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Bridging the equity gap for young innovative companies: The design of effective government venture capital fund programs

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ABSTRACT

Governmental venture capital funds (GVCs) are created by policymakers around the world to support young innovative companies (YICs) with the aim of "bridging the equity gap". In this paper, we study the heterogeneity in the design of GVC programs in Europe and identify the design features that are most effective in achieving the desired outcomes of this policy. Specifically, we focus on the probability that GVC-backed companies will receive additional funds from private venture capital investors and, ultimately, changes in their growth and innovation outcomes. We find that the choices of location, colocation, syndication and industry focus of a GVC program substantially influence the extent to which it is able to achieve such goals. Important policy implications are discussed.

> "…Not only are we faced with a serious investment gap; we are caught in an investment trap. […] While investment is taking off in the U.S., Europe is lagging behind. Why? Because investors lack confidence, credibility and trust. […]
>
> …What we are going to do is to set up the right system that will use available public money to leverage additional capital that would have never otherwise been mobilised. Every public euro mobilised can generate additional investment that would not have happened otherwise. And it can create jobs…"

Jean-Claude Juncker, former President of the European Commission, to the European Parliament in Strasbourg, France, on 26 November 2014

1. Introduction

The growth of young innovative companies (YICs) is often constrained by their lack of financing capabilities. If sufficient external financing is not available, governments can step in to back them. For example, governments can offer guarantees without actually deploying capital, or may add financial resources in the form of subsidies, debt, equity, or combinations thereof. For this purpose, they can establish government venture capital (GVC) fund policies under which affiliated intermediaries, i.e. GVC funds, provide financing to YICs. This paper addresses the effectiveness of various typical design features of such government venture capital (GVC) fund programs.[1]

GVC fund policies are in place because of the fundamental economic role of YICs, which are disproportionately important sources of new jobs, disruptive innovation, growth and future prosperity (Criscuolo et al., 2014). The establishment and survival of YICs, however, relies on the resolution of one severe impediment – access to finance (Cressy, 2012, 2002). Given their usually limited internal financing capacities, YICs' chances to survive, grow, create jobs, innovate, and provide tax revenues are constrained by their ability to raise external funds. In the absence of verifiable track records, weak tangible assets that could be pledged as collateral, high degrees of information asymmetry, and the typical uncertainty of the innovative commercial opportunities, YICs rarely qualify for "traditional" bank loans (Berger and Udell, 1998; Lerner, 2002). This creates the so-called "funding gap" problem where the credit market fails to clear the demand for financing (Meza and Webb, 1987; Stiglitz and Weiss, 1981).

Even though this phenomenon was originally discussed in the context of the loan market, it also affects the supply of equity (Cosh et al., 2009; Cressy, 2002). In fact, specialized early-stage

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[1] Alternatively, policy makers can channel funds to YICs via venture capital fund-of-fund structures. In these programs, governments act as one of the limited partners alongside the private institutional investors of the funds. Typically, the fund managing entities are not government affiliated but private companies. The investments of such fund management vehicles are not the scope of this paper. Such a policy is discussed in Alperovych et al. (2018).

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investors, such as professional venture capital (VC) funds or business angels (BAs), only back rigorously selected companies. This is due to the own resource limitations and high return expectations of such investors. Crowdfunding and initial coin offerings platforms provide new opportunities for YICs to raise early-stage capital (Belleflamme et al., 2014; Bruton et al., 2015; Chod and Lyandres, 2018; Howell et al., 2018). However, these funding alternatives are only appropriate for ventures in a handful of industries favored by "the crowd". Furthermore, such entrepreneurial projects need to be easily comprehensible and cannot rely on strategies or technology that should not be disclosed. As a consequence, many YICs with viable business models may still have serious problems receiving financial backing. This phenomenon is often referred to as the "equity gap".

Notably, the shortage in capital may also occur at later stages. In fact, YIC financing is usually staged and involves a series of funding rounds from smaller seed capital injections, e.g., by BAs or "the crowd", moving on to more important capital contributions, e.g., by professional VCs. This structure is often called the "funding escalator" (Mason, 2016), where investors generally position themselves in terms of the investment amounts they are willing to provide. If, for some reason, a venture's current investors are not able to provide follow-on financing and the funds needed are below the level of what subsequent investors usually supply, then the funding escalator stalls. This exacerbates the equity gap and may yield a structural problem of insufficient capital supply for YICs at higher levels of required funding. This is often called a "second equity gap", where more mature businesses might face funding difficulties a second time after having survived through the first equity gap (Wilson et al., 2018).[2]

If the supply of private capital is insufficient to provide viable YICs with the necessary funding, then policy response may be appropriate. Although often criticized (Brown, 2011; Cumming and Macintosh, 2006; Shane, 2009), a variety of indirect and direct policy measures can be used to improve access to financing for YICs. One such policy is to inject equity capital into selected ventures via GVCs. While many governments across the world make use of this device (Lerner, 2009), such initiatives are often found to be ineffective (Mason, 2016). The success or failure of a given policy, however, is a function of its design features (Arshed et al., 2014), and there is a strong heterogeneity among GVC policies, which are set up in different contexts and time periods. Yet , our understanding of the link between GVC program design features and their outcomes is mostly theoretical (Lerner, 2002). The few empirical studies include Bertoni and Tykvová (2015), who compare technology and development-oriented GVCs in one of their sub-analyses, Lim and Kim (2015), who study design features for private and public VC funds in South Korea, and Munari and Toschi (2015), who assess the impact of regional characteristics on the performance of GVC-backed investments in the UK. Evidently, our knowledge about the efficacy of different design features of GVC programs is still preliminary. This paper aims to fill this void.

Building on the literature and our own analysis of GVC initiatives, we identify three desired observable outcomes for GVC-backed YICs. The outcomes originate from the broad goal of such policies to "bridge the equity gap" for innovation and growth. First, GVC funds are meant to be a direct response to the funding gap and the broken funding escalator problem described above. Many of the YICs may not be appealing to private investors in terms of the amount of required capital or their inherent project risks. Supporting such YICs to render them attractive for private capital is therefore one of the desired outcomes (Mason and Harrison, 2003). Furthermore, because GVC initiatives usually target YICs for growth and innovation, these also are two naturally desired outcomes of a GVC policy (Auerswald and Branscomb, 2003; Link and Scott, 2010).

We then detect three distinct hard-wired design features of GVC policies. First, GVCs differ with respect to their location and with respect to their geographic investment focus. They can be placed in peripheral regions or economic hubs and are either constrained to invest locally or can allocate funds across their country (Heger et al., 2006; Mason and Pierrakis, 2013; Munari and Toschi, 2015). Second, some GVCs need to coinvest with PVC investors, while others are allowed to make solo investments. Third, GVCs may be required to focus on certain industries of strategic interest to policymakers or diversify investments across a broad spectrum of economic sectors (Lim and Kim, 2015).

We analyze the impact of GVCs' design features on the desired outcomes of YICs in Europe. The European setting is ideal for our analysis because it presents heterogeneous GVC design features across countries, regions, and time. Moreover, the European Commission expresses considerable interest in improving access to finance for YICs and has recently established the "Investment Plan for Europe"[3] whose goal is to close a funding gap and to foster innovation and growth.

Most of the previous literature assesses the impact of GVC by comparing GVC-backed companies to those that received PVC or no risk capital at all (Alperovych et al., 2015; Bertoni and Tykvová, 2015; Grilli and Murtinu, 2014; Cosh et al., 2009). In this paper, however, we elaborate on the cross-sectional variation in GVC design features and their effectiveness. Accordingly, we do not need to expand on the GVC selection process and have a simple identification strategy. We focus solely on GVC investments and exploit a sample of 1230 transactions originated by 72 GVC funds operating in 16 European countries. This identification strategy cannot be used to compare GVC-backing with other types of financing. It does, however, allow us to compare the various GVC-backed ventures contingent on GVC policy design features, which forms the core focus of this paper.

The data are retrieved from Thomson One and complemented with the VICO and Reuters EIKON datasets. We consider the financing rounds with GVC fund participation originated between 1995 and 2011. We stop sampling investments in 2011 because we need to track their outcomes until recently. Specifically, we observe investees' subsequent development in terms of receiving additional private capital financing from PVC funds (PVCs), their asset growth, and innovation output. Almost half (595) of the transactions are syndicated with PVCs in the first round. Syndication with a private investor can be an endogenous decision that could affect the investment outcome independent of the GVC program design. Therefore, we run all analyses on the full sample including syndicated transactions and on the subsample of investments exclusively originated by GVCs ("solo transactions").

Our results indicate that GVCs that back ventures in economically lagging regions, or countries with high perceived corruption are less successful in accomplishing their mission along the three dimensions considered above: subsequent injection of private capital, supporting growth, and fostering innovation. If, in addition, GVCs are also located in the economically lagging regions and predominantly source their transactions locally, then they are even less successful in reaching their goals. We interpret this as indirect evidence of collusion and political interference affecting the efficiency of GVC initiatives. We also detect that GVCs that build up industry-specific expertise and those who previously coinvested with PVCs are more likely to successfully bridge

[2] The equity gap is a strong policy concern around the globe. The existence of the gap in the US and appropriate measures to bridge it are discussed in Lerner (2002, 1999), Auerswald and Branscomb (2003), and Link and Scott (2010). Guan and Yam (2015) discuss the gap and measures in China. McCahery et al. (2015) estimate equity gaps in Europe to range between 0.7% (for The Netherlands) and 13.05% (for Romania) of the countries' GDP. Wilson et al. (2018) assess a first and second equity gap in the UK between £12 and £32 billion annually.

[3] Source: https://www.consilium.europa.eu/en/policies/investment-plan/.

equity gaps. This highlights the importance of learning processes for GVCs. Our results provide guidance to politicians for the design of effective GVC programs and contribute to the literature on how to facilitate access to financing for YICs with public money (Cortés and Lerner, 2013; Guerini and Quas, 2016; Martí and Quas, 2018; Meuleman and De Maeseneire, 2012; Ughetto et al., 2017).

We perform a series of robustness checks to verify our findings. First, we consider that the financial resources injected in the GVC round could be sufficient to back the venture until it turns profitable. In this case, there might be no need for an additional financing round, and our main measure for success would be flawed. We therefore control for the amount injected in the GVC round in a subsample for which this information is available. Second, we recast our models using alternative estimation techniques to account for the time dynamics of the desired outcomes and for the possible endogeneity of syndication decisions. Third, we consider different proxies for our main independent variables. All results remain unchanged.

We also take into account the heterogeneity of YIC characteristics and replicate our analyses distinguishing between ventures in high- and low-tech sectors and between those that received GVC in early and later stages of their lifecycles. We find that the results are stronger for high-tech and younger ventures. Finally, we explore whether the design features of GVC initiatives and their impact on YICs varied over time. We find that the global 2008 financial crisis was an important turning point for GVCs' *modus operandi* because several GVC design features had different impacts before and after 2008.

In the subsequent section, we review the related literature and develop our theoretical framework. Section 3 presents the data, methods and measures. Section 4 shows the results of the main analysis, and Section 5 presents additional evidence and robustness checks. Finally, we summarize the paper, discuss its limitations and discuss the GVC policy implications.

2. Overarching framework

2.1. Desired GVC program outcomes

Although heterogeneous in terms of particular remits, GVC initiatives can be evaluated by considering some largely shared desired outcomes. GVC programs are principally aimed at solving a market failure – the insufficient supply of capital to promising YICs.

