POLICY-DRIVEN EXPANSION OF VENTURE CAPITAL INDUSTRY: AN EMPIRICAL EXAMINATION OF CONT EXTS, FACTORS, AND EFFECTS BEHIND THE RECEN T SURGE OF KOREAN VENTURE CAPITAL INDUSTRY

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ABSTRACT

Using (almost) population-level data of venture capitals for the recent four years (2012-2015), this paper analyzes the dynamism of Korean venture capitals focusing on growth, funding, investment, and internal capabilities. During the last four years, Korean VC industry had grown rapidly, 1.55 times the funding and 1.64 times the investment. At the same time many qualitative indicators at VC-level related to personnel and capital had also enhanced. During the four-year period, public funding to vcs had increased by 14% per annum, which may have had crowding-in market participation to result in 9% growth rate on the private-side. More importantly, policy drivers had greater impacts on the areas such as early-stage ventures where the private sector had traditionally shied away. Our findings from panel regressions vindicate that public funding favors fledgling young vcs over older ones, which signals positive roles of public funding in terms of overcoming market failure. We could not find evidences that public funding was significantly associated with other internal capabilities of vcs.

INTRODUCTION

From the beginning, governmental intervention has been a vital element that sustained the VC ecosystem in Korea. Being this understood, one will be still astounded at the recent figures. Within just recent three years, total amount of VC funds and annual investment rose about 50%. What is going on and what effects this has made to Korean VC ecosystem? This is the main question this paper addresses.

This phenomenal increase can be ascribed mainly to a government-wide policy initiative called “the creative economy”. Admitting that this policy made the volume swelled, a qualitative assessment has not been conducted. Some questions arise regarding whether the recent changes also came up with fostering innovative early-stage companies, creating strong and active venture capital market, attracting private funds into the VC market. Also, one will be curious about whether government support was efficiently and effectively conducted. Using (almost) population-level data of vcs for the recent four years, this paper addresses these questions. In particular, we analyze the recent dynamism of Korean vcs focusing on growth, funding, investment, and internal capabilities.

This study contributes to the literature about public funding in VC markets which roughly fall in three groups: 1) direct investment (D. Cumming, 2007; Lerner, Moore, & Shepherd, 2005); 2) direct funding through governmental venture capital (Y. B. Kim, Lee, & Kim, 2007; Leleux & Surlemont, 2003) and 3) indirect funding through existing vcs (also known as ‘hybrid fund’) (Brander, Du, & Hellmann, 2015; Brander, Egan, & Hellmann, 2008; Buzzacchi, Scellato, &

Ughetto, 2013; Humphery-Jenner, 2012; Jääskeläinen, Maula, & Murray, 2007; Leleux & Surlemont, 2003). There are also comprehensive studies covering all three cases (e.g. (Colombo, Cumming, & Vismara, 2014). The literature mostly discusses and examines the impact of government funding on private funds participation and investment patterns. Regarding the investment pattern, researchers are widely interested in the factors and performance about (a lack of) investment in innovative early-stage firms (Da Rin, Nicodano, & Sembenelli, 2006; Gualandri, 2008; Colombo et al., 2014; Jensen & Meckling, 1976; Gualandri, 2008; mcnally, 2002; OECD 2006). Lerner (2002) insists that the government's contribution to venture capital fund should fill the investment gap in the VC market and foster entrepreneurial activity. This paper enriches the literature by providing unique contexts of recent Korean VC industry with government's role highlighted and shed new lights on micro aspects of the relationship between public funding and VC internal characteristics.

We present a brief review of the relevant literature in the next section. Then, we provide accounts on the history, contexts, and the recent developments of VC industry in Korea. After explaining our data and methods, we present the results from our analysis. Lastly, we conclude this paper by discussing our findings and directions for further research.

LITERATURE REVIEW

Governments play a major role in the growth of the VC market in many countries (Lerner et al., 2005). Governments support VC industries through various means such as tax benefits, utilization of pension funds, diversification of the exit market, opening a dedicated equity market, and funding (Branscomb & Keller, 1998; Murray & Marriott, 1998; OECD, 1997). Korean government has also been supporting the VC industry through various policies over 30 years. Of these various policies, scaling-up VC industry through direct funding is the most noteworthy during the period this research in interested in.

