The Effect of Government Hybrid Funds on IPO Underpricing in Emerging Markets: Evidence from the Korean Stock Market

Hyunjoo Lee and Jinho Jeong[*]

Korea University, Korea

Abstract

IPO underpricing has been a subject of great interest for researchers. Previous studies have focused on the underpricing of private venture capital-backed IPOs. However, underpricing in government-backed IPOs has been largely ignored by mainstream academic researchers. In this study, we aim to help fill this gap by investigating the pattern of IPO underpricing for government-backed IPOs in Korea. We analyzed the IPO price behavior of 278 newly listed firms on Korea Securities Dealers Automated Quotations during the period of 2009 through 2014. Empirical evidence shows that government sponsorship reduces the degree of asymmetric information in the IPO market by providing a certification role. In particular, the dual sponsorship of government and private VCs contributes most significantly to the reduction of information uncertainty in the IPO market.

Keywords: IPO Underpricing, Hybrid Fund, Information Asymmetry, Certification Role, Korea

---

[*] Corresponding author at : 2511 Sejong-ro, Sejong City, 339-770, Korea.
  E-mail address: jayjeong@korea.ac.kr

1. Introduction

The underpricing of initial public offerings (IPO) is a well-documented fact (e.g., Ritter (2003)). IPO underpricing has been a subject of great interest for many researchers. Previous studies have focused on the underpricing of private venture capital-backed IPOs. However, underpricing in government-backed IPOs has been largely ignored by mainstream academic researchers. Cotei and Farhat (2011) state that the association of an IPO company with specific venture types signals unique information to the capital markets. In this paper, we investigate whether government sponsorship in the IPO market produces a unique type of signal to the capital market. For this purpose, we examined underpricing of IPOs and compared government-backed IPOs with non-government backed IPOs in Korean equity markets. Our investigation of the Korean government's role in the IPO market contributes to the existing literature and further enhances our understanding of IPO underpricing.

New and early stage entrepreneurial ventures need seed money in order to develop technologies and improve business models. Yet the proportion of private financial investment to early stage venture firms has continuously declined from the early 2000's around the world, including in Korea. With rising concerns about insufficient private investment into venture economies, several governments have set up hybrid venture capital funds to increase venture capital investments in early stage SMEs.[1] The United States initiated government hybrid funds with the 'Small Business Investment Companies' program by the Small Business Administration (SBA) in 1958. The SBA involves itself significantly as a special limited partner (LP) or a public guarantor for the portion of total funds raised and invested. Similar programs were adopted in many other countries including the United Kingdom, Canada, and South Korea. In Korea, the government started a hybrid funds program called "The Korea Funds of Funds (KFoFs)" in 2005. KFoFs were based on the Special Measures for the Promotion of

---

[1] It was referred to pooled money from private and public sources (OECD (2004) 'Venture Capital: Trends and Policy Recommendations' Science Technology Industry. Paris).

Venture Businesses Act which was introduced by stipulating laws for businesses with high risks and high returns. The Act consists of the definitions of venture companies, requirements of venture businesses, measures of capital supply, the establishment of the Korea Venture Fund, and several restrictions. KFoFs' fund size is two trillion won (about 1.7 billion US dollars) as of May 2015, and the fund will last until the year 2035.

The Korean government anticipated the issue that private VCs are mostly interested in businesses where the risks and uncertainties are less extreme. This has led to a hiatus in funding for the youngest companies with high growth potential. As a result, the government is needed to play an important role in this high-risk and high-growth market as an alternative investor to venture capital firms, and/or as a co-investor with them. With the enactment of the act, eight different governmental ministries and agencies provide the capital to a designated governmental agency called Korea Venture Investment Corp (KVIC) in order to help industries in which private investors have less participation.

There are two different types of government funds that are invested in venture firms: pure governmental VC funds (GVCs) and government-private partnership funds.[2] There are several operational limitations of pure GVCs. First, GVCs are created by a political agenda or regulations, not by negotiations among partners. VCs usually establish venture funds with extensive negotiations among investors and detailed covenants. In the contract between limited partners and venture capitalists as a general partner, they set the terms in order to make efficient management of investments. The terms include restrictions on the investment decisions, public disclosure of investments, compensations, and much more. They are designed to reduce agency problems between general and limited partners in order to maximize the profits from investment. However,

---

[2] It is necessary to clarify the terminologies used in this paper before discussing the role of government in IPO market. Cumming et al. (2014) distinguishes governmental venture capitals (GVCs) and syndicated funds in order to explain different types of government sponsored venture funds. In this paper, we define GVCs as venture funds established by 100% of governmental sources of funds, and government hybrid funds as government and private partnerships syndicated funds.

GVCs usually do not have the similar terms on the management of the funds because the covenants are set by government regulators. Thus the performance of the fund management can be inefficient in terms of facilitating maximization of investee performance. Second, GVCs have less efficient compensation terms regarding fixed management fees and a profit bonus. Usually, the compensation structure of limited partners of venture capitals is 2 percent fixed fees and a 20 percent performance fee based on the profits the funds make. Yet, the compensation terms to the GVCs usually consist of fixed management fees alone, or with very small portion of performance bonus in rare cases in Korea. Third, GVCs lack independence in investment decisions due to political pressure, non-financial related governmental goals, or pressure to invest in marginal quality projects. Because of these limitations of GVCs, Cumming et al. (2014) suggest that GVC-private syndicated relations may enhance performance and overcome the limitations of GVCs.

Syndicate funds may have better performance which, in turn, reduces underpricing. At first, unlike private VCs, governmental hybrid funds can be beneficial, because they may improve the screening process by obtaining others' opinions (Gompers and Lerner, 2004). Second, they may reduce information asymmetry between insiders and investors through governmental resources, networks, and industry expertise. Thus, they can reduce the overall portfolio risk and may reveal a signal of the quality of the venture companies (Cumming et al., 2014). Megginson and Wiess (1991) suggest that VCs increase the certification role by incorporating reputable auditors and underwriters in order to decrease information asymmetry. Therefore, the reputation of government hybrid funds may lead to lower underpricing compared to private VCs.