In this context, the role of GVCs is to supply YICs with capital to alleviate financial constraints (Carpenter and Petersen, 2002) and to support the investee's development. If the backed YIC requires additional funding later in its lifecycle, then it may be possible to attract private capital at more favorable deal terms due to the reduced economic uncertainty and resulting lower investment risk. The receipt of subsequent PVC financing is therefore a clear proof that return-driven investors have faith in the venture's business plan and in the management team's quality. In other words, this event reveals that a GVC fund initially backed a venture with a potential to evolve into commercially viable company. It most likely would not have survived or at least would not have developed as successfully without the GVC fund's contribution. The GVC thus helped the YIC become "investment ready" (Mason and Harrison, 2001). The GVC's contribution itself, in this context, could also provide a signal to private capital investors and thus facilitate their investment (Guerini and Quas, 2016; Lerner, 2002; Mueller et al., 2012). We therefore consider the receipt of PVC financing following a GVC funding as proof of a successful equity gap bridge.

This success indicator is independent of the number of GVC rounds the YIC may have received in the meantime. The venture may actually require several additional GVC contributions prior to a PVC round. However, additional GVC does not trigger success in our model because, in an attempt to avoid bad media, public investors might not consistently abandon unsuccessful investments. Follow-on investments of public funds may nurture "living deads" and may not signal viable business models (Manigart et al., 2002). Consequently, we regard return-driven private investments as the only appropriate indicator that an equity gap has been bridged.

This definition, nevertheless, does not correspond to the goals of policymakers *stricto sensu*. In theory, GVC campaigns should improve the emergence and development of YICs and not solely produce deal flow for investors. It is further possible that a venture matures without requiring additional capital. For these reasons, we refer to the growth rates and innovation output of the investees as alternative desired outcomes for successful GVC investments. The empirical literature suggests that GVC-backed companies grow less in terms of employment and sales (Cumming et al., 2017; Grilli and Murtinu, 2014) and generate fewer patents (Bertoni and Tykvová, 2015) compared to PVC-backed ventures. In this paper, instead, we exclusively focus on GVC-backed companies and reveal the impact of different GVC program design features on growth and innovations of the investees.

2.2. GVC design features

GVC fund programs differ along at least three observable design features that are defined at their initiation.

First, policymakers decide on the location and geographic focus of a fund. In a few cases, GVCs invest nationwide (Lerner, 2009). These GVCs are often located in central regions and/or financial or innovation hubs and invest both locally and at distance. More frequently, GVCs are regionally focused (Mason and Harrison, 2003). These GVCs are more likely to be located in less developed peripheral regions and usually have a mandate to originate transactions locally. The second feature is related to their independence. Some GVC funds are allowed to act on their own and make transactions without syndicate partners (solo deals), while others are required to coinvest with PVCs. Third, GVC funds may need to originate transactions in clearly defined industries which are of particular interest for policy or society (Mason and Brown, 2013).

We label these three policy design features location/colocation constraint, syndication constraint, and industry focus. In the following, we discuss our expectations about the effectiveness of these designs for the achievement of the desired GVC policy outcomes.

2.2.1. Location/colocation

The literature indicates that PVCs and their investments exhibit a considerable level of spatial concentration in financial centers and high-tech regions (Chen et al., 2010; Colombo et al., 2019). To compensate for potential equity gaps in economically lagging areas, governments have often implemented local GVC programs to foster regional development (Bertoni et al., 2017; Bertoni and Tykvová, 2015; Kovner and Lerner, 2015; Lerner, 1999, 2002). The creation of such regional funds follows the assumption that there is enough high-quality demand for funding from YICs located in those regions (Mason, 2016). Recent accounts, however, do not support this argument: peripheral underdeveloped regions may suffer from a lack of infrastructure, R&D and innovation intensity, and appropriate quality of entrepreneurial human capital (Munari and Toschi, 2015). These characteristics result in smaller founding rates, lower quality YICs and thus a lower demand for risk capital (Bernstein et al., 2017; Colombo et al., 2019; Gompers et al., 2016).

Ownership structures and governance principles in peripheral regions can also differ from those in core centers and financial hubs. For example, we can assume that the presence and influence of family businesses is larger in peripheral areas. Family firms usually have high desired levels of control, a focus on wealth concentration, and noneconomic utilities, as discussed in Worek et al. (2018). Wilson et al. (2019) reveal that family firms probably have a much lower propensity to solicit and attract VC financing. This might constitute one reason why PVCs neglect peripheral regions in the first

place. Nevertheless, GVC programs are often located in those areas and have a local investment mandate only.[4]

Geographic proximity between investors and investees is generally considered beneficial because it improves monitoring efficiency (Bernstein et al., 2016). However, the opposite could be true in the case of GVCs. GVC programs focused and localized in underdeveloped regions can only pick from a very narrow pool of available investment opportunities (Mason and Harrison, 2003). Moreover, they face an eventual lack of local skilled human capital that undermines GVCs' ability to both select the most promising companies and to effectively support them (Dimov and Shepherd, 2005; Munari and Toschi, 2015). Furthermore, regionally focused programs have difficulties in attracting skilled investment managers from other regions because of their limited size (Jääskeläinen et al., 2007). We therefore expect that *GVCs located and investing in underdeveloped regions face stronger difficulties in attracting private capital and in fostering growth and innovation for their investees.*

Colocation can be detrimental for yet another reason unrelated to the economics of the region. In fact, the political science literature suggests that geographic proximity between the provider of public resources and the beneficiary can be harmful because it facilitates collusion between the parties. "…As geographical proximity makes it easier for companies to collaborate in research and innovation, so it makes it easier for companies or other agencies to collude in their supply of a critical input." (Akehurst, 1987, page 160). GVC policies may be subject to such collusion and political interferences, as politicians and their representatives sometimes constitute the majority on GVCs' investment committees (Jääskeläinen et al., 2007). Bertoni and Quas (2016) show that the timing and investment style of GVCs depends on election schedules and argue that this is attributable to their political nature. Political influences can distort GVCs' investment decisions because politicians may favor entrepreneurs and ventures to which they have a relationship (Becker, 1983; Peltzman, 1976). Schoenherr (2018) illustrates the negative consequences of political connections and resulting distortions of public capital allocation in South Korea. Lerner (1999) discusses the situation when GVCs' managers are personally connected to politicians and influenced by their political agenda. Faccio and Hsu (2017) provide indirect evidence that politically connected investors tend to exchange favors with policymakers. Such connections raise the likelihood that investees receive government grants and contracts. Because GVCs are politically connected by definition, they are not exempt from such allocative distortion issues. This should translate into an increased propensity to select investees of particular interest to the incumbent political party, regardless of their prospects for growth and success. We therefore expect that *GVC campaigns that require local investments are more likely to be influenced by collusion and, in turn, are less effective in bridging equity gaps.*

2.2.2. Syndication

Syndication is an important characteristic of the VC industry (Bubna et al., 2019; Hochberg et al., 2007; Lerner, 1994). The literature has emphasized the benefits of syndication, including obtaining a "second opinion" from a more reputed and experienced coinvestment partner (Casamatta and Haritchabalet, 2007) and the opportunity to reduce investment risks (Manigart et al., 2006). GVC programs that require systematic syndication with a private partner may thus benefit from such advantages. Empirical evidence suggests that coinvestments between PVC and GVC funds are more likely to be successfully exited in comparison to solo GVC deals (Brander et al., 2015; Cumming et al., 2017). The investees produce more innovation and achieve higher growth than isolated PVC-backed and GVC-backed peers (Bertoni and Tykvová, 2015; Cumming et al., 2017; Grilli and Murtinu, 2015; Kovner and Lerner, 2015). However, syndicating with PVCs may not only affect the success of a focal deal but also influence the way GVCs invest in the future. In fact, syndication provides them with the opportunity to learn from their partners (Clarysse et al., 2013). In this context, Lerner (2002) suggests that GVC programs should be structured to complement PVC funding, which would allow GVC fund managers to learn from PVCs. In addition, by syndicating with private investors, GVCs may enhance their networks of contacts, which should be beneficial for subsequent investments. We therefore expect *that GVC initiatives that require syndication with PVCs are more successful in bridging the equity gap.*

2.2.3. Industry focus

GVC policy initiatives are often designed to target specific industries, most likely high-tech industries, where both R&D cost and time-to-market are usually substantial. It is also frequently assumed that high-tech ventures are more innovative and yield higher growth and more economic prosperity (Mason and Harrison, 2003). However, empirical literature does not support this conjecture (Mason and Brown, 2013), and public support programs (including GVC) which exclusively target high-tech sectors are therefore criticized (Brown et al., 2017; Shane, 2009). At the same time, high-tech YICs are more exposed to potential equity gaps because private capital tends to avoid some high-tech industries (Bertoni et al., 2015). It therefore seems appropriate that the government steps in where the lack of private capital is most severe. A high-tech or selected industry focus may, in fact, be beneficial for an additional reason: Sørensen (2007) asserts a positive relationship between the industry-specific experience of PVC fund managers and investment performance. He reveals that by accumulating experience, VC managers become better at selecting portfolio companies and adding value. We therefore hypothesize *that GVC policies that focus on selected industries encourage GVCs' managers to develop industry-specific expertise. This should positively affect their ability to bridge equity gaps.*

3. Data and measures

3.1. Data sources and sampling

Our empirical analysis is based on a sample of European VC investments where a GVC fund provides financing in a first financing round up to 2011. We use 2011 as the GVC round cut-off year because we require sufficient time to track these investments afterwards.

We first gather a list of GVCs operating in Europe in the Thomson One database. This data source has some shortfalls, discussed in Bertoni et al. (2015), Da Gbadji et al. (2015), and Ivanov and Xie (2010). In particular, captive investors might be mischaracterized. Accordingly, we cross-checked our GVC list with the VICO database (www.vicoproject.org) and Reuters EIKON and performed direct internet queries. We identify 92 VC funds for which the parent company is a government body, and we retrieve the complete investment history for them from Thomson One. We also identify which of their investees receive financing by the end of 2014.[5] We exclude investees in the finance and real estate sectors and obtain a sample of 2142 companies that were involved in 4724 investment rounds between 1979 and 2014.

[4] For example, Mason and Harrison (2003) find a strong deficit of venture capital investments in Northern Ireland during the period 1997-2001. Northern Ireland is also the UK's region that scored the lowest Regional Competitive Index (please refer to Section 3.2 for a description). Northern Ireland had particularly low scores in terms of the infrastructure, market size and business sophistication dimensions of the index. It further has a low level of GDP/capita compared to the rest of the UK. In reaction to the perceived difficulties for young ventures to raise capital, the Northern Ireland government established several GVC funds with regional focus.

[5] We finished the investment data gathering process in May 2015. To verify completeness, we compare our data with the records in the Zephyr database and realize an appropriate match.

GVCs participated in 2912 of these rounds. We also gather data on investee characteristics, namely, location, industry sector and the founding year and information on the financing rounds.