One rationale of public funding to vcs is market failures explanation. Despite the higher-return on investment, investors are hesitant to invest in new technology-based firms (NTBF in short) because of information asymmetry (Colombo et al., 2014; Jensen & Meckling, 1976), complexity of due diligence process, inefficiency of monitoring and uncertain investment returns (D. Cumming, Fleming, & Schwienbacher, 2006; De Clercq, Fried, Lehtonen, & Sapienza, 2006; Ibrahim, 2008; Schwienbacher, 2005). The capital shortage experienced by early-stage entrepreneurs (so to speak, 'equity gap') works as critical obstacle to an active VC market and entrepreneurial eco-system (Cressy, 2002; Wilson & Silva, 2013). Governments are called for to fill in the equity gap and complement market failures (Bottazzi & Da Rin, 2002; Lerner, 2002). Governments are expected to play a larger role in the areas where market failures or equity gaps are more prominent (Leleux & Surlemont, 2003; Lerner, 2002; mcglue, 2002). Funding to innovative early-stage firms can be one area as such. Governments can also facilitate private funding to ventures by mitigating information asymmetry between investors and investees. The facts that governments fund a venture or a VC generates a positive signal for the investment to the markets (Collewaert, Manigart, & Aernoudt, 2010; Lerner, 2002; Sung, Oh, Oh, & Lee, 2014).

Provision of public funding can be either direct or indirect. Governments may operate an own venture capital (GVC) or just invest in private venture funds(Buzzacchi et al., 2013; Jääskeläinen et al., 2007; OECD, 1997). The latter mode of funding is sometimes called 'hybrid funds'. A number of studies examined the effects of public funds in alleviating the equity gap of

NTBF or inducing private investment for multiple countries (Brander et al., 2015; Mayer, Schoors, & Yafeh, 2005), for Canada (Brander et al., 2008), for European countries (Buzzacchi et al., 2013; Da Rin et al., 2006; Leleux & Surlemont, 2003; Schertler, 2005; Tykvova, 2004), and for Korea (Y. B. Kim et al., 2007; Y. H. Kim & Lim, 2015; Lee & Jung, 2016; Sung et al., 2014)

A number of studies discuss the adverse effects of public funding. Adverse effects are mainly attributed to the inherent limitations of GVC. Lower financial burden on investment failures and/or lower-powered incentives for successful investments of public sector than private sector make GVC operation less efficient and effective than private counterparts (Humphery-Jenner, 2012; Leleux & Surlemont, 2003). GVC tends to crowd out private involvement as it interferes with profitable investments and prevents private sector growth (Brander et al., 2008; D. J. Cumming & macintosh, 2006; Wallsten, 2000). Humphery-Jenner (2012) Points out that gvcs tend to 'pick winners' rather than promote the growth of innovative early-stage entrepreneurs with high risk. Regarding follow-up support for investment companies, Brander et al. (2008) found that government-run gvcs are less effective in mentoring and value-add capabilities. (Mason & Harrison, 1995)argued that GVC avoids investment in companies that have not been invested by private vcs because of lack of expertise (experience, network, information, etc.) Required for pre-investment assessment Y. H. Kim and Lim (2015) also observed that GVC tended to avoid venture investment compared to the private vcs. In sum, gvcs are preferred stable investment in the latter stage rather than risk investment in early stage firms.

VENTRUE CAPITALS AND PUBLIC FUNDING IN KOREA

History of VC Market and Public Intervention

The Korean government played a major role in developing venture capital market from the beginning(Yusuf, Altaf, & Nabeshima, 2004). In 1974, the Korean government established KTAC(Korean Technology Advancement Corporation), probably the first organization which provided financing to venture firms in Korea, to assist transferring research results from KIST(Korea Institute of Science and Technology) to smes. In early 1980s, the Korean government incorporated three more institutes which were to invest in early-stage technology ventures: i.e. Korea Technology Development Corporation (KTDC), Korean Development Investment Corporation(KDIC) and Korean Technology Finance Corporation(KTFC). Among these three, incorporation of KTDC was based on a special law regarding commercializing R&D outputs and later, in 1992, developed into a big VC firm named KTB Networks(K. Kim & Kutsuna, 2014). Therefore, KTDC is generally regarded as the first venture capital firm in Korea(Bae, Pyo, & Kim, 2012).