Yet, the syndication may provide several limitations of agency and transaction costs (Cumming et al., 2014). These costs are particularly high when the partners have same interests on the investment. If GVCs and VCs have different agenda on the syndication as GVCs have only political agenda and VCs have only profit maximization agenda on the investment, the syndication can be unsuccessful with principal-principal conflicts of each member's interests. Our research contributes to the research gaps of the

syndication roles on IPOs. We try to fill the gaps whether GVCs are by their own able to give certification role to the market with a positive exit, or syndication is able to provide the more certification to the market due to the complementary work of GVCs and VCs.

In this paper, we expect that the certification role of government hybrid funds is superior to that of private VCs whose reputation is not as good as hybrid funds. More specifically, we expect that the IPO underpricing of private VCs is higher than that of governmental hybrid funds. Likewise, we expect that the dual sponsorship of private VCs and government funds shows the least underpricing since the involvement of diverse VCs may improve the decision-making of the IPO and thereby mitigate adverse selection problems.[3] For this purpose, we investigated a sample of 278 newly listed IPOs in the Korean market during the period of 2009 through 2014.

This study comprises seven sections, including the present one. Section 2 discusses previous studies. Section 3 explains the structure of hybrid funds in Korea. Section 4 elucidates the hypotheses tested in this study. Section 5 describes the empirical models and the data. Section 6 presents the empirical results, and section 7 concludes the paper.

2. Previous Studies

2.1. VCs' role in IPOs and underpricing

VCs serve as financial intermediaries by raising capital from several institutions including pension funds, governments, insurance companies, and banks and providing capital to startup ventures. Jeng and Wells (2000) found that the possibility of having

---

[3] Cumming, Grilli, and Murtinu (2014) argue that different capitalists with more diverse backgrounds and expertise can perform due diligence complementarily.

IPOs is the strongest driver of venture capital investment among many factors, including gross domestic product, market capitalization growth, and labor market rigidities. Thus, the literature shows that VCs actively monitor and participate in the investee companies' management, often with negotiated contracts, in order to maximize their equities' values until having IPOs. Barry *et al.* (1990) found that venture capitalists are specialized in specific areas, such as business management and finance management. Croce, Marti, and Murtinu (2013) found VC funding to have a significantly positive impact on the enhanced productivity of European firms in early stages. VCs often have the rights to replace the senior management of the companies they invest in by participating on the board of directors (Hochberg 2012). Gompers (1995) analyzed the VCs' investment structures with a sample of 794 VC-backed firms. VCs tend to monitor invested firms if their tangible assets are reduced, M/B ratios are high, and R&D ratios are high in order to make profits through public offerings. He also pointed out that VCs emphasize the short-term performance of the invested companies and transfer the corporate values to the market. From the VCs' monitoring and control, outside investors consider VCs to play a certification role by reducing information asymmetry (Gompers 1995). Megginson and Weiss (1991) empirically concluded that VC-backed firms appoint reputable underwriters and outside auditors for IPOs in order to increase the certification roles.

In order to have successful exits of VC investment through IPOs, underpricing is one of the most attractive tactics for VCs even though the degree of underpricing varies (Loughran, Ritter, and Rydqvist, 1994). IPO underpricing is the basis of excess returns on the first day on the market, as proposed by Stoll and Curly (1970). Rock (1986) presented a model for IPO underpricing as the existence of information asymmetry on IPOs. If the shares are priced at their expected value, inside investors are privileged compared to outsiders. Therefore, the offering share prices should be discounted in order to attract uninformed investors to purchase them. Megginson and Weiss (1991) examined 320 VC-backed companies' IPOs compared to 320 companies' IPOs without VCs in the same industry. In the case of VC-backed companies, it takes 8.6 years to go

public as compared to the 12.2 years for the IPO without VCs. VC-backed IPOs show 7.1% average excessive returns compared to the 11.9% averages for the IPOs without VCs. Thus, the VCs' sponsorship leads to less underpricing with the certification roles of VCs.

Conversely, Lee and Wahal (2004) reported that VC-backed IPOs show higher excess returns on the date of IPOs. They concluded that the higher underpricing helps VCs increase their reputation in order to attract outside investors for IPOs. By examining 433 venture-backed IPOs Gompers (1996) showed that young VCs under six years old take investee firms public earlier in an effort to build a reputation and find other investment opportunities. IPO underpricing is one of the reward packages for IPOs with young VCs because outside investors are concerned about information asymmetry and firm quality before making an investment decision.

There is little evidence in the prior literature regarding government hybrid funds' impact on IPO underpricing. However, Cumming *et al.* (2014) reported that governmental hybrid funds have greater exit profits than regular VCs do due to the interaction of efficient fund management of VCs and superior industry information of governments.

2.2. The role of government hybrid funds

Using a database with international coverage such as USA, Canada, Europe and some from Asia, Brander, Du, and Hellmann (2015) determined that firms with GVCs and private equity funds have more investment due to a complementarity between GVCs and private finance. They found that mixed funding is the largest type of investment funding, followed by pure private funding, and then -pure GVC funding. They also found that there is a positive association between mixed funding and successful exits through IPOs. The positive effect of mixed funds on successful exits is due to the size of

funds because they do not have a significant effect on the same tests when they control the amount of investment.

Cumming (2007) analyzed 280 Australian venture capital and private equity funds and their investments focusing on the Australian governmental fund program. He found that the governmental program had facilitated investment in start-ups and early stage firms as well as value-added consultancy to the invested companies. He suggested that governmental hybrid funds foster the development of the Australian venture economy. However, exit performance cannot be measured given that most of the investments have not been exited. Jaaskelainen *et al.* (2012) examined current hybrid funds' profit distribution and compensation structure. They suggested that current structures can only resolve relatively modest market failures; thus, they need several modifications in order to attract highly competent investors who are willing to invest in failure market. Murray *et al.* (2012) also analyzed characteristics of Hybrid funds, notably in the USA, the UK, and Australia. Overall, the evaluation of the performance of funds is at least similar to the average industry returns of each country for the last decade. Cumming *et al.* (2014) reported that hybrid funds in EU countries have good IPO exits compared to pure governmental funds or pure private VCs, because of an effective compensation structure.