We drop observations with missing data and those for investees located outside Europe and finally elaborate on a sample of 1230 investments by 72 GVCs between 1995 and 2011. For a subset of 861 rounds, we identify the amounts invested. For 1150 YICs, we are able to retrieve patenting data until 2016, and for 503 YICs, we gather data on their total assets for the years 2007 until 2016. Both patents and total assets are sourced from Bureau Van Dijk's Orbis database.[6]

Table 1 shows the distribution of GVC funds by country of origin and reveals that one-third of the sample GVCs are located in the UK. However, while the number of GVCs from the UK is large, the UK only accounts for 180 of our sample transactions, i.e., 14.6%.[7] Table 2 presents the sample transaction distribution by investment year, investee's age and stage of development at funding, its industry and high-tech sector classification, and its country. We also show a breakdown of transactions where the GVC round is syndicated or not. We observe 635 investments (i.e., 51.63%) originated by GVCs in solo transactions and 595 investments (i.e., 48.37%) syndicated with PVCs. The distribution of the investments by investees' age shows that most of the contributions were made towards young companies. For 23.82% of the sample transactions, it was younger than 1 year, and for 76.58% of the transactions, it was younger than 6 years old. In the remaining 23.42% of the transactions, the investees were 6 years or older at the time of the GVC investment. These older ventures might therefore not strictly fit the definition "YIC" (not being young anymore) but apparently faced a second equity gap. The data provider Thomson One classifies VC transactions into "seed and early-stage" versus "later-stage" deals independently of the age of the investee at funding. The characterization follows the judgment of the originators of the transactions who report to the database provider. This classification distinguishes 768 (i.e., 62.44%) seed or early-stage from 462 (i.e., 37.56%) later-stage financing rounds. We define high-tech sectors according to Kile and Phillips (2009) based on 3-digit SIC codes and find that 50.57% of the GVCs' contributions are made to high-tech ventures.

We refer to these sample characteristics in Section 5.5, where we address the impact of the transactions' heterogeneity.

3.2. Measures

3.2.1. Dependent variables

We propose three alternative measures to capture a successful bridge of an equity gap. Our principal dependent variable – "Additional PVC" – is a dummy equal to one if the focal GVC investment yields a subsequent financing round with PVC participation. As substitutes, we refer to the growth of an investee's assets and to the number of patents granted within three years after the capital contribution of a GVC. We measure sample companies' growth using the difference of "log (total assets)". Alternatively, we could consider employment growth. However, employment figures are only available for 418 of our sample YICs. The resulting sample size does not allow us to detect significant and robust parameter coefficients. Nevertheless, since asset and employment growth are well correlated characteristics, asset growth qualifies as a substitute for the missing observations of employment growth. The number of new patents is calculated by comparing the patent stock over the three-year period. We describe the alternative variables in more detail in the respective analyses sections of the paper.

[6] The investees were matched between Thomson One and Orbis manually by company names and countries.

[7] In untabulated robustness checks, we i) controlled for GVC location with country dummies and ii) excluded UK-based deals. In both cases we, find similar results, which are available upon request.

Table 1
Distribution of GVCs by country.

GVC country	*N*	%
Austria	4	5.56
Belgium	6	8.33
Denmark	2	2.78
Estonia	1	1.39
Finland	1	1.39
France	5	6.94
Germany	5	6.94
Ireland	3	4.17
Italy	3	4.17
Netherlands	2	2.78
Norway	1	1.39
Poland	1	1.39
Portugal	1	1.39
Spain	6	8.33
Sweden	7	9.72
United Kingdom	24	33.33
Total	*72*	*100.00*

Table 2
Distribution of GVC investments by investment period, age at the time of the investment, country and industry of the target company.

Investment year	*N*	%	**Age at the time of the investment**	*N*	%
1995	4	0.33	0 years	293	23.82
1996–1997	14	1.14	1 year	233	18.94
1998–1999	32	2.60	2–3 years	280	22.76
2000–2001	92	7.48	4–5 years	136	11.06
2002–2003	150	12.20	6 years and older	288	23.42
2004–2005	237	19.27			
2006–2007	195	15.85			
2008–2009	226	18.37			
2010–2011	280	22.76			
Total	*1230*	*100.00*	*Total*	*1230*	*100.00*
Stage of development			**High-tech sectors**		
Seed and early stage	768	62.44	Yes	622	50.57
Later stages	462	37.56	No	608	49.43
Total	*1230*	*100.00*	*Total*	*1230*	*100.00*
Company industry	N	%	**Company country**	N	%
Construction and Mining	63	5.12	Austria	22	1.79
Chemical Products	54	4.39	Belgium	74	6.02
Electric and Electronica	165	13.41	Denmark	94	7.64
Instruments	94	7.64	Estonia	11	0.89
Machinery	51	4.15	Finland	76	6.18
Pharmaceuticals	63	5.12	France	62	5.04
Other Manufacturing	111	9.02	Germany	230	18.70
Computer-related Services	235	19.11	Ireland	70	5.69
Engineering and R&D Services	135	10.98	Italy	36	2.93
Trade	48	3.90	Netherlands	62	5.04
Public Utilities	49	3.98	Poland	13	1.06
Other Business Services	92	7.48	Portugal	107	8.70
Other Services	70	5.69	Spain	66	5.37
			Sweden	127	10.33
			United Kingdom	180	14.63
Total	*1230*	*100.00*	*Total*	*1230*	*100.00*
Presence of a PVC	*N*	%			
Yes (Syndicated investment)	595	48.37			
No (GVC solo investment)	635	51.63			
Total	*1230*	*100.00*			

3.2.2. Location

We refer to the EU's "Regional Competitiveness Index" to asess the impact of regional economic development on the outcome of a GVC fund investment. This index was computed at regional (i.e., NUTS2 - Nomenclature of Territorial Units for Statistics) levels by the European Commission in 2013 (Annoni and Dijkstra, 2013). The index builds on several sub-indices that consider the development, efficiency and innovation capacity of various European regions. To scale the regional competitive index for the individual sample countries, we create a dummy variable "Underdeveloped region" if the NUTS2 level's "Regional Competitiveness Index" is lower than the corresponding national average. Alternatively, we refer to "regional per capita GDP" at the NUTS2 level from Eurostat to directly assess different levels of economic development. To test our prediction on the effect of collusion, we follow an approach commonly used in the literature and assess the likelihood of regulatory capture with a nationwide indicator of perceived corruption, referring to the Transparency International Corruption Perceptions Index[8] (Dal Bó, 2006; Dal Bó and Rossi, 2007). The political science literature also suggests that political campaign contributions by individuals can be used as an alternative proxy for regulatory capture (Dal Bó, 2006; de Figueiredo and Edwards, 2007). As a consequence, we obtain information from the International Monetary Fund database on whether the amount that a donor can contribute to a candidate of a political party in a certain country is limited. This characteristic is coded using the dummy variable "No limit on contributions to candidates," which is equal to 1 if no limit exists.

3.2.3. Colocation

Our measure of proximity is based on the location of the investee with respect to the location of the GVC fund backing it. We use the dummy variable "Local deal", which is equal to one if the GVC fund is located in the same geographic region (NUTS2 code) as its investee. We also create important interaction terms using this dummy.

3.2.4. Syndication

We use a dummy variable "Syndicate" to denote syndicated transactions. For our measure of a GVC fund's "Syndication experience", we refer to the number of previous investments in which the fund syndicated with a PVC partner. As an alternative, we use the percentage of syndicated deals over total experience and name the variable "Syndication specialization".

3.2.5. Industry focus

We assess the "Industry experience" of a GVC fund by considering the number of previous transactions of the focal fund in the same industry as the focal investment. Alternatively, we refer to "Industry specialization" as the experience in a particular industry relative to total experience.

3.2.6. Control variables

We use several control variables describing investment characteristics that may affect a GVC fund's ability to bridge equity gaps. We include a "High-tech" dummy and add common controls, e.g., for the target's age ("Log of company age"), and industry, year, and country fixed effects, when specified. In separate analyses, we include the logarithm of the amount injected by VC investors ("Log of amount received"). The amounts enter the regressions in logs of USD million. In the analysis of total asset growth, we also include "Log of total assets ($t-1$)", which is the logarithm of total assets in the previous year. In the model for innovative output, we control for the "Patent stock" of each investee prior to the GVC investment.

[8] This index assigns higher values to lower levels of perceived corruption. To improve interpretability, we switch the sign of the Corruption Perceptions Index and generate the "Corruption" variable, which assigns higher values to higher levels of perceived corruption.

3.3. Descriptive statistics

All variables are summarized in Table 3, and their correlation matrix is presented in Table 4. Out of 1230 GVC investments, 390 (31.71%) subsequently attract private capital. The average logarithmic growth rates of total assets and patents in the three years following the initial GVC financing round are 1.244 and 1.360, respectively. This translates into level growth rates of 124.4% and 136.0%, respectively.

Although some of the bivariate correlations are statistically significant (in bold), the matrix in Table 4 reveals that their economic significance is rather low, with some predictable exceptions. The corruption and regional competitiveness indicators correlate at −0.61, and the experience measures at 0.64. Furthermore, the investment amount correlates with syndication and the ventures' total assets with their age. High correlations among these indicators suggest against using them simultaneously in the multivariate analyses to avoid multicollinearity. Therefore, we present regression models in which we carefully alternate correlating covariates. In parallel, we monitor potential multicollinearity with a variance inflation factor.

Table 5 presents the descriptive statistics of our subsamples of GVC solo and GVC/PVC-syndicated deals. We also report the significance levels of t-tests on the differences in means of the variables across the two subsamples. Compared to syndicates, solo GVC investments are significantly less likely to be successful in bridging the equity gap. Out of the 635 companies that are initially exclusively backed by GVCs, only 122 (i.e., 19.21% of them) receive subsequent PVC financing. Out of the 595 companies that initially receive a GVC/PVC-syndicated investment, 268 (i.e., 45.04%) subsequently obtain additional PVC financing. Moreover, our alternative measures of successfully bridged equity gaps, total asset growth and the number of new patents in the first 3 years after the investment, are higher for syndicated deals than for solo deals. GVC-backed companies in solo deals are located in less competitive regions and in more corrupt countries. They receive lower amounts of commitments and tend to be larger than ventures that initially receive GVC/PVC-syndicated funds. Lastly, alone acting GVCs have lower industry experience and previous PVC syndication experience.

Table 5 demonstrates that solo GVC deals are different from GVC/PVC-syndicated transactions. We therefore conduct the analyses on the full sample and separately on the subsample of solo GVC investments.

4. Main results

4.1. Receipt of subsequent PVC funding

Table 6 presents the regression results of our main analysis on the role of GVC design features on the ability to bridge equity gaps. The dependent variable is a dummy that is equal to 1 if the investee received PVC in a subsequent financing round. The appropriate model specification is a probit. We report robust standard errors.

In specification I of Panel A, we regress the dependent variable on our set of basic controls: industry and time fixed effects, company age, the high-tech dummy and the dummy denoting syndicated deals. All coefficient estimates are statistically significant at the 1% level and have the expected signs. The marginal effects indicate that a venture that is one year older than the median investee (at a median age of 2 years) at the initial GVC financing round is 1.60% less likely to receive subsequent PVC. This corresponds to a 5.1% (=1.61%/31.71%, see Table 3) reduction in the unconditional probability of later obtaining PVC funding. Along the same lines, investments in high-technology companies and syndicated transactions are 13.89% and 21.97%, respectively, more likely to attract PVC in later rounds. The positive impact of syndication is strong and could be due to a selection or treatment effect in syndicated deals. We discuss this in Section 5.3.

Table 3
Summary statistics.