In 1986 Korea enacted two important laws regarding venture capital: the ‘Small and Medium-Size Enterprise Start-up Support (SMESS) Act’ and the ‘New Technology Enterprise Financial Support (NTEFS) Act’. The former aimed to support smes and the latter the four early-born venture financing institutions. It was the SMESS Act that propelled establishment of private venture capital firms which counted 54 in 1992 (Lim, 2012). However, these early-stage venture capital firms then were interested in making loan instead of equity financing. In 1996, enactment of the ‘Act on Special Measures for the Promotion of Venture Businesses’ and establishment of the small enterprise oriented stock market(KOSDAQ: Korea Securities Dealers Automated Quotation is a trading board of Korea Exchange in South Korea benchmarked from the American counterpart, NASDAQ.) Levelled ground for private financing of smes. Also, four consecutive

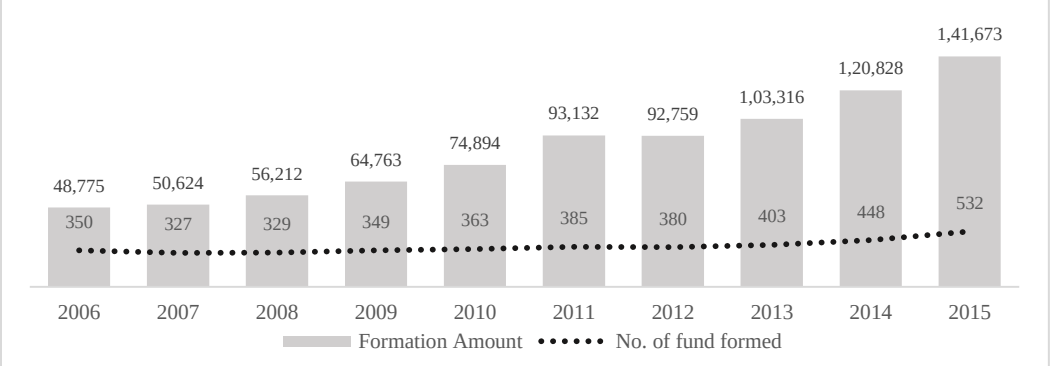
policy measures in 1997-1999 (which include launching of governmental venture capital funds, a matching fund program for private venture capital funds, permission of pension funds to invest up to 10 percent of their capital in venture capital funds, lifting up the restrictions on foreign investment regarding investing in vcs, and increase in tax benefits for investment in smes) resulted in the burst of formation of private VC firms and their investment. As a result, Korea's venture capital industry showed remarkable growth with more than 150 vcs and investment over 2 trillion won in year 2000(KVCA, 2016). Then, almost suddenly came the burst of IT bubble in early 2000s. In 2004, the number of venture capital firms decreased to 100 with total investment merely 600 billion won. Experiencing a downturn, the VC market asked for even larger amount of governmental support than before. However, the way of governmental VC support also faced challenges regarding its operational efficiency (Y. H. Kim & Lim, 2015).

Until 2004, the government supported VC industry directly through Governmental Venture Capital(GVC) which funded needed smes directly. This mode of subsidizing VC industry, however, revealed significant flaws such as low profitability, market distortions, and operational inefficiency stemming from bureaucracy, and investment myopia. Since GVC operated under a one-year-oriented investment plan enforced by the annual national budget cycle, long-term support for smes was volatile, if not impossible (Park & Yoon, 2012). In response to these growing concerns, a new way of governmental intervention in VC industry was sought after.

In 2005 korean government established the fund of funds by integrating all gvc assets. It is fof which has injected the largest amount of fund into vc industry since then. Additionally, fof has contributed to advancing korean vc industry into qualitatively and managerially more sound system: systematic management and investment were introduced, vcs became more transparent than before, and vintage vcs emerged. Since 2008, lots of regulations were lifted up. The minimum capital requirement for vc establishment was reduced. Now, vcs can be established in the form of llc. A secondary market was established to strengthen the exit opportunity.