3. Structure of hybrid funds in Korea

The Korean government also anticipated the issue that private VCs are mostly interested in businesses where the risks and uncertainties are less extreme. As a result, the government is needed to play an important role in this high-risk and high-growth market as an alternative investor. Therefore, the Korea fund of funds (KFoFs) was created in the early 2000s as one of the governmental solutions in order to support early stage venture firms in financial crisis and the IT bubble burst. Along with the objective

of achieving balanced economic development through helping venture companies, in which private investors are not very interested, and creating more sustainable jobs, KFoFs were established based on the Special Measures for the Promotion of Venture Businesses Act of 1997. In order to set up the funds, eight different governmental ministries and agencies provided the capital to a designated governmental agency called Korea Venture Investment Corp (KVIC) in the year 2005.

As the only government vehicle to support small businesses in Korea, KFoFs' main target areas are small firms in industries of entertainment, broadcasting, healthcare, and IP/Patents. In order to focus on target industries, eight different government ministries and agencies participated as LPs in separate accounts in order to maintain independence. KFoFs are managed by KVIC with the LP's guidelines. The total KFoFs' fund size is two trillion won (about 1.7 billion US dollars) as of May 2015. Also, it will not distribute the dividends but will reinvest to other partner funds until the year 2035 when the fund is retired.

Figure 1 The Flow of KFoFs

Government Budget		Korea Funds of Funds (KFoFs)		Partnership Funds (PFs)		Investments
Eight Ministries and Government Agencies (LPs)	→	KVIC	→	Venture Capitalists (GPs)	→	Venture Firms

↗

Venture Capitals
Regular Venture investors (LPs)
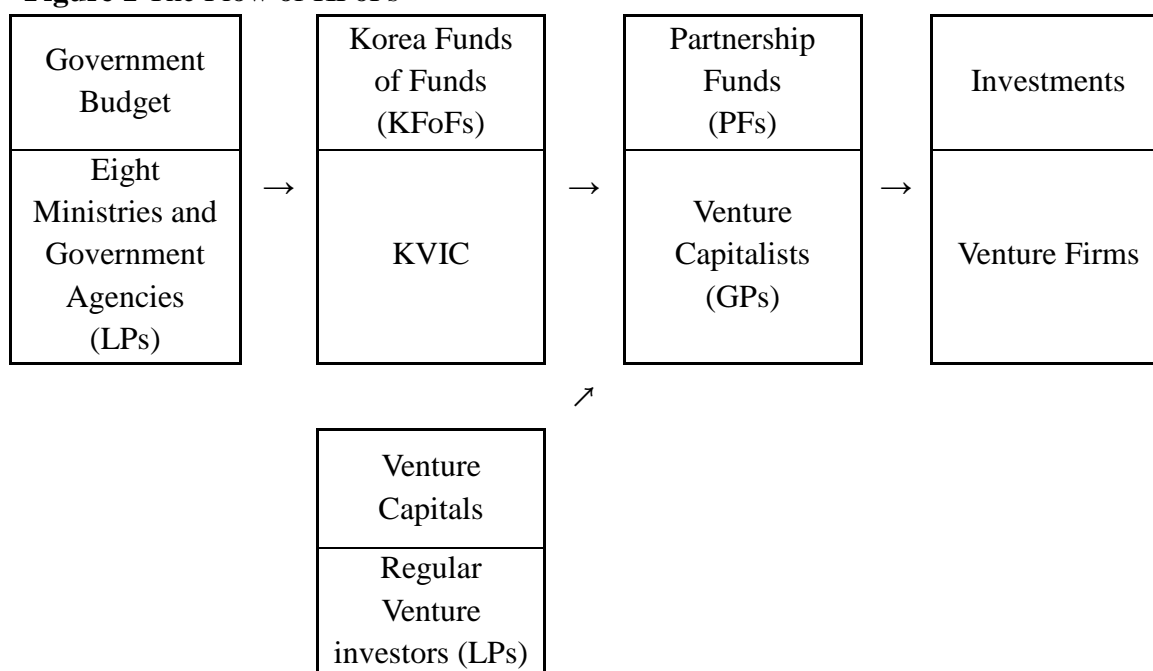
Table 1

Status of KFoFs and Partnership Funds (PF) Investments

Category		Ventures	Angels	Cultures	IP	Movies	Futures	Healthcare	Urban	Tourism	Sports	Extras	Total ('15.12)
Partnership Funds (PF) (in hundred million Korean won)	Total PF Amounts	76,386	1,911	11,134	7,822	886	912	1081	166	44	109	117	100,568
	KFoFs Amounts	17,578	1,762	4,629	2,308	476	417	199	75	26	55	42	27,567
Partnership Funds Investment (in hundred million Korean won)	No. of PF portfolio firms	4,130	295	1,824	522	181	75	24	9	3	6	-	7,069
	Total PF Investment Amounts	65,628	469	15,614	6,916	1,244	590	1,025	69	43	73	-	91,671

Table 2

Status of Partnership Funds (PF) Establishment

Year	~'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	Total
No. of PF application (A)	66	64	75	62	114	95	75	78	86	123	142	980
No. of PF permitted	26	30	37	30	54	41	38	35	61	52	81	485
No. of PF established (B)	24	26	32	26	48	37	34	30	57	50	69	418
Ratios (B/A)	36%	41%	43%	42%	42%	39%	45%	38%	66%	41%	49%	43%
Amounts of PF applied (A) (in hundred million Korean won)	4,450	4,496	7,044	4,766	12,568	8,740	7,247	9,879	9,256	13,553	14,061	96,060
Amounts of PF permitted (in hundred million Korean won)	1,946	2,024	2,696	2,002	4,201	2,449	2,928	3,409	6,524	5,086	6,493	40,252
Amounts of PF invested actually (B) (in hundred million Korean won)	1,831	1,494	2,476	1,730	3,751	2,130	2,528	2,691	5,494	4,891	5,517	34,007
Ratios (B/A)	41%	33%	35%	36%	30%	24%	35%	27%	59%	36%	39%	35%

Figure 1 shows the operation structure of KFoFs. Essentially the figure shows the flows to and from the participating parties in a hybrid VC program including the recipients of the risk capital incentivized by the program. The government uses a range of structures, which has the effect of leveraging the consequent investment returns preferentially to the partnership fund.