Variable	*N*	Mean	Median	Std Dev	Min	Max
Additional PVC	1230	0.317	0.000	0.466	0.000	1.000
Log of total asset growth (from t to $t + 3$)	528	1.244	0.964	1.567	−4.074	7.992
Number of new patents (from t to $t + 3$)	1150	1.360	0.000	3.797	0.000	54.000
High-tech	1230	0.506	1.000	0.500	0.000	1.000
Log of company age	1230	1.242	1.099	1.043	0.000	4.779
Regional competitiveness	1230	0.462	0.522	0.519	−0.858	1.192
Syndicate	1230	0.484	0.000	0.500	0.000	1.000
Local deal	1230	0.456	0.000	0.498	0.000	1.000
Corruption	1230	−7.878	−7.900	1.246	−9.700	−3.400
Syndication experience	1230	22.794	8.000	32.724	0.000	141.000
Industry experience	1230	6.202	2.000	10.911	0.000	67.000
Log of amount received (t)	861	1.253	1.008	1.053	0.001	5.612
Log of total assets (t-1)	528	6.269	6.092	2.261	0.000	14.754
Patent stock (t-1)	1150	0.710	0.000	4.670	0.000	96.000

Time t refers to the year of the focal investment.

Table 4
Correlation matrix.

	Variable	1	2	3	4	5	6	7	8	10	12
1	High-tech	1.00									
2	Log of company age	−0.14	1.00								
3	Regional competitiveness	**0.18**	**−0.11**	1.00							
4	Syndicate	**0.30**	−0.05	**0.14**	1.00						
5	Local deal	**−0.07**	0.05	**0.11**	−0.04	1.00					
6	Corruption	**−0.18**	**0.16**	**−0.61**	**−0.13**	−0.05	1.00				
7	Syndication experience	**0.16**	**−0.12**	**0.18**	**0.22**	**−0.11**	**−0.21**	1.00			
8	Industry experience	**0.19**	**−0.06**	−0.01	0.05	**−0.07**	−0.03	**0.64**	1.00		
10	Log of amount received (t)	**0.23**	**0.11**	**0.08**	**0.47**	−0.05	0.03	**0.07**	−0.03	1.00	
12	Log of total assets (t-1)	**−0.29**	**0.59**	**−0.26**	**−0.22**	0.06	**0.30**	**−0.19**	**−0.10**	**0.23**	1.00
14	Patent stock (t-1)	0.00	**0.18**	0.02	0.00	−0.04	0.00	−0.01	−0.03	0.06	**0.23**

The correlation coefficients are computed using the maximum number of observations available. The bolded coefficients are significant at least at the 5% level. Time t refers to the year of the focal investment.

Table 5
Descriptive statistics of the syndicated and nonsyndicated deals.

	Solo GVC investments			Syndicated investments			Difference T-test
	Mean	Std Dev	N	Mean	Std Dev	N	
Additional PVC	0.192	0.394	635	0.450	0.498	595	0.258***
Log of total asset growth (from t to $t + 3$)	1.022	1.273	266	1.471	1.792	262	0.449***
Number of new patents (from t to $t + 3$)	0.697	2.257	590	2.059	4.828	560	1.362***
Log of company age	1.289	1.183	635	1.191	0.868	595	−0.097
High-tech	0.359	0.480	635	0.662	0.473	595	0.303***
Regional competitiveness	0.390	0.576	635	0.539	0.437	595	0.149***
Local deal	0.477	0.500	635	0.434	0.496	595	−0.044
Corruption	−7.716	1.456	635	−8.051	0.943	595	−0.335***
Industry experience	5.643	10.493	635	6.798	11.319	595	1.156*
Syndication experience	15.729	26.149	635	30.333	37.088	595	14.604***
Log of amount received (t)	0.689	0.756	376	1.690	1.044	0.689	0.756***
Log of total assets (t-1)	6.758	2.331	266	5.773	2.076	262	−0.984***
Patent stock (t-1)	0.705	5.488	590	0.716	3.618	560	0.011

The significance levels are *: $p < 0.10$; **: $p < 0.05$; and ***: $p < 0.01$. Time t refers to the year of the focal investment.

In specifications II and III, we add "Regional competitiveness" and the "Local deal" dummy. Their coefficient estimates are both significant at the 1% level. The marginal effects reveal that a one-standard deviation increase in the level of regional competitiveness enhances the likelihood of future PVC funding by 6.04% for the "average" transaction. More intuitively, the likelihood of receiving additional funding in Greater London is 6.21% percentage points higher than in Andalucía (in Southern Spain) solely because of the difference in local development. The marginal effect of "Local deal" reveals that locally sourced deals are 7.27% less likely than the average transaction to receive follow-on PVC funding.

In specification IV, we substitute the "Regional Competitiveness Index" with the dummy "Underdeveloped region", finding that its parameter estimate is not significant. In specification V, we include the interaction of "Underdeveloped Region" and "Local deal" to test whether the focus in underdeveloped regions affects GVCs' ability to bridge the equity gap. The coefficient estimate is negative and significant at the 1% level. We follow Ai and Norton (2003) to quantify the economic

Table 6
Effect of GVC design features on investees' receipt of additional PVC funding.

Syndicated deals	I Included	II Included	III Included	IV Included	V Included	VI Included	VII Included	VIII Included	IX Included	X Included
Panel A: all GVC deals										
Log of company age	−0.190	−0.184	−0.172	−0.184	−0.196	−0.176	−0.177	−0.156	−0.167	−0.162
	(0.043)***	(0.043)***	(0.043)***	(0.043)***	(0.044)***	(0.043)***	(0.044)***	(0.045)	(0.043)***	(0.043)***
High-tech	0.474	0.473	0.489	0.482	0.500	0.475	0.477	0.432	0.496	0.501
	(0.151)***	(0.154)***	(0.153)***	(0.150)***	(0.151)***	(0.150)***	(0.151)***	(0.157)***	(0.154)***	(0.154)***
Syndicate	0.750	0.745	0.754	0.757	0.743	0.742	0.743	0.662	0.762	0.742
	(0.092)***	(0.093)***	(0.093)***	(0.092)***	(0.092)***	(0.092)***	(0.093)***	(0.098)***	(0.093)***	(0.093)***
Regional competitiveness		0.404	0.459						0.458	0.436
		(0.085)***	(0.090)***						(0.090)***	(0.091)***
Local deal			−0.254	−0.187	−0.001	−0.223	−1.418	−2.022	−0.248	−0.243
			(0.088)***	(0.087)**	(0.105)	(0.087)**	(0.588)**	(0.778)***	(0.088)***	(0.088)***
Underdeveloped region				−0.051	0.164	−0.076	−0.051	−0.057		
				(0.087)	(0.110)	(0.087)	(0.088)	(0.104)		
Underdeveloped region * Local deal					−0.721					
					(0.197)***					
Corruption						−0.126	−0.057	0.203		
						(0.036)***	(0.049)**	(0.173)		
Corruption * Local deal							−0.149	−0.230		
							(0.072)	(0.093)**		
Industry experience									0.007	
									(0.004)	
Syndication experience										0.003
										(0.002)
Constant FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	No	No	No	No	No	Yes	No	No
N of observations	1230	1230	1230	1230	1230	1230	1230	1230	1230	1230
Pseudo R^2	0.173	0.186	0.192	0.176	0.184	0.183	0.185	0.208	0.193	0.194
Log pseudolikelihood	−635.03	−625.29	−621.11	−632.81	−626.62	−627.63	−625.82	−608.13	−619.91	−619.64

Syndicate deals	XI Excluded	XII Excluded	XIII Excluded	XIV Excluded	XV Excluded	XVI Excluded	XVII Excluded	XVIII Excluded	IXX Excluded	XX Excluded
Panel B: solo GVC deals										
Log of company age	−0.163	−0.156	−0.144	−0.157	−0.158	−0.136	−0.135	−0.129	−0.127	−0.127
	(0.057)***	(0.057)***	(0.057)**	(0.057)***	(0.057)***	(0.057)**	(0.057)***	(0.060)**	(0.056)**	(0.057)**
High-tech	0.421	0.391	0.408	0.435	0.437	0.399	0.393	0.317	0.426	0.411
	(0.210)**	(0.214)*	(0.210)*	(0.207)**	(0.208)**	(0.208)*	(0.209)*	(0.216)	(0.213)**	(0.212)*
Regional competitiveness		0.396	0.500						0.518	0.464
		(0.116)***	(0.128)***						(0.128)***	(0.131)***
Local deal			−0.360	−0.230	−0.011	−0.297	−1.134	−1.872	−0.332	−0.328
			(0.136)***	(0.127)*	(0.157)	(0.129)**	(0.740)	(0.981)*	(0.137)**	(0.138)**
Underdeveloped region				0.007	0.273	−0.051	−0.026	0.003		
				(0.128)	(0.170)	(0.129)	(0.130)	(0.162)		
Underdeveloped region * Local deal					−0.823					
					(0.282)***					
Corruption						−0.138	−0.092	0.066		
						(0.044)***	(0.060)	(0.318)		
Corruption * Local deal							−0.105	−0.200		
							(0.090)	(0.118*)		
Industry experience									0.018	
									(0.006)***	
Syndication experience										0.005
										(0.003)**
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	No	No	No	No	No	Yes	No	No
N of observations	635	635	635	635	635	635	635	635	635	635
Pseudo R^2	0.152	0.166	0.177	0.157	0.168	0.168	0.17	0.191	0.188	0.183
Log pseudolikelihood	−263.55	−259.21	−255.84	−261.99	−258.39	−258.49	−257.95	−251.38	−252.30	−253.99

magnitude of the interaction term and detect that for companies located in an underdeveloped region, the colocation with a GVC fund reduces the chances of attracting additional private capital by 14.28%.

In specification VI, we drop the interaction term and add our proxy for corruption. We cannot simultaneously include the variable "Regional competitiveness" because of its correlation with "Corruption". However, the "Underdeveloped region" dummy does not correlate with corruption ($\rho = -0.0541$) and can therefore be kept. The results indicate that corruption hinders the progress of the investment cycle. A decrease of one standard deviation in the corruption

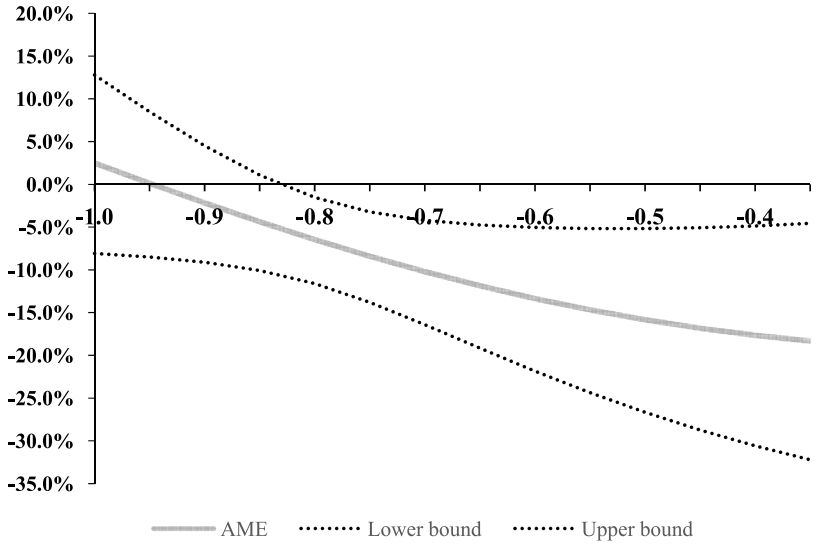

Fig. 1. AME of the local deals for different levels of corruption and a 95% confidence interval.

measure increases the chances to receive additional private capital by 4.53%.