In 2013, "creative economy" policy initiative was announced by a new administration led by President Park, geun hye. Aiming to foster startups and vc industry, the central government introduced a variety of new public funds and regulatory reform resulting in growth ladder fund (glf), establishment of micro vcs, accelerators and crowd funding platforms. The total fund size had grown from 9.2 trillion won in 2012 to 14.1 trillion in 2015 while the number of funds grew from 380 to 532 (figure1).

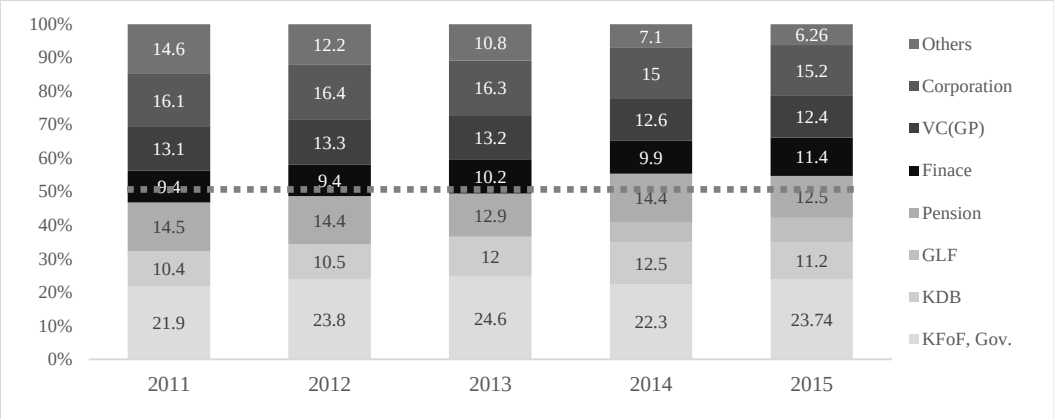
Figure 1
OPERATING VENTURE CAPITAL FUNDS (KVCA, 2016)



Public Sources of Venture Funding in Korea

Government, corporations, financial companies, pension funds and venture capital firms (as General Partners) have contributed as major funding sources in the Korean VC industry. Below we briefly discuss 4 public sources such as FoF, local governments, GLF, and pension funds which jointly explain over 50% of all VC funds in Korea recently (Figure 2).

Figure 2
SOURCE FORMATION IN VENTURE CAPITAL FUNDS (KVCA, 2016)



The fund of funds (or 'mother fund') invests not in corporations but in individual investment funds (or 'child fund'). Fof was first established in 2005. Its duration was set to 30 years. A major distinction of fof from the previous gvcs is found in separating funders from investment decisions. While the government provides funds and overall operational direction, actual investment and managerial decisions are made by a newly established specialist company, Korea Venture Investment Corporation (KVIC, 2016). In total 8 governmental departments (listed in Table 2) participate in fof as limited partners. Investments by each department are carried out with separate accounts and subject to the respective policy objectives and guidelines of its own.

By the year of 2015, a total of 3.4 trillion won has been invested in the formation of a total of 279 venture funds. The total amount of these child funds is 12.78 trillion won, leveraged by investments from other fund sources such as pension, bank, corporations, and etc. The total number of venture funds formed from 2012 to 2015 is 287, among which 191 child funds are funded by the fof. The fof-affiliated child funds account for 66.6% in number and 81.1% in amount of all VC funds (KVCA & KVIC, 2016). In a nutshell, fof is one of the most important players in the Korean VC ecosystem.