Table 1 shows the status of KFoFs and partnership funds investments. There are ten categories of KFoFs that are invested: ventures, angels, cultures, intellectual property (IP), movies, futures, healthcare, urban, tourism, and sports. KFoFs have invested a total amount of 27,567 hundred million Korean won in partnership funds whose total amount is 100,568 hundred million Korean won as of December 2015. Furthermore, a total of 91,671 hundred million Korean won is invested in 7,069 firms. Table 2 shows the status of partnership establishment. Overall, 43% of filed applications for partnership funds are permitted and 35% of applications for partnership funds are actually invested since the establishment of KFoFs.

4. Hypotheses

Megginson and Weiss (1991) argued that VCs increase certification role by incorporating reputable auditors and underwriters in order to decrease information asymmetry; thus, they reduce IPO underpricing. Two implications pertaining to the certification roles of KFoFs are that the level of underpricing and the compensation of underwriters will be less for more prestigious capitalists. If KFoFs are able to reduce the asymmetric information around stakeholders of issuing firms, the level of rewards to the participants for bearing risks of having incredible information will be lowered. If the KFoFs do not provide certification to the levels of the information asymmetry, the initial returns and spreads for KFoFs backed firms should be lower than for other cases.

In particular, governmental hybrid funds do not have to attract market participants to the IPOs through sacrificing their investment profits because of the following reasons. First, the government may improve the screening process by obtaining many experts' opinions in order to mitigate the risks of funds. Second, they may reduce information asymmetry between insiders and investors through various governmental resources, networks, and industry expertise, so that they can signal to outsiders that their portfolios are desirable investments (Cumming *et al.*, 2014).

Consequently, we hypothesize that the non-sponsored IPOs will have the greatest underpricing due to the information asymmetry between insiders and outside market participants. We also hypothesize that VC-backed IPOs will show bigger underpricing compared to hybrid fund-backed ones due to the greater certification from government resources. Similarly, we hypothesize that the dual sponsorship of private VCs and government funds will show the least underpricing since the involvement of diverse VCs may improve decision making and thereby mitigate adverse selection problems.

H1. KFoFs' involvement in the IPO market will reduce the degree of underpricing.

In addition to H1, we expect that the more KFoFs are involved, the more of their resources (*i.e.*, diverse knowledge and experience) will be used in order to enhance the venture firm's performance. Therefore, we hypothesize that the number of KFoFs will have a negative impact on IPO underpricing.

H2-1. The number of KFoFs will be negatively related to the degree of IPO underpricing.

Many prior studies have shown that the shares held by VCs send an important signal to the IPO market. Filatotchev and Bishop (2002) provided empirical evidence showing

13

that share ownership interests of non-executive directors are positively associated with IPO underpricing in the U.K due to reduced information asymmetry. Therefore, we hypothesize that the share ownership of KFoFs is negatively related to the degree of IPO underpricing.

H2-2. The share ownership of KFoFs will be negatively related to the degree of IPO underpricing.

Megginson and Weiss (1991) attributed IPO underpricing to the certification role of VCs in IPOs. In comparison with no sponsorships on IPOs, VC-backed IPOs show significantly lower initial returns and gross spreads. They argued that the presence of VCs in the issuing firms lower the total costs of IPOs due to the certification role of VC participation. They also reported that the participation of prestigious VCs reduces underpricing, underwriter spread, and the costs of legal, auditor, and other related expenses. Along with the certification role of prestigious VCs, we hypothesize that the market will believe that the participation of the government reduces the information asymmetry associated with initial offerings. Also, IPO underpricing is one of the most risk bearings for underwriters due to the asymmetric information hypothesis. Underwriters' risks are derived from their fees from spreads, which has fixed fees and variable fees. The fixed parts are usually related with the offering size, and the variable parts are associated with volatility of the new issue. In other words, underwriters are subject to have loss if the IPOs are unsuccessful. Therefore, underwriter spreads are combination of fixed fees and rewards from the risk bearings. In terms of assessing the risks of IPOs with KFoFs, we presumably underwriters consider the offerings have reduced information asymmetry due to the monitoring from governments and venture capitalists. Thus, VCs and KFoFs should reduce underpricing and underwriter spread, because the compensation to stakeholders including underwriters will be lowered if KFoFs can convey credible information to the market during the initial offerings. We hypothesize that the dual sponsorship on IPOs with the interaction of spread should reduce IPO underpricing.

H3. The interaction of private VCs and KFoFs in dual sponsorships and underwriter spread are negatively related to the degree of lPO underpricing.

5. Empirical Models and data

5.1 Empirical models

IPO underpricing is defined as the difference between the closing price on the first day of trading and the IPO offer price (Ritter and Welch, 2002)

$$Underpricing_{i,t} = \frac{S_{i,t} - S_{i,o}}{S_{i,o}},$$

$S_{i,o}$: IPO offer price, $S_{i,t}$: the closing price on the first day of trading

In order to compare the difference in IPO underpricing among different types of sponsorships, we constructed the following regression model.

For H1.

$UND = \alpha_0 + \alpha_1\, NVC\ (dummy) + \alpha_2\, KFOF\ (dummy) + \alpha_3\, VCKF\ (dummy) + \alpha_4\, Size + \alpha_5\, Lev + \alpha_6\, Roe + \alpha_7\, Age$ (1)

UND is the underpricing, which is defined as the difference between the closing price on the first day of trading and the IPO offer price. NVC is a dummy variable: if no VCs or KFoFs are involved, it takes the value of 1; otherwise, it is 0. KFOF is a dummy variable: if KFoFs are the only VCs involved, it takes the value of 1; otherwise, it is 0. VCKF is a dummy variable: if both private VCs and KFoFs are involved in an IPO, it takes the value of 1; otherwise, it is 0. Underpricing is measured by the difference

between the offering price and the first date closing price divided by the offering price. We include several control variables. Size is measured by the offering amount divided by total assets. Lev is measured by asset/liability ratio just prior to the listing. Roe is the return on equity. Age is the firms' age in months measured by the difference between founding dates and IPO dates.