Specification VII presents a model in which we add an interaction term between the level of corruption and the "Local deal" dummy. The parameter estimate is statistically significant,[9] revealing that the level of corruption in a given country is a stronger inhibitor of success if GVCs source their transactions locally. We find that if there is colocation between a GVC fund and its investee, a one-standard-deviation increase in perceived corruption decreases the probability of subsequent PVC funding by 6.98%. For a better understanding of the interplay of these variables, we also compute the average marginal effect (AME) of the GVC and investee colocation interaction term with corruption at different levels of corruption. The result is depicted in Fig. 1. The solid line represents the AMEs, and the dashed lines represent a 95% confidence band. It turns out that the colocation effect is indistinguishable from zero at the low corruption levels, while the negative effect of the colocation is entirely driven by more corrupted regions. In column VIII, we add country fixed effects and show that our main results do not change substantially compared to those of specification VII.

Specification IX shows the effect of GVCs' industry focus, assessed by "Industry experience", on their ability to bridge the equity gap, which is not significant. Similarly, in column X, we include our measure of the "Syndication experience", which also does not have a statistically significant coefficient estimate.

Panel B of Table 6 repeats the analyses of Panel A excluding syndicated GVC transactions. Even if the sample size shrinks by almost half, the results remain stable. However, important differences emerge with respect to industry and syndication experience in specifications IXX and XX. Both parameter coefficients are positive and significant in the "solo GVC deals". A one-standard-deviation increase in "Industry experience" and "Syndication experience" improves investees' chances to receive additional PVC financing by 4.31% and 3.75%, respectively. This means that GVCs can benefit from their industry and syndication experience when they invest alone.

[9] The inclusion of the corruption measure and its interaction with locally sourced transactions may lead to multicollinearity problems that could bias the coefficients. Indeed, we notice a jump in the coefficient of the Local deal dummy variable between models VI and VII. To address this problem, we adopt the residual-centering procedure described in Lance (1988), which has been used in more recent studies, for example, by Tiwana (2008). This procedure yields (unreported) comparable results.

4.2. Growth in total assets

We analyze the drivers of total asset growth in random effects panel regressions according to Evans (1987), in which investees are observed annually from their initial GVC investment until 2016. However, we can only gather information on total assets from 2007 onwards and therefore need to discard all investments prior to 2007 from the sample. Additional transactions need to be dropped due to missing data yielding a sample of 519 deals. Of these, 193 are solo GVC investments, and the remainder are GVC/PVC-syndicated deals. The dependent variable is "Total assets logarithmic growth", which is measured as the difference in the logs of a venture's total assets between a focal year and the previous year, winsorized at the 1% level. In addition to the covariates used in the main analyses, we include "Log of total assets ($t-1$)", which is the logarithm of total assets in the previous year. This equation is a standard specification in the industrial organization literature on firm growth and was used in the context of GVC, e.g., by Grilli and Murtinu (2014). We also include the variable "Log of amount received", which is the logarithm of the additional outside capital eventually contributed to the investee in a subsequent financing round in the respective year. This variable captures the jump in total assets caused by the injected capital.

Table 7 shows the results of the panel regression analysis. Specifications I to V elaborate on the full sample, while specifications VI to X exclude syndicated transactions. We find a negative and significant coefficient for the "High-tech" dummy. This result is justified because high-technology ventures are often less asset intensive than other ventures. The coefficient of "Log of amount received" is expectedly positive and significant. We find that size has a negative impact on growth, which is caused by the principle that small firms exhibit higher growth rates (Bottazzi et al., 2011). We do not find that syndicated deals perform better than solo GVC investments in terms of asset growth once we control for the investee size and amounts injected. "Regional competitiveness" positively influences GVC investees' total asset growth. Similarly, "Underdeveloped region" has a negative coefficient, at least in the full sample. However, we cannot conclude that the effect is stronger for collocated deals because the coefficient estimate of the interaction term with "Local deal" is not significant. Instead, we find a negative and significant coefficient estimate for the interaction term of corruption and colocation. We also find that the coefficients of GVC industry and syndication experience have the expected positive signs and are both significant in the full sample. The results are similar for the subsample of solo GVC investments (specifications VI to X), with the exception of the coefficient estimates of high-

Table 7
Effect of GVC design features on investees' total asset growth.

Syndicated deals	I Included	II Included	III Included	IV Included	V Included	VI Excluded	VII Excluded	VIII Excluded	IX Excluded	X Excluded
Log of company age	−0.036	−0.033	−0.039	−0.016	0.003	−0.027 (0.056)	−0.025	−0.031	−0.013	−0.011
	(0.041)	(0.042)	(0.042)	(0.039)	(0.039)		(0.055)	(0.054)	(0.050)	(0.051)
High-tech	−0.174	−0.182	−0.193	−0.165	−0.156	−0.039	−0.043	−0.063	−0.024	−0.031
	(0.078)**	(0.077)**	(0.075)**	(0.077)**	(0.076)**	(0.082)	(0.082)	(0.081)	(0.082)	(0.081)
Log of amount received (t)	0.164	0.163	0.162	0.162	0.162	0.111	0.110	0.110	0.106	0.106
	(0.016)***	(0.016)***	(0.016)***	(0.017)***	(0.017)***	(0.052)**	(0.052)	(0.052)**	(0.052)**	(0.051)**
Log total assets (t-1)	−0.204	−0.204	−0.204	−0.206	−0.205	−0.172	−0.171	−0.173	−0.169	−0.168
	(0.043)***	(0.043)***	(0.043)***	(0.044)***	(0.043)***	(0.046)***	(0.045)	(0.045)***	(0.045)***	(0.044)***
Syndicate	−0.032	−0.032 (0.048)	−0.030 (0.048)	−0.038	−0.052					
	(0.047)			(0.048)	(0.045)					
Regional competitiveness				0.172	0.163				0.135	0.124
				(0.052)***	(0.047)***				(0.075)*	(0.066)*
Local deal	−0.060	−0.024	−0.692	−0.046	−0.034	−0.095	−0.081	−0.731	−0.097	−0.084
	(0.059)	(0.052)	(0.236)***	(0.058)	(0.054)	(0.081)	(0.064)	(0.272)***	(0.054)*	(0.055)
Underdeveloped region	−0.111	−0.082	−0.076			−0.038	−0.026	−0.003		
	(0.057)*	(0.043)*	(0.044)*			(0.068)	(0.061)	(0.063)		
Underdeveloped region * Local deal	0.150					0.067				
	(0.093)					(0.151)				
Corruption		−0.021	0.025				−0.005	0.039		
		(0.073)	(0.080)				(0.064)	(0.070)		
Corruption * Local deal			−0.085					−0.083		
			(0.031)***					(0.038)***		
Industry experience				0.006					0.005	
				(0.001)***					(0.002)**	
Syndication experience					0.003					0.001
					(0.001)***					(0.001)
N of observations	3041	3041	3041	3041	3041	1166	1166	1166	1166	1166
N of companies	519	519	519	519	519	193	193	193	193	193
R^2	0.156	0.155	0.156	0.16	0.164	0.186	0.186	0.189	0.192	0.19

This table reports the coefficients and robust standard errors (in brackets) of the random effect panel regressions of the dependent variable "Log of total asset growth" on different sets of independent variables and controls. Standard errors are clustered around VC names. Industry, time and country fixed effects, as well as a constant term, are included in all estimates. The significance levels are *: $p<0.10$; **: $p<0.05$; and ***: $p<0.01$.

tech and syndication experience.

4.3. Innovation output

Fostering innovation is usually an important policy goal in GVC initiatives. We therefore refer to the innovation output as a second alternative measure for bridging an equity gap. Using the variable "Number of new patents" as the dependent variable, we study the impact of GVC design features on the innovation output of investees. This variable represents the number of all patents that were granted to the ventures in the first three years after the GVC financing round. We retrieve data on 1050 of our sample transactions from Orbis and apply negative binomial regressions. The regression model is appropriate if a dependent count variable is overdispersed. This is the case for "Number of new patents". As it is common in analyses on innovative output (e.g., Bertoni and Tykvová, 2015), we control for the "Patent stock" of each investee prior to the GVC investment.

Table 8 reveals that high-tech companies backed in solo GVC transactions are more innovative (specifications VI-X). A venture's age has no significant impact on patent output, while "patent stock" has positive coefficients, as expected. The findings confirm that GVC/PVC-syndicated deals yield a higher innovative productivity (Bertoni and Tykvová, 2015) and the importance of regional competitiveness for innovation. We surprisingly find a positive coefficient of "Underdeveloped regions". This could be driven by selection decisions of GVCs that operate in the lagging regions of their countries. These GVCs tend to invest in ventures with a larger patent stock because it serves them as a signal for innovation capacity. We find that ventures located in underdeveloped regions and backed by local GVCs are less likely to file patents in both the full sample (specification I) and in solo GVC deals (specification VI). Corruption decreases the probability of generating innovation, and this effect is driven by locally sourced transactions (specifications II and III). We do not find an effect of GVC industry or syndication experience on the innovation capacity of the investees.

5. Additional evidence and robustness checks

In this section, we conduct several robustness checks to verify our results with respect to our primary measure for GVC financing success, which is the subsequent receipt of private capital. In particular, we control for the amount injected, use an alternative model specification, control for the potential endogeneity of syndication, apply substitutes for some covariates, and finally analyze the detected effects in split samples.

5.1. Controlling for the resources injected

Thus far, we have neglected that the capital contribution in the GVC round could be sufficient to completely cover the financing requirements of an investee until it breaks even and hence subsequent funding would not be required. In this case, our main success measure would be flawed. Therefore, the GVC round financing volume could itself be a negative predictor of the likelihood of a subsequent financing round. The variable "Log of amount received" captures this effect. However, the data are only available for a subset of 861 deals (of which 376 solo deals), as shown in Table 3. For this reason, we do not include this variable in all of our analyses. The results including it are reported in Table 9 and reveal that the effect of the amount injected in the GVC round is positive, in contrast to the expectation. The coefficient estimate is significant at the 1% level in the full sample (specifications I-V) and at the 10% level in three solo deals regressions (specifications VII, IX, and X). The marginal effect in specification I is such that receiving an additional 1 million USD over the median GVC round financing volume improves the chances to receive additional PVC financing by

Table 8
Effect of GVC design features on investees' patenting activities.

