policy mix for supporting the VC industry – components of the Quality of Public Institutions index

The table shows the coefficients and robust standard errors (in parentheses) of random effects and fixed effects models, whose dependent variables are indicated in the first row of the table. All models include the lagged variables "VC/GDP", "Interest rate", "Bank concentration", "Unemployment %", "Government consumption", "Public subsidies" and the crisis dummy, plus the variable indicated in the first column and a constant. The dataset includes 314 observations. *Legend*: * p-value<10%, ** p-value<5%, *** p-value<1%.

	Random effects			Fixed effects		
	I	II	III	IV	V	VI
Dependent variable	GLP+GVC	GLP	GVC	GLP+GVC	GLP	GVC
	VC	VC	VC	VC	VC	VC
Property rights index, lagged	-0.111 ***	-0.123 ***	0.012	-0.084 **	-0.102 *	0.018
	(0.034)	(0.044)	(0.020)	(0.037)	(0.059)	(0.050)
R^2 (overall)	0.049	0.106	0.071	0.014	0.071	0.042
χ^2 (7 d.o.f.)	45.678 ***	97.696 ***	88.196 ***			
F (6 d.o.f.)				5.447 ***	12.92 ***	6.157 ***
Ethics and Corruption index, lagged	-0.006	-0.072	0.040 **	0.021	-0.080	0.101 **
	(0.040)	(0.048)	(0.016)	(0.054)	(0.069)	(0.039)
R^2 (overall)	0.01	0.039	0.060	0.000	0.022	0.038
χ^2 (7 d.o.f.)	28.53 ***	73.879 ***	69.988 ***			
F (6 d.o.f.)				5.259 ***	9.762 ***	9.34 ***
Undue influence index, lagged	-0.036	-0.103 **	0.047	-0.006	-0.101	0.095 *
	(0.033)	(0.045)	(0.031)	(0.033)	(0.064)	(0.052)
R^2 (overall)	0.016	0.061	0.067	0.001	0.042	0.05
χ^2 (7 d.o.f.)	26.229 ***	72.451 ***	76.163 ***			
F (6 d.o.f.)				3.87 ***	9.048 ***	10.519 ***
Public sector performance index, lagged	-0.052	-0.135 ***	0.054 *	-0.039	-0.148 **	0.109 *
	(0.045)	(0.047)	(0.029)	(0.049)	(0.061)	(0.057)
R^2 (overall)	0.009	0.033	0.058	0.001	0.02	0.039
χ^2 (7 d.o.f.)	27.766 ***	80.616 ***	73.752 ***			
F (6 d.o.f.)				3.708 ***	9.28 ***	11.119 ***
Security index, lagged	0.015	-0.046	0.055 *	0.030	-0.038	0.068
	(0.057)	(0.061)	(0.032)	(0.061)	(0.066)	(0.040)
R^2 (overall)	0.013	0.042	0.113	0.002	0.019	0.092
χ^2 (7 d.o.f.)	31.475 ***	76.235 ***	71.024 ***			
F (6 d.o.f.)				6.248 ***	9.41 ***	8.116 ***

The Quality of Public Institutions index is based on the following five dimensions: the property rights index, ethics and corruption index, undue influence index, public sector performance index, and security index. We estimate the same models as above using the random and fixed effects but considering only one component of the Quality of Public Institutions index at a time. In Table III, we report the coefficients of the components and suppress the control variables (the same as in Table II) to save space. As before, the standard errors are White-robust. As in the composite index, we find that all components load negatively on GLP activity and positively on GVC activity. However, components differ in terms of significance. "Property rights index" and "Public sector performance index" components show the most significant and consistent coefficients across the random and fixed effects models. In an unreported estimate, we included simultaneously all five index components in the regression, despite their high correlation. We find that these two indexes have the most significant effects. This result confirms that higher-quality public authorities adopt a more direct approach in their support of the VC market and prefer to intervene in the form of GVC programs. Moreover, better intellectual property protection (captured by the property rights index) limit the use of government intervention in the VC market. This can be explained by the higher interest of private individual and institutional investors in the VC asset class due to the beneficial effect of stronger property rights on expected returns (Bruton et al. 2005).