We use the following equations (2) through (4) for H2.

For H2-1.

$$UND = \alpha_0 + \alpha_1\, KFN \tag{2}$$

$$UND = \alpha_0 + \alpha_1\, KFN + \alpha_2\, Size + \alpha_3\, Lev + \alpha_4\, Roe + \alpha_5\, Age \tag{3}$$

UND is the underpricing, which is defined as the difference between the closing price on the first day of trading and the IPO offer price. KFN is the number of all KFoFs involved in IPOs.

For H2-2.

$$UND = \alpha_0 + \alpha_1\, VCOS + \alpha_2\, KFOS + \alpha_3\, VCKFS + \alpha_4\, Size + \alpha_5\, Lev + \alpha_6\, Roe + \alpha_7\, Age \tag{4}$$

Equation 4 tests the impact of ownership structure on IPO underpricing. UND is the underpricing, which is defined as the difference between the closing price on the first day of trading and the IPO offer price. VCOS is the ownership percentage of private VCs. KFOS is the ownership percentage of KFoFs. VCKFS is the sum of ownership percentages of both VCs and KFoFs.

For H3.

16

$$UND = \alpha_0 + \alpha_1\,SPR \tag{5}$$

$$UND = \alpha_0 + \alpha_1\,SPR + \alpha_2\,SPR \times VCKF\,(dummy) \tag{6}$$

$$UND = \alpha_0 + \alpha_1\,SPR + \alpha_2\,SPR \times VCKF\,(dummy) + \alpha_3\,Lev + \alpha_4\,Roe + \alpha_5\,Age \tag{7}$$

We use equations (5) through (7) for H3. UND is the underpricing, which is defined as the difference between the closing price on the first day of trading and the IPO offer price. SPR is the underwriter spread. SPR × VCKF is the interaction variable of underwriter spread and dual sponsorship. VCKF is a dummy variable; if both private VCs and KFoFs are involved in an IPO, it takes the value of 1; otherwise, it is 0.

5.2 DATA

Our sample consisted of 300 newly listed Korean firms that made their issue of common equity shares to the public on the Korea Securities Dealers Automated Quotation (KOSDAQ) from 2009 to 2014. We manually collected the shareholders' information from each firm's IPO report, which was available in the database of Korean Financial Supervisory Service. Each participating private VC's information was retrieved from the database of the Korean Venture Capital Association. The information on KFoFs was collected from the database of Korean Venture Investment Corporation. The corresponding financial information was obtained from the KIS Value database and FN guide. The final sample included 278 offerings after subtractions of IPO companies in the financial and insurance industry and previously listed IPOs in KOSDAQ. Table 3 summarizes the sample selection for 278 IPOs during the period from 2009 to 2014.

Table 3
Sample Selection

Sample Selection Criteria	Number of Firms
Total IPOs listed in KOSDAQ during 2009-2014	300
- Firms in financial and insurance industry	14
- Firms listed on the KOSDAQ previously	8
= Final Sample	278

Table 4
Number of Newly Listed IPOs on the KOSDAQ during the period of 2009-2014*

Country	2009	2010	2011	2012	2013	2014	Total
Total number of IPOs	52	62	59	21	36	48	278
The number of IPOs backed by VC only	15	16	10	3	6	18	68
The number of IPOs backed by KFoFs single sponsorship (No VC)	2	3	9	6	3	3	26
The number of IPOs backed by both VC and KFoFs	9	4	9	2	5	5	34
The number of IPOs backed by neither VC nor KFoFs	25	37	28	10	35	20	142

*There are eight IPOs, which did not identify investors' information.

Table 5
Industries of IPO firms

Industry	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Manufacturing(C)	199	71.58	199	71.58
Utility(D)	1	0.36	200	71.94
Construction(F)	1	0.36	201	72.30
Retailing(G)	5	1.80	206	74.10
Information(J)	49	17.63	255	91.73

Science and Technology(M)	21	7.55	276	99.28
Business Facilities Management(N)	1	0.36	277	99.64
Arts and Sports(R)	1	0.36	278	100.00

Table 4 shows that there were 278 IPOs in KOSDAQ from 2009 to 2014. During the sample period, the total number of IPOs backed by KFoFs was 60 including 26 IPOs exclusively sponsored by KFoFs. The number of IPOs was significantly decreased in the year 2012 reflecting the aftermath of the global economic crisis; however, the number of IPOs exclusively sponsored by KFoFs increased compared to the other type of IPO sponsorship. Table 5 shows the industries of newly listed firms during the sample period. More than 71 percent of all 278 IPOs were for manufacturing companies.

Table 6 shows the descriptive statistics by VC type. It shows that the mean underpricing was 35.9 percent with a maximum of 165 percent and a minimum of negative 23%. Compared to the mean underpricing percentage of all IPOs during the sample period, we have the mean underpricing percentage of sub-grouped IPOs. Sample statistics in Panel B compares the underpricing percentages among NVC, VCO, KFO, and VCKF. Consistent with the findings of previous studies that market recognizes the most reputable shareholders with the least underpricing, VCKF backed IPOs have the least underpricing because the dual sponsorships have the most reputation. It shows that the VCs only group had significantly more underpricing than other IPO groups. For the VC only group, the average underpricing was 48.8 percent. The mean underpricing was 42.6 percent for KFoFs-exclusive IPOs and 32.7 percent for dual sponsorship IPOs. The average underpricing of no sponsorship IPOs was 32.9 percent.

Table 7 presents the correlation matrix of variables used in this study.

Table 6
Descriptive Statistics partitioned by VC status.