Syndicated deals	I Included	II Included	III Included	IV Included	V Included	VI Excluded	VII Excluded	VIII Excluded	IX Excluded	X Excluded
Log of company age	−0.078	−0.029	−0.041	−0.057	−0.066	0.009	0.076	0.072	0.014	0.007
	(0.070)	(0.071)	(0.071)	(0.069)	(0.068)	(0.098)	(0.099)	(0.099)	(0.102)	(0.101)
High-tech	0.108	0.152	0.149	0.107	0.107	0.638	0.709	0.697	0.596	0.619
	(0.209)	(0.207)	(0.208)	(0.203)	(0.203)***	(0.286)***	(0.272)***	(0.275)**	(0.274)**	(0.272)***
Patent stock	0.118	0.110	0.109	0.118	0.118	0.092	0.089	0.088	0.095	0.097
	(0.030)***	(0.028)***	(0.029)***	(0.030)***	(0.031)***	(0.033)***	(0.034)***	(0.033)***	(0.039)**	(0.040)***
Syndicate	0.908	0.894	0.893	0.906	0.928					
	(0.138)***	(0.139)***	(0.138)***	(0.137)***	(0.136)***					
Regional competitiveness				0.346	0.366				0.501	0.538
				(0.136)**	(0.137)***				(0.198)**	(0.202)***
Local deal	0.067	−0.175	−1.775	−0.294	−0.307	−0.022	−0.466	−1.169	−0.542	−0.559
	(0.166)	(0.136)	(0.939)*	(0.132)**	(0.133)**	(0.250)	(0.207)***	(1.167)	(0.208)***	(0.211)***
Underdeveloped region	0.468	0.241	0.270			0.665	0.175	0.202		
	(0.178)***	(0.140)*	(0.143)*			(0.256)***	(0.202)	(0.212)		
Underdeveloped region *Local deal	−0.645					−1.102				
	(0.265)**					(0.441)**				
Corruption		−0.171	−0.087				−0.242	−0.204		
		(0.058)***	(0.083)				(0.070)***	(0.098)**		
Corruption * Local deal			−0.201					−0.089		
			(0.116)*					(0.143)		
Industry experience				−0.007					−0.018	
				(0.010)					(0.012)	
Syndication experience					−0.004					−0.004
					(0.003)					(0.004)
lnα	1.014	1.008	0.999	1.021	1.018	1.082	1.058	1.053	1.099	1.103
	(0.093)***	(0.093)***	(0.093)	(0.092)***	(0.091)***	(0.155)***	(0.154)***	(0.155)***	(0.148)***	(0.147)***
N of observations	1150	1150	1150	1150	1150	590	590	590	590	590
Pseudo R^2	0.085	0.087	0.088	0.085	0.085	0.098	0.101	0.102	0.098	0.097
Log likelihood	−1445.872	−1443.697	−1441.995	−1446.581	−1446.004	−524.121	−522.22	−522.039	−524.063	−524.63

This table reports the coefficients and robust standard errors (in brackets) of the negative binomial regressions of the dependent variable "Number of new patents" on different sets of independent variables and controls. The significance levels are *: $p<0.10$; **: $p<0.05$; and ***: $p<0.01$. Industry and time fixed effects, as well as a constant term, are included in all estimates.

2.10%. This finding is contrary to our expectation but points to an important characteristic of GVC activity. If they invest higher amounts, they do not decrease the likelihood of a subsequent funding round. Importantly, our main results remain unaffected. Nevertheless, the statistical significance decreases for some parameter estimates due to the reduced number of observations.

5.2. Alternative model specification

The analyses in Table 6 only consider the event of an additional financing round with PVC participation. These analyses do not take into account how much time it takes until the event. A proportional hazard Cox (1972) model captures the joint effect of the likelihood of the event and the elapsed time. This model was applied to the VC context in Bertoni and Groh (2014), Chang (2004), Giot and Schwienbacher (2007) and Guerini and Quas (2016). We use it to model the receipt of additional PVC based on the hazard rates, i.e., the probability that an event occurs at a certain time, contingent on it not having occurred before. In our setting, the elapsed time between the initial and the subsequent financing round determines the hazard rate. If a particular investee never receives subsequent funding, we refer to the elapsed time between the initial transaction and the cut-off year 2014. The successful event ("Additional PVC") follows, on average, 1.84 years after the initial GVC round. Table 10 presents the results of the Cox regressions and reveals that our general findings hold. However, some coefficient estimates have higher standard errors and thus lower significance levels than those in the probit models. The results are robust for both the full sample, including syndicated transactions, and the sample of transactions sourced by GVC funds only. In this analysis, we also find that GVC syndication experience has a weakly significant effect in the full sample (specification V).

5.3. Potential endogeneity of syndication

Table 6 indicates that the likelihood that a GVC-backed company will receive follow-on capital from a PVC is greater if the initial round is syndicated. It is possible that this result is driven by unobserved factors explaining both the syndication decisions and the receipt of subsequent PVC financing. For example, the quality of a deal is unobservable to us but is observable by the investors. High-quality investments are more likely to be syndicated and to receive follow-up on funding. To control for this potential endogeneity of the "Syndicate" variable, we resort to recursive bivariate probit models (see Greene, 2011, pp. 778–785 for details). These allow us to simultaneously estimate the conditional likelihood that the initial GVC round is a syndicated transaction and that the focal target company receives subsequent PVC financing. In the outcome regression, the dependent variable remains "additional PVC". The dependent variable of the selection model is "Syndication". We refer to the target's age, high-tech status, GVC syndication experience and a new variable "Number of active PVC investors" as explanatory variables. "Number of active PVC investors" is defined as the number of PVC funds with investment activity in the focal investee country and in the focal year. It captures the availability of potential private syndication partners for GVCs.

Table 11 presents the bivariate probit results. Expectedly, GVCs with greater syndication experience and those having deeper pools of potential syndication partners are more likely to syndicate. Furthermore, syndicates have a higher propensity to target high-tech investees. Table 11 confirms our previous results on the receipt of additional PVC. We also observe that the decision to syndicate is indeed affected by some unobserved heterogeneity. This is captured by the correlation coefficients (ρ) between the error terms of the selection and outcome equations. These correlations are negative and significant in all specifications. This result indicates that unobserved factors that affect both

Table 9
Effect of GVC design features on investees' receipt of additional PVC funding: controlling for the amount injected in the GVC round.

Syndicated deals	I Included	II Included	III Included	IV Included	V Included	VI Excluded	VII Excluded	VIII Excluded	IX Excluded	X Excluded
Log of company age	−0.228	−0.213	−0.215	−0.211	−0.213	−0.160	−0.137	−0.137	−0.141	−0.138
	(0.054)***	(0.054)***	(0.055)***	(0.054)***	(0.054)***	(0.075)**	(0.077)*	(0.077)*	(0.078)*	(0.078)*
High-tech	0.482	0.446	0.449	0.460	0.458	0.489	0.407	0.405	0.430	0.410
	(0.187)***	(0.186)***	(0.187)**	(0.188)***	(0.187)**	(0.263)*	(0.265)	(0.265)	(0.268)	(0.269)
Regional competitiveness				0.395	0.391				0.525	0.475
				(0.101)***	(0.103)***				(0.150)***	(0.155)***
Log of amount received	0.209	0.231	0.228	0.214	0.212	0.140	0.185	0.178	0.198	0.197
	(0.055)***	(0.055)***	(0.055)***	(0.054)***	(0.054)***	(0.111)	(0.111)*	(0.112)	(0.112)*	(0.110)*
Syndicate	0.331	0.309	0.317	0.347	0.341					
	(0.117)***	(0.117)***	(0.118)***	(0.117)***	(0.117)***					
Local deal	0.068	−0.180	−1.435	−0.224	−0.225	0.087	−0.305	−1.096	−0.289	−0.281
	(0.123)	(0.102)*	(0.699)**	(0.100)**	(0.100)**	(0.200)	(0.161)	(1.002)	(0.168)*	(0.169)*
Underdeveloped region	0.291	0.007	0.036			0.368	−0.153	−0.118		
	(0.135)***	(0.106)	(0.107)			(0.224)	(0.166)	(0.172)		
Underdeveloped region * Local deal	−0.872					−1.552				
	(0.235)***					(0.404)***				
Corruption		−0.138	−0.059				−0.197	−0.146		
		(0.043)***	(0.065)				(0.060)***	(0.094)		
Corruption * Local deal			−0.156					−0.099		
			(0.086)*					(0.123)		
Industry experience				0.005					0.014	
				(0.005)					(0.007)*	
Syndication experience					0.001					0.005
					(0.002)					(0.003)
N of observations	861	861	861	861	861	376	376	376	376	376
Pseudo R^2	0.186	0.182	0.185	0.187	0.186	0.189	0.178	0.179	0.186	0.183
Log pseudolikelihood	−466.80	−468.78	−467.25	−466.13	−466.47	−172.42	−174.76	−174.44	−173.06	−173.55

This table reports the coefficients and robust standard errors (in brackets) of the probit regressions of our dependent variable "Additional PVC" on different sets of independent variables and controls. Industry and time fixed effects, as well as a constant term, are included in all models. The significance levels are *: $p<0.10$; **: $p<0.05$; and ***: $p<0.01$. Columns 1-VI include all deals, while columns VII-X include only solo GVC deals. The average VIF is always below the threshold of 5 in all models.

Table 10
Effect of GVC design features on investees' receipt of additional PVC funding: Cox (1972) regressions.

Syndicated deals	I Included	II Included	III Included	IV Included	V Included	VI Excluded	VII Excluded	VIII Excluded	IX Excluded	X Excluded
Log of company age	−0.279	−0.259	−0.260	−0.247	−0.243	−0.291	−0.264	−0.264	−0.251	−0.256
	(0.057)***	(0.058)***	(0.058)***	(0.057)***	(0.058)***	(0.093)***	(0.095)***	(0.095)***	(0.092)***	(0.093)***
High-tech	0.534	0.485	0.482	0.538	0.539	0.552	0.491	0.478	0.591	0.569
	(0.210)***	(0.201)**	(0.200)**	0.207)***	(0.206)***	(0.313)***	(0.310)	(0.306)	(0.310)*	(0.314)*
Regional competitiveness				0.610	0.588				0.788	0.722
				0.122)***	(0.124)***				(0.208)***	(0.211)***
Local deal	0.016	−0.257	−1.841	−0.323	−0.318	0.018	−0.373	−2.451	−0.464	−0.458
	(0.133)	(0.110)**	(0.795)**	(0.112)***	(0.112)***	(0.247)	(0.199)*	(1.307)*	(0.209)**	(0.209)**
Syndicate	0.951	0.959	0.956	0.970	0.953					
	(0.130)***	(0.128)***	(0.128)***	(0.129)***	(0.129)***					
Underdeveloped region	0.238	−0.034	−0.003			0.394	−0.036	0.029		
	(0.138)*	(0.111)	(0.113)			(0.249)	(0.202)	(0.204)		
Underdeveloped region * Local deal	−0.895					−1.105				
	(0.279)***					(0.479)**				
Corruption		−0.187	−0.097				−0.219	−0.116		
		(0.046)***	(0.064)				(0.071)***	(0.089)		
Corruption * Local deal			−0.194					−0.252		
			(0.096)**					(0.154)		
Industry experience				0.010					0.026	
				(0.006)					(0.008)***	
Syndication experience					0.004					0.008
					(0.002)*					(0.004)**
N of observations	1,230	1,230	1,230	1,230	1,230	635	635	635	635	635
Pseudo R^2	0.054	0.054	0.055	0.057	0.057	0.073	0.074	0.076	0.083	0.081
Log pseudolikelihood	−2536.6	−2535.3	−2533.5	−2528.1	−2527.8	−712.8	−711.6	−710.3	−705.0	−706.6

This table reports the estimated coefficients and the robust standard errors (in brackets) of Cox (1972) event history-type models. The dependent variable is always "Additional PVC." The time until the event is defined by the number of days since the seed-financing round. Industry and time fixed effects are included in all models. We use Efron's (1977) correction for ties. The significance levels are *: $p<0.10$; **: $p<0.05$; and ***: $p<0.01$.

Table 11
Effect of GVC design features on investees' receipt of additional PVC funding: bivariate probit model.