Table 1
OVERVIEW OF KOREA FUND OF FUNDS

INITIAL ORGANIZATION	JULY 15, 2005
LIMITED PARTNERS	SBC (Small & Medium Business Corporation) MCST (Ministry of Culture, Sports, and Tourism) KIPO (Korean Intellectual Property Office) KOFIC (Korea Film Council) KCC (Korea Communications Commission)

	MOEL (Ministry of Employment and Labor) MHW (Ministry of Health & Welfare) KSPO (Korea Sports Promotion Foundation)
FUND SIZE	2 trillion won (as of end of 2015. 05)
FUND DURATION	30 years (2005-2035)
INVESTMENT AREAS	(SBC) Start-ups, Venture companies, SMEs and etc. (MSCT Account) Projects and companies in Cultural Industries (KIPO Account) Companies applying or commercializing IP (KCC Account) Projects and companies in Broadcasting and Telecommunication Industries (KOFIC Account) Korean Films and etc.

(Source: KVIC, 2016)

Korea Development Bank, founded in 1954, is a government-owned bank for long-term industrial financing and comprehensive banking services. Since 2000s it expanded its businesses into financing startups and smes. Although it sometimes directly invests in smes, KDB mostly makes indirect investments in smes via private venture funds. KDB operates more than eight early-stage funds including young entrepreneurial funds, patent commercialization funds, and a future creation funds. As shown in Figure 2, the share of KDB in VC funds from 2011 to 2015 is between 10.4% and 12.5%.

Growth Ladder Fund (GLF) is another fund-of-funds dedicated to address funding gaps of startups and smes through financial intermediaries such as vcs and pefs. GLF, established in August 2013, has collected 1.85 trillion won from major government-dominated banks such as KDB, IBK Industrial Bank, and 'Young Business Foundations of Banks'. As of March 2016, total amount of subordinate funds grew to 4.5 trillion won (FSC, 2016). GLF aims to create a healthy corporate growth ecosystem called 'start-up-growth-exit-and re-start'. It provides sufficient funds for innovative young companies, stimulates an inflow of private funds, and invests in growth-stage firms.

The share of local governments in VC funds is about 12% in recent years (KVCA, 2016). Local governments aims to facilitate investments in local venture businesses and promote local economies. Since 2010, 19 local governments have made investments with the size of 314.5 billion won.

Pension fund is generally an important funding source for vcs and ventures (Gompers, 1994; Mayer et al., 2005). Korea National Pension Service (NPS) operates 478 trillion won. The investment portion for the venture fund is about 1 to 2% of the total fund, and the profit rate is slightly higher than the average return on total investment in Korea (NPS, 2016). NPS fund invests in venture funds to help ventures companies and promising new technology businesses in the earlier stages of growth, but also it diversifies its portfolio into the growth stage.

DATA AND VARIABLES

In this paper, we investigate the recent expansion of public provision into VC industry and its effect on VC market in both industry- and firm-base using three different methods. First, we use a descriptive analysis to see if the quantitative expansion has affected VC market in healthier direction (e.g. more private fund placements, more early-stage fund establishments, higher early-stage & high-tech investment ratio). Second, again, we use a descriptive analysis to see if the policy driven expansion has affected in intrinsic characteristics. Third, we use a panel data analysis to find out relationship between the characteristics of VC firms and their public

fund scale.

We use a dataset of 126 korean vc firms that registered to smba(small and medium business administration) during 2012 to 2015. We collected information about each vc including its sources of funding, paid-in capital, and personnel. From diva(disclosure information of venture capital analysis). Diva, provided by kvca(korea venture capital association), is the only accredited database which contains information about company governance, financial statements, funds and investment information. We also collected data from kvca yearbooks (2013-2016) for additional information such as annual growth data in the number of managers and investments. Unfortunately, diva does not provide information about fund level within each vc so that we could not break down sources of funds and target of investment at a fund level. After removing limited liability corporations (only 6% of our sample) and several inactive vcs, we analyzed 114 korean vc firms between 2012 and 2015.

We constructed three different groups of variables:

- The Characteristics of a VC
- Size and Sources of Funds, and
- Actual Investment.

The dependent variable of this study is the ratio(public ratio) of public placement to the total fund amount by each VC(R_Public), representing dependence on public sources. Independent variables are the key characteristics of each VC, such as firm-age, paid-in capital, number of venture capitalists, professional work experience of investment managers, and size of total funds and they are what public investors appreciate importantly when selecting the right VC house. The dataset were collected in order of year for panel analysis. The description of all variables and the basic statistics are shown in Table 2.