Panel A. Key variables					
Variable	N	Mean (t value)	Standard Deviation	Minimum	Maximum
UND (%)	278	0.3590 (12.54***)	0.4624	-0.23	1.6468
VCO (numbers)	68	0.2527 (9.52***)	0.4354	0	1
KFOF (numbers)	26	0.0966 (5.35***)	0.2960	0	1
VCKF (numbers)	34	0.1263 (6.23***)	0.3329	0	1
NVC (numbers)	142	0.5278 (17.31***)	0.5001	0	1
VCON (numbers)	68	0.4089 (8.03***)	0.8353	0	5
KFN (numbers)	26	0.1449 (4.55***)	0.5231	0	5
VCKFN (numbers)	34	0.9330 (11.02***)	1.3886	0	10
NVCN (numbers)	142	3.1037 (29.33***)	1.7385	0	15
VCOS (%)	68	5.7604 (5.84***)	16.1754	0	100
KFOS (%)	26	1.2098 (4.56***)	4.3500	0	35
VCKFS (%)	34	9.1521 (9.34***)	16.0712	0	96
NVCS (%)	142	62.7787 (42.24***)	24.4196	0	100

SIZE (%)	278	0.5173 (12.52***)	0.6413	0	5.01907
LEV (%)	278	106.7618 (9.48***)	175.3988	5.31	2550.63
ROE (%)	278	17.6473 (16.32***)	16.8258	-68.52	142.3500
AGE (in month)	278	140.082 (18.17***)	12.8569	1.0	629

Panel B. Key variables based on VC affiliations

VC affiliations	Mean (t value)			
	VCO	KFO	VCKF	NVC
UND (%)	0.4877 (6.92***)	0.4264 (4.59***)	0.3270 (3.94***)	0.3287 (8.62***)
SIZE (%)	0.4535 (8.24***)	0.5273 (7.85***)	0.5033 (3.99***)	0.5535 (8.27***)
LEV (%)	73.8483 (9.87***)	185.7137 (2.02***)	117.6700 (6.94***)	100.4259 (14.79***)
ROE (%)	19.0605 (14.60***)	24.0974 (5.48***)	15.2977 (5.21***)	16.3308 (10.32***)
AGE (in month)	140.8939 (6.15***)	119.2222 (12.22***)	125.8709 (8.64***)	153.1468 (16.03***)

This table reports the descriptive statistics for the sample of IPO underpricing backed by VCs only, KFoFs single sponsorship, and VCs and KFoFs dual sponsorship regarding whether one is invested, what numbers of them are invested, and what percentage of shares they acquire. *** indicates significance at the 1% level, respectively.

Table 7

Pearson Correlation Coefficients

	UND	NVC	VCKF	KFN	VCKFS	SIZE	LEV	ROE	AGE
UND	1								
NVC	-0.05491	1							
	0.3770								
VCKF	-0.04889	-0.40221	1						
	0.4315	<.0001***							
KFN	-0.00505	-0.56234	0.70551	1					
	0.9353	<.0001***	<.0001***						
VCKFS	0.00159	-0.93062	0.45619	0.56526	1				
	0.9796	<.0001***	<.0001***	<.0001***					
SIZE	-0.23526	0.01927	-0.07744	0.01801	-0.0317	1			
	0.0003***	0.7665	0.2320	0.7814	0.6251				
LEV	-0.05983	0.0719	0.10503	0.08156	-0.0454	-0.22593	1		
	0.3643	0.2672	0.1046	0.2080	0.4839	0.0004***			
ROE	-0.03194	-0.13971	-0.06968	0.05688	0.12609	0.45143	-0.37272	1	
	0.6284	0.0305**	0.2823	0.3803	0.0511*	<.0001***	<.0001***		
AGE	0.18029	0.13786	-0.05821	-0.07937	-0.18403	-0.17986	0.01397	-0.17183	1
	0.0035***	0.0237**	0.3416	0.1944	0.0024***	0.0051***	0.8288	0.0074***	

This table reports the Pearson Correlation Coefficients of all variables used in the research. ***, **, * indicate significance at 1%, 5%, and 10% levels, respectively.

6. Empirical results

Sample statistics in Table 6 show that VCO (IPOs exclusively sponsored by VCs) had significantly more underpricing than other type of IPOs. To examine the certification role of VCKF and KFOF, underpricing of the initial offerings are regressed against whether the issue is VC or KFOF backed. The dummy equals one if an issue is backed by each capitalists, zero otherwise. Table 8 shows that both KFOF and VCKF had significantly negative coefficients. The standard deviation of the underpricing of IPOs with KFoF and VCKF are significant at the five percent level and carry the expected negative signs. In particular, VCKF, the dual sponsorship of VCs and KFoFs had the lowest underpricing. It is also interesting to see that the IPO group with no sponsorship showed a lower IPO underpricing than the IPO group with VC only sponsorship. Our results are consistent with the findings of Lee and Wahal (2004) who argued that VC has a motivation for providing a lower offering price to attract more investors. Lee and Wahal (2004) found that VC-backed IPOs show higher underpricing than IPOs without any VCs. Overall results support H1. KFoFs' involvement in the IPO market is more likely to reduce the degree of underpricing by reducing the information asymmetry regarding the future prospects of the firm. Empirical results in this study provide evidence to support the certification role of prestigious VCs to participants in the IPO market (Megginson and Weiss, 1991).

Table 8
Regression Analysis of IPO underpricing for KFoFs single sponsorship, and VCs and KFoFs dual sponsorship compared to VCs single sponsorship

Variables	Model
Intercept	0.62535^{***} (<.0001)
NVC(dummy)	**- 0.15622**** **(0.0485)**
KFOF(dummy)	**- 0.05177** **(0.6479)**
VCKF(dummy)	**- 0.21111**** **(0.0445)**
SIZE (%)	0.00005

	(0.8680)
LEV (%)	- 0.11562**
	(0.0198)
ROE (%)	- 0.00023
	(0.1977)
AGE	- 0.00205
	(0.2942)

For hypothesis 1, this table reports the result of IPO underpricing difference between KFoFs single sponsorship, and VCs and KFoFs at the same time, compared to VCs only. NVC is a dummy variable: if there are no VCs and KFoFs involved, it takes the value of 1; otherwise, it is 0. KFOF is a dummy variable: if KFoFs are the only VCs involved the IPOs, it takes the value of 1; otherwise, it is 0. VCKF is a dummy variable: if both private VCs and KFoFs are involved in the IPO, it takes the value of 1; otherwise, it is 0. Underpricing is measured by the difference between the offering price and the first date closing price divided by the offering price. We include several control variables. Size is measured by the offering amount divided by total assets. Lev is measured by asset/liability ratio just prior to the listing. Roe is the return on equity. Age is the firms' age in months measured by the difference between founding dates and IPO dates. ***, **, * indicate significance at 1%, 5%, and 10% levels, respectively.