	I	II	III	IV	V
Dependent variable: Syndicate					
Company age (log)	0.053	0.051	0.052	0.053	0.053
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
High-tech	0.683	0.689	0.691	0.695	0.695
	(0.154)***	(0.154)***	(0.154)***	(0.154)***	(0.154)***
Number of active PVC investors	0.004	0.004	0.004	0.004	0.004
	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Syndication experience	0.006	0.006	0.006	0.006	0.006
	(0.001)***	(0.001)***	(0.001)***	(0.002)***	(0.002)***
Dependent variable: Additional PVC					
Company age (log)	−0.173	−0.156	−0.157	−0.158	−0.157
	(0.040)***	(0.040)***	(0.040)***	(0.041)***	(0.041)***
High-tech	0.134	0.108	0.117	0.201	0.197
	(0.161)	(0.160)	(0.163)	(0.188)	(0.190)
Regional competitiveness				0.381	0.375
				(0.089)***	(0.088)***
Local deal	0.049	−0.142	−1.035	−0.180	−0.178
	(0.090)	(0.077)	(0.521)***	(0.083)**	(0.083)**
Syndicates	1.782	1.790	1.778	1.647	1.651
	(0.155)***	(0.158)***	(0.169)***	(0.267)***	(0.269)***
Underdeveloped region	0.120	−0.088	−0.070		
	(0.094)	(0.075)	(0.076)		
Underdeveloped regions	−0.628				
* Local deal	(0.173)***				
Corruption		−0.110	−0.058		
		(0.032)***	(0.044)		
Corruption * Local deal			−0.111		
			(0.064)*		
Industry experience				0.002	
				(0.005)	
Syndication experience					0.001
					(0.002)
Chi2 of the significance of Rho	14.91***	13.78***	12.17***	5.38**	5.40**
N	1230	1230	1230	1230	1230
Log pseudolikelihood	−1322.07	−1323.14	−1321.82	−1318.88	−1318.97

This table reports the coefficients and robust standard errors (in brackets) of the bivariate probit regressions of the dependent variables "Syndicate" and "Additional PVC" on different sets of independent variables and controls. Industry and time fixed effects, as well as a constant term, are included in all models. The analysis includes the full sample of 1,230 observations. The significance levels are *: $p<0.10$; **: $p<0.05$; and ***: $p<0.01$.

the likelihood of syndication and additional PVC funding are negatively correlated. A failure to control for this should result in downward biased parameter estimates of the Syndication variable. This is exactly what we observe by comparing the results in Table 11 and in Table 6. We conclude that even if the decision to syndicate is endogenous, it will not affect the previously presented evidence on the impact of GVC program design features on the ability to bridge equity gaps.

5.4. Alternative measures for underdeveloped regions, room for regulatory capture, industry and syndication experience

Table 12 reproduces the previous analyses using alternative measures of regional development, room for regulatory capture, industry focus, and syndicating tendency.

To measure regional development, we use the per capita GDP at the local (NUTS2) level instead of the "Regional Competitiveness Index". The advantage of per capita GDP is that it varies over time. However, the disadvantage is that important pillars of the "Regional Competitiveness Index", such as education or innovation scores, are ignored. Furthermore, the variable has missing values because it is not reported for some regions, which results in a smaller sample size. Specifications I and III of Table 12 reveal that regional per capita GDP positively affects the chance of investees to raise PVC in a subsequent round. In specifications II and IV, we refer to underdeveloped regions as those where per capita GDP is lower than the national average using the variable "Underdeveloped Region (GDP)". The specifications confirm that GVCs located and simultaneously investing in those underdeveloped regions are less likely to bridge equity gaps.

In specifications V and VI, we use an alternative measure of corruption that allows the inclusion of the "Regional Competitiveness Index" as a covariate. The variable "No limit on contributions to candidates" correlates only moderately (0.28) with the "Regional Competitiveness Index". The specifications reveal that the joint effect of the higher likelihood of collusion in locally sourced transactions remains even after controlling for the competitiveness of the investee firm's location.

Furthermore, we substitute "Industry experience" and "Syndication experience" with "Industry specialization" and "Syndication specialization". These indicators are calculated using the respective experience measures but divided by the total number of deals of a particular GVC until the time of a focal transaction. In other terms, these new variables present percentages of investments carried out in a particular industry or together with a private syndicate partner. The specifications VII-X demonstrate the positive effect of both experience measures on the probability of bridging equity gaps.

5.5. Sample split

In this section, we analyze the impact of the heterogeneity of our sample transactions on the ability of GVCs to bridge equity gaps. In the first step, we split high-tech and low-tech ventures. These investees are more strongly affected by information asymmetries (e.g., Martí and Quas, 2018) and have higher perceived investment risks. The task of GVCs to bridge equity gaps is therefore more important for this sector.

Table 12
Effect of GVC design features on investees' receipt of additional PVC funding: alternative measures for underdeveloped regions, regulatory capture, industry focus and syndication tendency.

	I	II	III	IV	V	VI	VII	VIII	IX	X
Syndicated deals	Included	Included	Excluded	Excluded	Included	Excluded	Included	Excluded	Included	Excluded
Company age (log)	−0.188***	−0.189***	−0.139**	−0.127**	−0.174***	−0.145**	−0.173***	−0.152***	−0.179***	−0.142**
	(0.046)	(0.046)	(0.060)	(0.059)	(0.043)	(0.057)	(0.043)	(0.057)	(0.044)	(0.057)
High-tech	0.489***	0.499***	0.471**	0.462**	0.478***	0.368*	0.465***	0.387*	0.469***	0.381*
	(0.159)	(0.160)	(0.219)	(0.219)	(0.154)	(0.214)	(0.154)	(0.213)	(0.153)	(0.210)
Local per capita GDP	0.013***		0.012**							
	(0.003)		(0.005)							
Local deal	−0.316***	−0.019	−0.331**	−0.020	0.057	0.166	−0.263***	−0.363***	−0.283***	−0.361***
	(0.096)	(0.119)	(0.143)	(0.192)	(0.158)	(0.240)	(0.088)	(0.136)	(0.090)	(0.137)
Syndicates	0.743***	0.737***			0.749***		0.768***		0.654***	
	(0.095)	(0.096)			(0.093)		(0.093)		(0.095)	
Underdeveloped region (GDP)		−0.048		0.120						
		(0.112)		(0.170)						
Underdeveloped region (GDP) * Local deal		−0.492***		−0.447*						
		(0.181)		(0.265)						
Regional competitiveness					0.433***	0.476***	0.475***	0.504***	0.449***	0.446***
					(0.093)	(0.132)	(0.090)	(0.130)	(0.092)	(0.133)
No limit on contributions to candidates					0.256*	0.290				
					(0.139)	(0.211)				
No limit on contributions * Local deal					−0.451**	−0.789***				
					(0.188)	(0.283)				
Industry specialization							0.613**	0.670*		
							(0.255)	(0.387)		
Syndicating specialization									0.624***	0.407*
									(0.142)	(0.227)
N of observations	1149	1149	584	584	1230	635	1230	635	1230	635
Pseudo R^2	0.183	0.182	0.155	0.152	0.195	0.189	0.195	0.181	0.204	0.182
Log pseudolikelihood	−587.27	−588.32	−238.89	−239.62	−618.28	−251.92	−618.67	−254.60	−611.65	−254.27

This table reports the coefficients and robust standard errors (in brackets) of the probit regressions of our dependent variable "Additional PVC" on different sets of independent variables and controls. Industry and time fixed effects, as well as a constant term, are included in all models. The significance levels are *: $p<0.10$; **: $p<0.05$; and ***: $p<0.01$.

Table 13
Effect of GVC design features on investees' receipt of additional PVC funding: high-tech sectors vs other sectors.

	I	II	III	IV	V	VI	VII	VIII
Sample	High-tech	High-tech	High-tech	High-tech	Others	Others	Others	Others
Company age (log)	−0.365***	−0.365***	−0.330***	−0.340***	−0.099*	−0.066	−0.060	−0.052
	(0.073)	(0.073)	(0.072)	(0.072)	(0.053)	(0.054)	(0.054)	(0.054)
Syndicates	0.766***	0.766***	0.773***	0.758***	0.691***	0.687***	0.692***	0.676***
	(0.126)	(0.128)	(0.129)	(0.129)	(0.150)	(0.149)	(0.148)	(0.148)
Regional competitiveness			0.381***	0.395***			0.477***	0.461***
			(0.140)	(0.140)			(0.125)	(0.129)
Local deal	0.200	−1.312	−0.098	−0.113	−0.157	−1.291*	−0.345**	−0.346**
	(0.140)	(1.043)	(0.121)	(0.120)	(0.160)	(0.727)	(0.140)	(0.139)
Underdeveloped regions	0.386***	0.169			−0.079	−0.341**		
	(0.144)	(0.120)			(0.180)	(0.143)		
Underdeveloped regions * Local deal	−0.817***				−0.792**			
	(0.269)				(0.342)			
Corruption		−0.040				−0.093		
		(0.085)				(0.062)		
Corruption * Local deal		−0.157				−0.114		
		(0.127)				(0.091)		
Industry experience			0.014***				−0.001	
			(0.005)				(0.011)	
Syndication experience				0.003*				0.002
				(0.002)				(0.003)
N of observations	622	622	622	622	608	608	608	608
Pseudo R^2	0.17	0.165	0.177	0.172	0.175	0.181	0.179	0.18
Log likelihood	−354.77	−356.77	−351.41	−353.60	−242.18	−240.41	−240.83	−240.58

This table reports the coefficients and robust standard errors (in brackets) of the probit regressions of our dependent variable "Additional PVC" on different sets of independent variables and controls. The significance levels are *: $p<0.10$; **: $p<0.05$; and ***: $p<0.01$. Columns I-IV include deals in high-tech sectors, while columns V-VIII include deals in other sectors. Industry and time fixed effects, as well as a constant term, are included in all estimates.

Table 14
Effect of GVC design features on investees' receipt of additional PVC funding: seed and early stages vs later stages.

Sample	I Early stage	II Early stage	III Early stage	IV Early stage	V Later stage	VI Later stage	VII Later stage	VIII Later stage
Company age (log)	−0.245***	−0.236***	−0.212***	−0.209***	−0.095	−0.067	−0.089	−0.098
	(0.077)	(0.078)	(0.075)	(0.076)	(0.062)	(0.062)	(0.063)	(0.063)
High-tech	0.585***	0.523***	0.571***	0.591***	0.270	0.272	0.255	0.250
	(0.194)	(0.193)	(0.194)	(0.196)	(0.270)	(0.275)	(0.273)	(0.273)
Syndicates	0.800***	0.809***	0.815***	0.786***	0.698***	0.679***	0.738***	0.764***
	(0.113)	(0.115)	(0.114)	(0.115)	(0.172)	(0.171)	(0.173)	(0.177)
Regional competitiveness			0.407***	0.369***			0.570***	0.590***
			(0.119)	(0.121)			(0.139)	(0.139)
Local deal	0.103	−2.139**	−0.192*	−0.174	−0.148	−0.578	−0.282*	−0.263*
	(0.131)	(0.856)	(0.113)	(0.112)	(0.191)	(0.864)	(0.158)	(0.155)
Underdeveloped regions	0.302**	0.070			−0.155	−0.280*		
	(0.131)	(0.110)			(0.229)	(0.166)		
Underdeveloped regions * Local deal	−0.947***				−0.253			
	(0.252)				(0.344)			
Corruption		−0.016				−0.154*		
		(0.068)				(0.083)		
Corruption * Local deal		−0.244**				−0.037		
		(0.105)				(0.109)		
Industry experience			0.009*				−0.002	
			(0.005)				(0.011)	
Syndication experience				0.005**				−0.004
				(0.002)				(0.004)
N of observations	768	768	768	768	462	462	462	462
Pseudo R^2	0.177	0.175	0.179	0.182	0.213	0.227	0.235	0.237
Log likelihood	−418.35	−419.629	−417.729	−416.211	−190.925	−187.56	−185.613	−185.01

This table reports the coefficients and robust standard errors (in brackets) of the probit regressions of our dependent variable "Additional PVC" on different sets of independent variables and controls. The significance levels are *: $p<0.10$; **: $p<0.05$; and ***: $p<0.01$. Columns I-IV include deals in the early stages of development, while columns V-VIII include deals in the later stages of development. Industry and time fixed effects, as well as a constant term, are included in all estimates.