Our last set of analyses documents the preliminary evidence on the impact of GLP and GVC initiatives on the easiness with which companies can access finance. As argued above, the reason for governments to introduce VC programs (direct or indirect) is to resolve the equity gap issue advocated by Lerner (2002). The equity gap is directly related to the access to financing which the SAFE survey tracks since 2009. In Table IV below, we use fixed effects estimators with robust standard errors to study the effect of GLP/VC, and GVC/VC on four dependent variables: "Availability of Equity", "General Economy", "Public Finance" and "Willingness of Investors". We find positive and significant effects of GLP activity on all dependent variables with significance levels ranging from 5% to 1%. This suggests that GLP initiatives are an effective policy tool to improve companies' access to finance. While the coefficient on the GVC/VC variable are positive across the models, it is only significant in Model IV, which has "Willingness of Investors" as dependent variable, at the 10% significance level. Explanations for the limited impact of GVC programs on the easiness with which companies can access finance have been identified in the empirical literature. For example, there is a possibility that GVC investments are captured by politically connected companies (Lerner 1999) or that GVC investors target companies that do not fit the investment mandate of resolving the equity gap (Johan et al. 2014).

Table IV: Impact of the policy mix for supporting the VC industry on the easiness to access capital of SMEs.

The table shows the coefficients and robust standard errors (in parentheses) of fixed effects models, whose dependent variables are indicated in the first row of the table. *Legend*: * p-value<10%, ** p-value<5%, *** p-value<1%.

Dependent variable	I Availability of Equity		II General Economy		III Public Finance		IV Willingness of investors	
GVC/VC, lagged	0.544		0.497		0.251		0.597	*
	(0.397)		(0.339)		(0.271)		(0.327)	
GLP/VC, lagged	0.372	**	0.540	**	0.438	***	0.394	**
	(0.151)		(0.197)		(0.145)		(0.147)	
VC/GDP, lagged	-0.200		-0.131		-0.066		-0.425	*
	(0.204)		(0.392)		(0.247)		(0.246)	
Interest rate, lagged	0.007		0.016		0.011		0.009	
	(0.010)		(0.016)		(0.011)		(0.013)	
Banks concentration, lagged	0.002		-0.001		0.000		0.000	
	(0.004)		(0.007)		(0.004)		(0.004)	
Unemployment %, lagged	0.012		0.009		-0.009		0.012	
	(0.012)		(0.016)		(0.011)		(0.011)	
Crisis dummy	-0.096	**	-0.144		-0.069		-0.108	**
	(0.044)		(0.104)		(0.057)		(0.051)	
Government consumption, lagged	0.010		-0.015		-0.053		0.001	
	(0.030)		(0.058)		(0.036)		(0.032)	
Public subsidies, lagged	-0.004	***	-0.010	***	-0.007	***	-0.003	
	(0.001)		(0.003)		(0.002)		(0.002)	
Quality of Public Institutions, lagged	0.169		0.109		0.191		0.060	
	(0.120)		(0.240)		(0.131)		(0.119)	
Constant	-1.199		-0.004		0.326		-0.382	
	(1.096)		(1.601)		(1.104)		(0.870)	
N of countries	25		25		25		25	
N of observations	117		117		117		117	
R^2	0.081		0.075		0.150		0.075	
F (9 d.o.f.)	86.652	***	56.151	***	46.767	***	29.544	***

5 Conclusions

This paper provides an overview of government VC activity in Europe, which we divide into direct and indirect activity depending on the channel used by various supranational, national and regional governments to fund entrepreneurial ventures. Most of the extant evidence at the macro level (often country-specific studies) focuses on the direct channel, i.e., investments by

stand-alone government-backed venture capital funds (GVC). Here, we also consider investments made by funds sponsored by governments as limited partners (GLP). By doing so, we are able to provide an idea of the relative importance of GVC and GLP channels in the European VC industry. Further, we also provide some preliminary evidence on the effectiveness of both GVC and GLP channels. More specifically, we focus on the role of GVC and GLP activity in improving the easiness with which companies can access finance. We hereby contribute to the literature on the impact of different types of government intervention in VC markets (Colombo et al. 2016).

We build on a novel hand-collected and unique sample of 137 GVC initiatives and 35 GLP programs in Europe during 1997-2015. First, our findings indicate a strong governmental presence in the European venture capital market. On average 42.2% of investments are made by funds directly and indirectly supported by European governments during our sample period. This is a much more important proportion than previously suggested (e.g., Bottazzi et al. 2004). More specifically, every year in European countries, 12.5% of investments are made by GVC programs, and an additional 29.7% are financed by GLP funds. Moreover, we find that European governments are heterogeneous in their policy mix for supporting the VC industry. Our preliminary evidence indicates that macro-economic factors and the quality of public institutions are related to the use of the direct or indirect channels of government intervention in the VC industry. According to our results, better quality governments use a more direct GVC approach, while in countries with lower-quality governments, GLP initiatives, backed by EIF, seem to prevail. Second, we find that of both channels, only the GLP channel significantly improves companies' access to finance. As such, our results suggest that the GLP channel is a more effective tool to improve companies' access to finance.