Table 9

Regression Analysis of IPO underpricing for the number of firms in KFoFs involved in IPOs.

Variables	Model 1	Model 2
Intercept	0.35979***	0.51694***
	(0.0001)	(0.0001)
KFN	- 0.00213	- 0.01500
	(0.9544)	(0.6988)
SIZE (%)		- 0.12567**
		(0.0116)
LEV (%)		- 0.00022
		(0.2010)
ROE (%)		- 0.00148
		(0.4454)
AGE		- 0.00001
		(0.9929)

For hypothesis 2-1, Table 9 reports the results of the difference in IPO underpricing between numbers involved by KFoFs. KFN is the number of all KFoFs involved in IPOs. Underpricing is measured by the difference between the offering price and the first date closing price divided by the offering price. We include several control variables. Size is measured by the offering amount divided by total assets. Lev is measured by asset/liability ratio just prior to the listing. Roe is the return on equity. Age is the firms' age in months measured by the difference between founding dates and IPO dates. ***, **, * indicate significance at 1%, 5%, and 10% levels, respectively. Panel B shows how many firms are included in each number of KFoFs that is involved in the IPOs, whether they are co-sponsored with regular VCs or not. There are eight missing variables, which are due to lack of shareholder information.

Table 10

Regression Analysis of IPO underpricing with different shares percentages of VCs single sponsorship, KFoFs single sponsorship, and VCs and KFoFs dual sponsorship.

Variables	Model
Intercept	0.53151^{***} (0.0007)
VCOS	**0.00760** **(0.1434)**
KFOS	**0.00939** **(0.2392)**
VCKFS	**- 0.00840*** **(0.0872)**
SIZE (%)	- 0.15124 (0.1139)
LEV (%)	- 0.00027 (0.1581)
ROE (%)	- 0.00312 (0.3114)
AGE	0.00089 (0.1134)

For hypothesis 2-2, this table reports the results of IPO underpricing difference between shares percentages involved by VCs only, KFoFs single sponsorship, and VCs and KFoFs at the same time. VCOS is the ownership percentages of private VCs. KFOS is the ownership percentages of KFoFs. VCKFS is the sum of ownership percentages of both VCs and KFoFs. Underpricing is measured by the difference between the offering price and the first date closing price divided by the offering price. We include several control variables. Size is measured by the offering amount divided by total assets. Lev is measured by asset/liability ratio just prior to the listing. Roe is the return on equity. Age is the firms' age in months measured by the difference between founding dates and IPO dates. ***, **, * indicate significance at 1%, 5%, and 10% levels, respectively.

We also examined the impact of the number and the shares percentages of KFoFs on IPO underpricing. Table 9 shows that there is no significant relationship between the number of KFoFs and IPO underpricing. The result does not support H2-1. Table 10 examines the relationship between underpricing and KFoFs ownership. In Table 10, we divide all ownership percentages of sponsored IPO firms into three categories: VCs only shares, KFoFs single sponsorship shares, and dual VCs and KFoFs shares. Consistent with the certification hypothesis, as indicated by the results in the table 10, the relationship between dual sponsorships and underpricing is negative. The expected

negative relationship is only significant for the ownership structure of VCs and KFoFs dual-sponsored group. The H2-2 is only consistent with the result for IPO group with dual sponsorship, and not with KFoFs alone. It confirms Cumming et al (2014) that mixed syndicates of VCs and GVC give the most successful exits than that of VC backing.

Table 11 examines the KFoFs' role by analyzing the effect of KFoFs' spread on the degree of underpricing. Chen and Mohan (2002) argued that underwriter spread can explain the IPO underpricing because the spread variable reflects the uncertainty of the IPO. In an IPO there are two ways to measure the issuing equity's risks: underwriter spread and underpricing. Underwriter spread is the underwriters' revenue from managing an IPO, containing information on risk compensation. Since the spread is an underwriter's assessment of riskiness of IPOs, the spread is expected to be positively correlated with underpricing. Table 11 shows that the coefficient of spread is significantly positive, implying that spread plays the role of risk premium in the IPO. Also, reputation can serve as an effective measures to guarantee the quality of the offerings. Outside investors inluding underwriters are willing to pay a premium for the certification provided by the issuing firms. If the presence of VCKF provide credible information about the offerings to the market, the compensation to investors and underwriters will be lower for issues with VCKF than others. Besides, the reputation of VCKF in the IPO process help their invested companies choose underwriters that can reduce the spread costs. Therefore, the level of underwriting spread should be lower for VCKF backed IPOs. Also the presence of VCKF may provide a complement to underwriter for reducing IPO uncertainty because VCKF has the most reputation to the market.

Table 11

Regression Analysis of IPO underpricing for the interaction of underwriter spread and dual sponsorship

Variables	Model 1	Model 2	Model 3
Intercept	0.12018[**] (0.0470)	0.07959 (0.4258)	0.01147 (0.9539)

	5.43918***	8.01433***	7.44385***
SPR	(<0.0001)	(0.0001)	(0.0006)
SPR x VCKF(dummy)		- 3.54370*	- 4.23087**
		(0.0711)	(0.0499)
LEV (%)			- 0.00016
			(0.8195)
ROE (%)			0.00019
			(0.9631)
AGE			0.00121**
			(0.0300)

For hypothesis 3, this table reports the results of IPO underpricing and underwriter spread. SPR is the underwriter spread. SPR × VCKF is the interaction variable of underwriter spread and dual sponsorship. VCKF is a dummy variable: if both private VCs and KFoFs are involved in the IPO, it takes the value of 1: otherwise, it is 0. Underpricing is measured by the difference between the offering price and the first date closing price divided by the offering price. We include several control variables. Lev is measured by asset/liability ratio just prior to the listing. Roe is the return on equity. Age is the firms' age in months measured by the difference between founding dates and IPO dates. ***, **, * indicate significance at 1%, 5%, and 10% levels, respectively.