Table 13 presents the results. We find a strong negative impact of age for high-tech companies. "Syndicate" and "Regional competitiveness" have a positive impact of the same magnitude in the two subsamples. The negative influence of colocation is more severe in low technology transactions. Colocation is harmful in underdeveloped regions in both subsamples. Lastly, we find that GVC industry and syndication experience matter only in high-technology deals.

In the next step, we differentiate "seed and early-stage" from "later-stage" deals according to the judgements made by the providers of the sample data.[10] The probit regression results are presented in Table 14. The positive impact of syndicates and regional competitiveness is strong and significant across all specifications. However, the investee's age and high-technology orientation are significant in early-stage transactions only. More importantly, the negative effect of colocation in underdeveloped regions, or in corrupted countries, and the positive impact of GVC industry and syndication experience are also driven by early-stage transactions.

In a final sample split, we analyze whether the propensity to successfully bridge equity gaps changes over time. Our sampling cut-off dates include the global financial crisis period. During and shortly after the crisis, it was particularly difficult for entrepreneurial ventures to raise funds (Block et al., 2010). We therefore split our sample into GVC transactions before the end of 2007 (728) and thereafter (506). The probit regression results presented in Table 15 reveal differences between the two periods. First, it was simpler for high-tech ventures located in more competitive regions to raise additional PVC only before the crisis. After the crisis, we detect no advantage. Second, the colocation of investors and investees in underdeveloped regions has a strong negative impact on both subsamples, and the effect of colocation in corrupted countries was stronger after the crisis.

6. Conclusion

Policymakers have a strong motivation for being actors in the entrepreneurial finance market and facilitating YICs' access to finance. For example, they have a clear interest in spurring innovation, creating employment and wealth, receiving tax revenues and making social contributions, of which YICs are important drivers. They also aim to support less developed regions and infrastructures. Therefore, they design funding and support programs where GVC funds directly inject capital into young ventures. One major argument made by policymakers is a requirement to "bridge equity gaps" for YICs that suffer from a lack of capital supply. Such government interventions are criticized in the academic literature, e.g., in Brown et al. (2017), Cumming and Macintosh (2006), and Shane (2009). It is also questionable whether these government interventions actually help foster entrepreneurship, employment, and growth of investees. Grilli and Murtinu (2014) find that GVC financing does not spur sales or employee growth of European YICs and argue that public interventions should focus on the creation of a favorable environment via indirect forms of support rather than by adopting a 'hands-on-approach'.

GVC fund initiatives nevertheless exist and continuously grow in investment volume, especially in Europe. European market data reveal that 29% of the funds provided to back YICs come from government agencies.[11] The recent implementation of the European Fund for Strategic Investments (EFSI), whose official goal is to "close the investment gap caused by the financial and economic crisis",[12] signals that this type of public intervention will sustain for some time.

[10] We also use the age of the firm at the time of the investment, with 6 years or older as a cutoff instead of the stage of development in an unreported robustness check. This classification splits our sample less evenly and reveals that the results are even stronger for the younger companies.

[11] Invest Europe: European Private Equity Activity Report 2017, https://www.investeurope.eu.

[12] https://ec.europa.eu/commission/sites/beta-political/files/juncker-plan-factsheet-july2018_en.pdf.

Table 15
Effect of GVC design features on investees' receipt of additional PVC funding: before vs after the global financial crisis.

Sample	I Before 2008	II Before 2008	III Before 2008	IV Before 2008	V Since 2008	VI Since 2008	VII Since 2008	VIII Since 2008
Company age (log)	−0.132**	−0.112**	−0.119**	−0.115**	−0.318***	−0.334***	−0.277***	−0.270***
	(0.053)	(0.054)	(0.054)	(0.053)	(0.077)	(0.078)	(0.077)	(0.078)
High-tech	0.607***	0.568***	0.586***	0.578***	0.136	0.178	0.209	0.203
	(0.188)	(0.190)	(0.190)	(0.189)	(0.292)	(0.285)	(0.293)	(0.290)
Syndicates	0.727***	0.713***	0.754***	0.738***	0.642***	0.628***	0.622***	0.605***
	(0.117)	(0.117)	(0.117)	(0.116)	(0.138)	(0.139)	(0.138)	(0.138)
Regional competitiveness			0.505***	0.482***			0.168	0.155
			(0.107)	(0.108)			(0.145)	(0.149)
Local deal	0.032	−1.112	−0.174	−0.162	0.075	−1.828*	−0.234*	−0.226*
	(0.134)	(0.733)	(0.113)	(0.115)	(0.161)	(1.027)	(0.133)	(0.135)
Underdeveloped regions	−0.024	−0.300**			0.461***	0.272**		
	(0.160)	(0.122)			(0.153)	(0.132)		
Underdeveloped regions * Local deal	−0.491*				−0.889***			
	(0.256)				(0.333)			
Corruption		−0.188***				0.163**		
		(0.067)				(0.078)		
Corruption * Local deal		−0.112				−0.214*		
		(0.090)				(0.130)		
Industry experience			0.014				0.006	
			(0.010)				(0.005)	
Syndication experience				0.001				0.002
				(0.004)				(0.002)
N of observations	724	724	724	724	506	506	506	506
Pseudo R^2	0.22	0.245	0.233	0.231	0.134	0.129	0.122	0.121
Log likelihood	−353.22	−341.84	−347.19	−348.25	−273.38	−275.00	−277.22	−277.40

This table reports the coefficients and robust standard errors (in brackets) of the probit regressions of our dependent variable "Additional PVC" on different sets of independent variables and controls. The significance levels are *: $p<0.10$; **: $p<0.05$; and ***: $p<0.01$. Columns I-IV include deals carried out before 2008, while columns V-VIII include deals carried out since 2008. Industry and time fixed effects, as well as a constant term, are included in all estimates.

For this reason, we focus on typical design features of GVC initiatives and the efficacy thereof. We analyze the impact of the location/colocation, syndication and industry focus design features on three success measures for 1230 GVC investments in 16 European countries. We find that GVC is less likely to accomplish its mission of "bridging the equity gap" if the investees are older and are located in economically lagging regions. Furthermore, GVC policies are less successful if targets are sourced locally. The negative effect is even stronger if the GVCs and the ventures are collocated in underdeveloped regions or in countries with higher perceived corruption. Syndication with private capital investors improves the chances of achieving the "bridging the gap" goals. Moreover, GVCs improve their skills by accumulating industry-specific knowledge and syndication experience. Our results hold regardless of the success measure we employ (the target's receipt of an additional PVC funding, total asset growth, and innovation output). In addition, we verify our results with several robustness checks, including the analysis of the endogenous nature of syndication decisions.

Our paper therefore contributes to the debate on how GVC initiatives can more effectively accomplish their goals. It is advised that future policy consider the detected strengths and weaknesses of some of the typical design features. While GVCs are the category of VC investors which is more likely to invest nearby (Bertoni et al., 2015), our first recommendation for policymakers is not to restrict GVCs to local investments, especially in underdeveloped regions. Localizing GVCs in underdeveloped regions limits their access to private capital investors, who are often not locally available and who are difficult to attract from more developed areas. Instead, promising YICs in underdeveloped regions should be supported by national GVC policies, which obviously can more easily exploit scale and learning effects, and can better link with private capital investors. Regardless of the level of local development, local GVC investments are more likely to be exposed to collusion and inefficiencies due to the political nature of GVCs (Bertoni and Quas, 2016; Liben-Nowell et al., 2005). Again, we recommend incentivizing geographically distant and diversified investments, which are less likely to be affected by regulatory capture. In sum, while geographical distance has a negative effect on PVC investments (e.g., Cumming and Dai, 2010), we reveal that it may be beneficial for GVCs.

Our second recommendation to policymakers is to request GVCs to syndicate with PVCs whenever this is possible. Ample evidence has shown that syndicated PVC-GVC deals outperform solo GVC investments (e.g., Bertoni and Tykvová, 2015; Cumming et al., 2017). We extend our understanding by showing that the benefits of GVC/PVC syndication persist over the life of a GVC fund. GVCs benefit from their private partners' experience and improve their own selection and investment skills, which they can then use even when they invest alone to achieve investment success.

Third, and perhaps in contrast with the recommendation of other studies that address similar issues (Brown et al., 2017; Shane, 2009), we support the establishment of GVC funds with a precise industry focus. We find that GVCs can and do learn from their own industry-specific experience and should therefore specialize rather than invest across many sectors.

The limitations of our analyses are mostly caused by the availability of the data, but they pave the way to interesting avenues for future research. First, we do not include information on other measures of success for our sample companies, such as their revenue, profits, or number of employees. Such measures would be relevant to assess whether GVCs are able to achieve their mission of supporting growth but are, unfortunately, difficult to collect for startups. Along the same line, it would be interesting to differentiate the commercial activities and innovativeness of the business plans of the GVC-backed ventures to sort out the selection and treatment effects of GVCs with different design features. We are further lacking qualitative data that could help assessing the ability of entrepreneurs or GVC fund managers. Such data could allow us to test if GVC funds located in underdeveloped regions could also have difficulties in attracting skilled human capital. Additionally, there may be some heterogeneity among GVC programs and funds themselves that is not captured by our data. It is possible, for example, that using different incentive schemes to attract fund

managers affect the individual GVCs' achieved results. We are unable to control for these aspects but recognize them as interesting avenues for future research. Another important limitation is the European focus of our dataset. GVC programs targeted to YICs have been created elsewhere, such as in the US (Lerner, 2010), Canada (Cumming, 2007) and even China (Guan and Yam, 2015). Expanding the analysis of the design features of GVC programs to an international sample would certainly bear interesting results.

Further work is also warranted on some specific aspects linked with the design of GVCs. For instance, future studies could deepen our understanding of how precisely political distortions influence GVCs' investment decisions, especially in local deals. We contribute to the empirical evidence on the consequences of the PVC-GVC syndication, but further analysis should tackle the drivers of such phenomena, specifically addressing the free-riding mechanisms and agency problems that may influence the relationship between public and private actors. Finally, while we only observe realized GVC investments, it would be interesting to have information on the actual demand for external equity from YICs and understand whether GVC funds step in after investees already solicited capital elsewhere but have been rejected or if they directly compete with the private sector. If they back ventures that failed to convince private investors but are able to raise private capital after the GVC contribution, then GVCs have a truly meaningful role to bridge such equity gaps.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.respol.2020.104051.

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