The average public ratio is 39% and the highest is 90%. The public placements for each venture capital are calculated by summing the total contributions of fof, state-controlled banks(e.g. KDB), NPS and other public institution such as local governments. An average of KRW 35.4 bn of public funds was placed in to each VC and reaching a maximum of KRW 196 billion. Paid-in capital is an important indicator representing financial capacity and its average is 13.7 billion won, and the maximum is 83.5 billion won. Firm-age normally represents VC firm's management stability The average firm-age is 11 years old and maximum is 29 years old. The average number of investment managers is 7.2 per VC and the average investment experience is 5.5 years. We also controlled each VC firm's own interest in industry sector.

Table 2
THE DESCRIPTION OF ALL VARIABLES AND THE SUMMARY STATISTICS

GROUP	DESCRIPTION	MEAN	STD. DEV.	MIN	MAX
CHARACTERISTICS	Year	2013.5	1.12	2012	2015
	Age of VC firm	11.1	7.9	1.0	29.0
	Paid-in capital (million won)	13,662	12,796	2,275	83,500
	Number of investment managers(venture capitalist)	7.2	5.6	0	41.0
	Average years of service of investment managers(venture capitalist)	5.5	2.6	0	16.0
FUND & SOURCES	Total fund asset under management(AUM)	103,625	127,832	0	876,600
	4year summation of the newly formed early-stage	5,777	11,733	0	123,100

	funds				
	The proportion of placement from public sources in total funds('Fund_All')	42.5	20.0	0	86.5
INVESTMENT	Total amount of investment processed	14,658	19717.5	0	155,119
	Total amount of investment in start-ups and early-stage firms (under 3 years after establishment)	4,167	6211.0	0	50,400
	The proportion of investment in start-ups and early-stage firms in total investment	37	33.2	0	100
	Total amount of investment in companies in high-tech industry (ICT manufacturing, ICT service, Biomedical, SW)	6,925	11382.9	0	77,300
	The proportion of investment in high-tech companies in total investment	43.42	34.0	0	100
	Dummy variable(1: VC which invests in media & contents business over 50% of total investment)	0.13	0.33	0	1
	Dummy variable(1: VC which invests in Biomedical business over 50% of total investment)	0.06	0.23	0	1
	Dummy variable(1: VC which invests in Game & Software business over 50% of total investment)	0.03	0.17	0	1

ANALYSIS AND RESULTS

Using our dataset we first analyze overall trends by focusing on overall growth, dependence on public funding, and investment in early-stage or high-tech firms. A summary of key figures is presented in Table 3.

First of all, Korean VC industry had grown rapidly (12% per annum on average for funds and 13% for investment) during the last 4 years. Total amount of VC funds in 2015 is 1.55 times the total funds in 2012. Even surprisingly, early funds for startups and early-stage smes had grown by 22% during the same period. Over three years, the amount of early funds more than doubled. This implies that supply-side policy driven by Creative Economy initiative was successful to a certain extent. While public funds had grown by 14%, private funds had grown by just 9%. As a result, dependence on public funds had even strengthened. This implies that Korean VC industry may be still fragile without public support.

Looking at the investments, the size of investment had increased by 13% per annum. Start-up and early-stage investment grew by 14% per annum, resulting in 0.56 trillion won invested in early stage in 2015. The share of early-stage investment recovers to around 30% in 2015 after slight decrease in 2013 and 2014. The investment in the high-tech sector almost doubled during the 4 years which was driven by ICT, software and biomedical sectors (KVCA, 2016).

Overall, compared to the first two years, all figures in the last two years had increased by a large amount. Again, thanks to massive government-wide interests in innovative ventures, Korean VC industry seems to become both rapidly expansive and qualitatively enhancing.