This early evidence uncovers a broad set of questions that have not been previously examined. First, we compare GVC and GLP initiatives at the macro level in terms of volume and their impact on improving access to finance, but a more thorough investigation of the differences between the two channels – in terms of their investment patterns and effectiveness in fulfilling governmental goals such as job creation – is still missing. Second, while we provide evidence on the frequency of the collaboration between PVC and different forms of government intervention in the VC market, the consequences of such collaboration from the PVC perspective are not quite clear yet. Future research will hopefully shed light on these issues.

References

Alperovych, Y., Hübner, G., & Lobet, F. (2015). How does Governmental versus Private Venture Capital Backing Affect a Firm's Efficiency? Evidence from Belgium. *Journal of Business Venturing*, *30*(4), 508–525. doi:10.1016/j.jbusvent.2014.11.001

Bellavitis, C. (2016). Do Interest Rates Affect Venture Capital Investments? *Academy of Management Proceedings*, *2016*(1), 11572. doi:10.5465/AMBPP.2016.11572abstract

Berger, A. N., & Udell, G. F. (1998). The Economics of Small Business Finance: The Roles of Private Equity and Debt Markets in the Financial Growth Cycle. *Journal of Banking & Finance*, *22*(6–8), 613–673. doi:10.1016/S0378-4266(98)00038-7

Bertoni, F., Colombo, M. G., & Quas, A. (2015). The patterns of venture capital investment in Europe. *Small Business Economics*, *45*(3), 543–560. doi:10.1007/s11187-015-9662-0

Bertoni, F., Colombo, M. G., & Quas, A. (2018). The role of governmental venture capital in the venture capital ecosystem: an organizational ecology perspective. *Entrepreneurship: Theory and Practice*, *In press*, 1–19. doi:10.1177/1042258717735303

Bertoni, F., & Tykvová, T. (2015). Does Governmental Venture Capital Spur Invention and Innovation? Evidence from Young European Biotech Companies. *Research Policy*, *44*(4), 925–935. doi:10.1016/j.respol.2015.02.002

Black, S. E., & Strahan, P. E. (2002). Entrepreneurship and Bank Credit Availability. *The Journal of Finance*, *57*(6), 2807–2833. doi:10.1111/1540-6261.00513

Bottazzi, L., Da Rin, M., & Hellmann, T. F. (2004). The Changing Face of the European Venture Capital Industry Facts and Analysis. *The Journal of Private Equity*, *7*(2), 26–53. doi:10.3905/jpe.2004.391048

Brander, J. A., Du, Q., & Hellmann, T. F. (2015). The Effects of Government-Sponsored Venture Capital: International Evidence. *Review of Finance*, *19*(2), 571–618. doi:10.1093/rof/rfu009

Bruton, G. D., Fried, V. H., & Manigart, S. (2005). Institutional Influences on the Worldwide Expansion of Venture Capital. *Entrepreneurship: Theory and Practice*, *29*(6), 737–760. doi:10.1111/j.1540-6520.2005.00106.x

Buzzacchi, L., Scellato, G., & Ughetto, E. (2013). The investment strategies of publicly sponsored venture capital funds. *Journal of Banking & Finance*, *37*(3), 707–716. doi:10.1016/j.jbankfin.2012.10.018

Colombo, M. G., Cumming, D. J., & Vismara, S. (2016). Governmental Venture Capital For Innovative Young Firms. *Journal of Technology Transfer*, *41*(1), 10–24. doi:10.1007/s10961-014-9380-9

Cumming, D. J. (2007). Government policy towards entrepreneurial finance: Innovation investment funds. *Journal of Business Venturing*, *22*(2), 193–235. doi:10.1016/j.jbusvent.2005.12.002

Cumming, D. J., Grilli, L., & Murtinu, S. (2017). Governmental and independent venture capital investments in Europe: A firm-level performance analysis. *Journal of Corporate Finance*, *42*, 439–459. doi:10.1016/j.jcorpfin.2014.10.016

Cumming, D. J., & Johan, S. (2009). Pre-seed government venture capital funds. *Journal of International Entrepreneurship*, *7*(1), 26–56. doi:10.1007/s10843-008-0030-x

Cumming, D. J., & Macintosh, J. G. (2006). Crowding out private equity: Canadian evidence. *Journal of Business Venturing*, *21*(5), 569–609. doi:10.1016/j.jbusvent.2005.06.002

Da Gbadji, L., Gailly, B., & Schwienbacher, A. (2015). International Analysis of Venture Capital Programs of Large Corporations and Financial Institutions. *Entrepreneurship: Theory and Practice*, *39*(4), 1213–1245. doi:doi: 10.1111/etap.12105

EIF. (2012). *JEREMIE: A new way of using EU Structural Funds to promote SME access to finance via Holding Funds*. Luxembourg. http://www.eif.europa.eu/news_centre/publications/jeremie-leaflet.htm