In the table, underwriter spread and the interaction term of spread and VCKF are all statistically significant at the conventional level. Initial underpricing is found to be positively impacted by underwriter spread, which reveals a complementary relation as Chen et al. (2002) argued. More interestingly, the significantly negative coefficient of interaction term suggests that dual sponsorship of VC and KFoF can reduce the effect of spread on IPO underpricing. Our results confirm the findings of Timothy (1996) that the magnitude of underwriting spread is lower for the prestigious VC-backed IPOs, because of the certification role provided by the reputable VCs. The participation of KFoFs gives a certification effect to the market so that it can lower the impact of spread on the degree of underpricing. Our result is consistent with hypothesis 3.

7. Conclusion

IPO underpricing has been a subject of great interest to many researchers. It has been suggested that IPOs are generally underpriced due to the concerns of information asymmetry and future value uncertainty. Previous studies report that prestigious venture capitalists have certification roles which reduce information asymmetry between

insiders and outsiders. We investigate whether the involvement of the government in the IPO market can reduce the degree of underpricing by providing this certification role.

More specifically, we examined whether government involvement in the IPO market produces a unique signal to the capital market. To the best of the authors' knowledge, this is the first attempt to investigate the relationship between government involvement and the degree of IPO underpricing. Empirical evidence in this paper shows that government sponsorship reduces the degree of underpricing in the IPO market. In particular, we find that the dual sponsorship of government and private VCs send the most credible signal to the market in Korea with respect to the value of the firm. We also find that dual sponsorships can reduce the effect of spread on underpricing.

Government-backed IPOs have been ignored by mainstream academic researchers. The present study contributes to the IPO literature, especially for emerging economies, by filling the gap mentioned above.

References

Ayayi, A. (2004). Public Policy and Venture Capital: The Canadian Labor-Sponsored Venture Capital Funds. *Journal of Small Business Management* 42 (3):335-345.

Barry, C. B., C. J. Muscarella, and J. W. Peavy. (1990). Evidence from the going-public process. *Journal of Financial Economics 27* (2):447-471.

Brander, J. A., D. Qianqian, and H. Thomas. (2015). The Effects of Government-Sponsored Venture Capital: International Evidence. *Review of Finance 19* (2):571-618.

Chen, C. R., and N. J. Mohan. (2002). Underwriter spread, underwriter reputation, and IPO underpricing: A simultaneous Equation Analysis. *Journal of Business Finance & Accounting* 29 (3-4):521-540.

Cohen, D. A., and N. S. Langberg. (2008). Venture Capital Financing and the Informativeness of Earnings. *Asia-Pacific Jorunal of Accounting & Economics* 16 (2):171-189.

Croce, A., J. Marti, and S. Murtinu. (2013, July). The impact of venture capital on the productivity growth of European entrepreneurial firms: 'Screening' or 'value added' effect?. *Journal of Business Venturing* 28 (4):489-510.

Cumming, D. (2007). Government policy towards entrepreneurial finance: Innovation investment funds. *Journal of Business Venturing*, 193-235.

Cumming, D., L. Grilli, and S. Murtinu. (2014). Governmental and independent venture capital investments in Europe: A firm-level performance analysis. *Journal of Corporate Financ,* 1-21.

Filatotchev, I., and K. Bishop. (2002). Board composition, share ownership, and 'underpricing' of U.K. IPO firms. *Strategic Management Journal* 23 (1):941-955.

Gompers, P. A. (1995). Optimal Investment, Monitoring, and Performance of Venture Capital. *Journal of Finance* 50 (5):1461-1489.

Gompers, P. A. (1996). Grandstanding in the venture capital industry. *Journal of Financial Economics* 42 (1):133-156.

Jaaskelainen, M., M. Maula, and G. Murray. (2012). Profit distribution and compensation structures in publicly and privately funded hybrid venture capital funds. *Research Policy* 36 (7):913-929.

Jeng, L. A., and P. C. Wells. (2000). The determinants of venture capital funding: evidence across countries. *Journal of Corporate Finance* 6 (3):241-289.

Kim, J. B., I. Krinsky, and J. Lee. (1995). The aftermarket performance of initial public offerings in Korea. *Pacific-Basin Finance Journal 3* (4):429-448.

Lee, P. M., and S. Wahal, (2004). Grandstanding, certification and the underpricing of venture capital backed IPOs. *Journal of Financial Economics* 73 (2):375-407.

Lee, P. M., T. G. Pollock, and K. Jin. (2011). The contingent value of venture capitalist reputation. *Strategic Organization, 9* (1):33-69.

Leleux, B., and B. Surlemont. (2003). Public versus private venture capital: seeding or crowding out? A pan-European analysis. *Journal of Business Venturing,* 18 (1):81-104.

Lin, T. H. (1996). The certification role of large block shareholders in initial public offerings: The case of venture capitalists. *Quarterly Journal of Business and Economics*, 55-65.

Loughran, T., J. R. Ritter, and K. Rydqvist. (1994). Initial public offerings: International insights. *Pacific-Basin Finance Journal* 3 (1):165-199.

Megginson, W. L., and K. A. Weiss. (1991). Venture Capitalist Certification in Initial Public Offerings. *Journal of Finance* 46 (3):861-878.

Murray, G, M. Cowling, W, Liu, and O. Kalinowska-Beszczynska. (2012). Government co-financed 'Hybrid' Venture Capital programmes: generalizing developed economy experience and its relevance to emerging nations. *Kauffman International Research and Policy Roundtable, Liverpool*:1-29

OECD. (1997). Government Venture Capital forTechnology-Based Firms. *OCDE/GD*, 201.

Ritter, J.R. (2003). Investment banking and securities issuance. Handbook of the Economics of Finance 1:255-306.

Rock, K. (1986). Why new issues are underpriced. *Journal of Financial Economics* 15 (1-2): 187-212.

WFE. (2008). *Annual Report.* World Federation of Exchanges.