Table 3
FUNDING AND INVESTMENT OF KOREAN VCS FROM 2012 TO 2015

	FUND (TOTAL)	EARLY FUND	PUBLIC (SHARE)	PRIVATE (SHARE)	TOTAL INVESTMENT	AVG. INVESTMENT	EARLY (SHARE)	HIGH-TECH (SHARE)
2012	8,161,339	365,100	3,411,860 (42%)	4,478,587 (55%)	1,123,959	12,351	334,345 (30%)	447,825 (40%)
2013	9,133,147	447,700	3,869,467 (425)	4,816,323 (53%)	1,318,748	13,882	333,675 (25%)	638,516 (48%)
2014	10,755,160	651,060	4,677,646 (44%)	5,672,391 (53%)	1,464,000	14,939	411,419 (28%)	746,392 (51%)
2015	12,675,097	806,560	5,815,674 (46%)	6,267,790 (49%)	1,842,700	16,906	558,300 (30%)	888,700 (48%)
CAGR	12%	22%	14%	9%	13%	8%	14%	19%
12&13	17,294,486	812,800	7,281,327 (42%)	9,294,910 (54%)	2,442,707	26,233	668,020 (27%)	1,086,341 (45%)
14&15	23,430,257	1,457,620	10,493,320 (45%)	11,940,181 (51%)	3,306,700	31,844	969,719 (29%)	1,635,092 (49%)
GR	35%	79%	44%	28%	35%	21%	45%	51%

Note: CAGR stands for compound annual growth rate. All monetary units are million won.

Now we turn our attention to internal capabilities of VCs. Key figures regarding some internal capabilities are presented in Table 4. The number of VCs continues to increase from 91 in 2012 to 109 in 2015, which indicates that VC ecosystem in Korea becomes more lively and active as time goes on. Average VC has about 7 investment managers whose working experience spans about 7 years in 2015. However, average paid-in capital became smaller, which partially reflects lowered minimum level of paid-in capital legally enforced for new VCs.

Table 4
INTERNAL CAPABILITIES OF KOREAN VCS FROM 2012 TO 2015

YEAR	VC FIRMS				INVESTMENT MANAGERS		
	Number	New entry	Exit	Capital (Average, million won)	Total number	per VC firm	Average year of service
2012	91	6	6	14,216	618	6.8	5.4
2013	95	3	7	13,905	704	7.4	5.4
2014	98	6	4	13,745	730	7.4	6.0
2015	109	14	2	12,914	797	7.3	6.8
CAGR	6%	-	-	-3%	9%	2%	8%

Finally, we examine what kind of vcs depends more on public support. Using the share of public sources in funds (R_public) as a dependent variable we ran regressions on year and a set of variables capturing VC characteristics. In particular, we ran regressions using random effects panel regression model. Model specification is based on the results of several tests: 1) We rejected pooled OLS model based on the results from Breusch and Pagan Lagrangian multiplier test for random effects (χ^2=245.31; p<0.001); and 2) we adopted random effects instead of fixed effects model based on the results of Hausman test (χ^2=10.88; p>0.20). Our independent variables are year, firm age (as first appeared in the sample), capital, size of VC funding, and the number and experience (as measured by years of services) of investment managers. We controlled areas of expertise for each VC as measured by whether a half of its investments were

directed toward a particular sector. They include contents (i.e. For movies and entertainment sectors), biomedical sector, and game and software sectors, respectively. Both regression models are statistically significant and explanatory as indicated by fitness statistics. The results of regression in Table 5 show that the share of public funding has increased as indicated by positive and significant coefficient on "Year" (1.27; $p<0.01$). The dependence on public funding does not seem to change by VC characteristics except for firm age. Our results show that younger VCs are likely to depend more on public funding than older ones. As firm age increase by one year, the share of public funding is likely decrease by 0.57 percentage points holding other variables constant.