Grilli, L., & Murtinu, S. (2014). Government, Venture Capital and the Growth of European High-tech Entrepreneurial Firms. *Research Policy*, *43*(9), 1523–1543. doi:10.1016/j.respol.2014.04.002

Groh, A. P., von Liechtenstein, H., & Lieser, K. (2010). The European Venture Capital and Private Equity country attractiveness indices. *Journal of Corporate Finance*, *16*(2), 205–224. doi:10.1016/j.jcorpfin.2009.09.003

Guerini, M., & Quas, A. (2016). Governmental venture capital in Europe: Screening and certification. *Journal of Business Venturing*, *31*(2), 175–195. doi:10.1016/j.jbusvent.2015.10.001

Ivanov, V. I., & Xie, F. (2010). Do Corporate Venture Capitalists Add Value to Start-Up Firms? Evidence from IPOs and Acquisitions of VC-Backed Companies. *Financial Management*, *39*(1), 129–152. doi:10.1111/j.1755-053X.2009.01068.x

Jääskeläinen, M., Maula, M. V. J., & Murray, G. C. (2007). Profit distribution and compensation structures in publicly and privately funded hybrid venture capital funds. *Research Policy*, *36*(7), 913–929. doi:10.1016/j.respol.2007.02.021

Jeng, L. A., & Wells, P. C. (2000). The determinants of venture capital funding: evidence across countries. *Journal of Corporate Finance*, *6*(3), 241–289. doi:10.1016/S0929-1199(00)00003-1

Johan, S., Schweizer, D., & Zhan, F. (2014). The Changing Latitude: Labor-Sponsored Venture Capital Corporations in Canada. *Corporate Governance: An International Review*, *22*(2), 145–161. doi:10.1111/corg.12057

Kelly, R. (2011). The Performance and Prospects of European Venture Capital. *EIF working paper 2011/09*, 1–24.

Kovner, A., & Lerner, J. (2015). Doing Well by Doing Good? Community Development Venture Capital. *Journal of Economics & Management Strategy*, *24*(3), 643–663. doi:10.1111/jems.12100

Leleux, B., & Surlemont, B. (2003). Public versus Private Venture Capital: Seeding or Crowding Out? A Pan-European Analysis. *Journal of Business Venturing*, *18*(1), 81–104. doi:10.1016/S0883-9026(01)00078-7

Lerner, J. (1999). The Government as Venture Capitalist: The Long-Run Impact of the SBIR Program. *Journal of Business*, *72*(3), 285–318. doi:10.3905/jpe.2000.319960

Lerner, J. (2002). When Bureaucrats Meet Entrepreneurs: The Design of Effective "Public Venture Capital" Programmes. *Economic Journal*, *112*(477), F73–F84. doi:10.1111/1468-0297.00684

Lim, S., & Kim, Y. (2015). How to Design Public Venture Capital Funds: Empirical Evidence from South Korea. *Journal of Small Business Management*, *53*(4), 843–867. doi:10.1111/jsbm.12109

Mc Cahery, J., de Silanes, F. L., Schoenmaker, D., & Stanisic, D. (2015). The European capital markets study: Estimating the financing gaps of SMEs. *Duisenberg School of Finance*, *1*(3), 1–179. https://www.narcis.nl/publication/RecordID/oai:tilburguniversity.edu:publications%2F67cb39c2-71b9-4046-810e-8c31007175dc. Accessed 28 July 2017

Munari, F., & Toschi, L. (2015). Assessing the impact of public venture capital programmes in the United Kingdom: Do regional characteristics matter? *Journal of Business Venturing*, *30*(2), 205–226. doi:10.1016/j.jbusvent.2014.07.009

Murray, G. C., & Cowling, M. (2014). Evaluation of the Danish Growth Fund. Evaluation of activities, 2010-2012, 1–139. http://www.vf.dk/~/media/files/analyser/evalueringer og effektanalyser/evaluering 2014.pdf

OECD. (2013). *Policies for seed and early stage finance: findings from the 2012 OECD financing questionnaire*. http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/IND(2013)5/FINAL&docLanguage=En

Rice, T., & Strahan, P. E. (2010). Does Credit Competition Affect Small-Firm Finance? *Journal of Finance*, *65*(3), 861–889. doi:10.1111/j.1540-6261.2010.01555.x

Standaert, T., & Manigart, S. (2017). Government as fund-of-fund and VC fund sponsors: effect on employment in portfolio companies. *Small Business Economics*, *forth.* doi:10.1007/s11187-016-9831-9

WEF. (2016). *The Global Competitiveness Report 2016–2017*. *World Economic Forum Reports 2016*. doi:92-95044-35-5