Table 5
RESULTS OF REGRESSION

VARIABLES	PANEL: RANDOM EFFECTS
YEAR	1.270***
	(0.462)
TOTAL FUND ASSET UNDER MANAGEMENT(AUM)	6.25e-06
	(1.40e-05)
AGE OF VC FIRM	-0.569*
	(0.317)
CAPITAL (BILLION WON)	0.163
	(0.153)
NUMBER OF INVESTMENT MANAGERS(VENTURE CAPITALIST)	0.185
	(0.297)
AVERAGE YEARS OF SERVICE OF INVESTMENT MANAGERS(VENTURE CAPITALIST)	0.555
	(0.424)
DUMMY FOR CONTENTS	1.145
	(2.826)
DUMMY FOR BIOMEDICAL SECTOR	-0.596
	(2.785)
DUMMY FOR GAME AND SOFTWARE SECTORS	1.464
	(4.559)
CONSTANT	-2,518***
	(929.9)
OBSERVATIONS	349
R-SQUARED	0.056
WALD CHI2	19.35
NUMBER OF GROUPS	101

Note: dependent variable is the share of public funding in total funds. Unit of analysis is venture capital firm.
Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

CONCLUSION AND POLICY IMPLICATIONS

Using (almost) population-level data of vcs for the recent four years , this paper analyzes the recent dynamism of Korean vcs focusing on growth, funding, investment, and internal capabilities. Even within four years, Korean VC industry had grown rapidly, 1.55 times the funding and 1.64 times the investment. The number of vcs had increased from 91 to 109 (20%). VC turnover (net inflow over total number of existing vcs) was 0 in 2012 but increase to 12% in 2015. The number of investment managers had grown from 618 to 797 (29%). All in all, Korean VC industry had experienced a record-breaking growth.

A major driving force was policy change and funding from the central government. The Creative Economy initiative announced in 2013 explicitly declared startups as a next-generation force of economic growth. Consequently, lots of policies were newly introduced to bolster startups and venture capital industry. During the 4-year period, public funding to vcs had increased by 14% per annum, which may have crowding-in effects to the market resulting in 9% growth rate on the private-side. As a consequence, the share of public sources of funding had increase from 42% in 2012 to 46% in 2016. More importantly, policy drivers had differential impacts on the areas where the private sector had traditionally shied away. In particular, the amount of funding dedicated to early-stage ventures bulged by amazing 221% and actual investments made for early-stage ventures by 167%.

Then, was the public funding spent effectively and efficiently? This paper addresses a part of this important question by looking at the impacts of VC characteristics on the dependence of vcs on public funding. Our finding from panel regressions vindicates that public funding favors fledgling young vcs over older ones, which signals positive roles of public funding in terms of overcoming market failure. However, public funding does not differentiate vcs based on the areas of investment as well as internal capabilities, which may or may not be good for vcs. This summons further research on this topic. The last thing we can say regarding this finding is, however, that participants of Korean VC industry as well as policy makers were continuously complaining about operational effectiveness of public funding to vcs. Our finding reveals a facet on which these complaints are reflected.

Public funding can play both positive and negative roles to making VC ecosystem healthier. On the positive aspects, it can promote the participation of new born VC firms and new venture capitalists, strengthen the competency of existing vcs, and, finally, direct more funds toward the areas where markets tend to opt out (such as smes in the future-oriented industry. However, just injecting more money may not always guarantee improvement of the VC ecosystem. On the negative side, the dramatic rise in public funding can adversely affect the health of the VC market. First, there is a possibility that public funding crowd out private funding. Second, public funding that does not come abreast with bolstering VC internal capabilities can result in conservative and risk-free investment decision. This is because as an investment manager's time and attention is restricted the larger she needs to deal with the more likely she will be keep each investment safer and more efficient. Third, oftentimes demand (ventures) does not qualitatively support supply (VC funding). Effectiveness of vcs is ultimately measured against success of ventures who receive VC investment. The increase in funding supply does not guarantee returns from the investment. It is hardly believable that smes and ventures may be able to leap off within very short time period.

Back to Korea, the early-stage investments or private participation may lag behind the public initiative. However, it is hardly expectable to see the similar level of growth in these performances as the public input (14% annual growth). Although a bold public initiative is laudable, it is worrisome as noted in several previous studies (Da Rin et al., 2006; Gromb & Scharfstein, 2002) that policies having only a short-term target without supporting policies with more comprehensive and long-term oriented perspectives may result in distortion of the market. Korean VC market is unique and very noteworthy partially because VC policy is highly influencing, dynamic, extensive, and focused at the same time. We wish that the current paper has successfully revealed a part of this interesting aspect and summons further research on this topic.

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