

# **The Effect of Government Hybrid Funds on IPO Underpricing: Evidence from Venture-Backed Initial Public Offerings in Korea**

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## **Abstract**

An IPO underpricing has been a subject of great interest from researchers. Previous studies have focused on the underpricing of private venture capital backed IPOs. There is a significant gap in the literature as underpricing in government-backed IPOs has been largely ignored by the mainstream academic research. We investigate how Korea Fund of Funds (KFoFs), which are government hybrid funds, influence the IPO underpricing. For this purpose, we analyze the price behavior of newly listed firms on KOSDAQ during the period of 2009 through 2014. Empirical evidence shows that KFoFs sponsorship reduces the degree of asymmetric information in IPO market. In addition, dual sponsorship of KFoFs and private VCs is found to have the most negative impact on the degree of IPO underpricing.

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## 1. Introduction

IPO underpricing has been a subject of great interest from many researchers. Previous studies have focused on the underpricing of private venture capital backed IPOs. There is a significant gap in the literature as underpricing in government-backed IPOs has been largely ignored by the mainstream academic research. Cotei and Farhat (2011) state that IPO company association with specific venture type signals unique information to the capital markets. In this paper, we investigate whether the government sponsorship in IPO market produces a unique type of signal to the capital market. For this purpose, we examine underpricing of IPOs and compare government-backed IPOs with non-government backed IPOs in the Korean equity markets. Investigation of the Korean government's role in IPO market can contribute to the existing research and further enhance our understanding of IPO underpricing. Korean capital market is structurally different from the other industrialized capital markets in several perspectives. Some of the differences are government regulations including daily price limits, and, rather than small and young firms, relatively large and well-established firms going public (Kim et al., 1995). Such characteristics of Korean IPO market offers an interesting research setting to examine the effect of Korea Fund of Funds(KFoFs) on 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 Korea. With the raised concerns for the insufficient private investment into the venture economies, several governments have set up hybrid venture capital funds to increase venture capital investments in early stage SMEs.<sup>1</sup> The initiation of government hybrid funds was in the United States with the 'Small Business Investment Companies' program by Small Business Administration in 1958. SBA involves significantly as a special limited partner (LP)

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

or a public guarantor for the portion of total funds raised and invested. Similar programs were adopted in many other countries including the United Kingdoms, Canada, and South Korea. In Korea, the government has started hybrid funds program, called “The Korea Funds of Funds (KFoFs)” in 2005. KFoFs were based on the Special Measures for the Promotion of 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 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 of 2035.

Korean government contemplated an 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 which private investors have less participation.

There are two different types of government funds to be invested in the venture firms; pure governmental VC funds (GVC) and government-private partnership funds. Because of the several operational limitations of pure GVC, the latter shows a better financial performance relatively. First, GVCs are created by political agenda or regulations, not by negotiations among partners. Second, GVCs have less efficient compensation terms regarding fixed management fees and a profit bonus. Third, GVCs lack of independence in investment decisions due to the political pressure, non-financial related governmental goals, or pressure to invest in marginal quality projects. In this regard, Cumming, Grilli, and Murtinu (2014) suggest that GVC-private syndicated relations may enhance performance and overcome the limitations of GVCs.

So far, no consensus has been reached on the impact of the government hybrid funds in IPO market. One perspective is that the involvement of the government in the ventures may require more attractive rewards in order to justify its participation since the government has decided to make the investment to the specific firms or industries with a perceived private equity market failure (Maula and Murray, 2003). In order to compensate other investors for the participation, policy makers sometimes design and use the profit distribution and compensation structures in order to reward private sector investors and professional managers for participating in these firms (Jaaskelainen, 2007). In this case, we expect that the government-backed IPOs have bigger underpricing in order to have successful IPOs.

On the other hand, it can be argued that syndicate funds may have better performance which, in turn, reduces underpricing. At first, unlike VCs only backed IPOs, governmental hybrid funds are reputed to be beneficial because it may improve the screening process by obtaining others' opinions (Gompers and Lerner, 2004). Second, they may reduce information asymmetry between insiders and investors through the 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, Grilli, and Murtinu, 2014). This gives government's certification role so hybrid funds may not have much IPO underpricing in order to attract or reward private investors. Megginson and Wiess (1991) conclude that VCs increase certification role by incorporating reputable auditors and underwriters in order to decrease information asymmetry. Therefore, we expect governmental funds' certification role is greater than regular VCs because VCs have a greater motivation of better exit than governments. In this paper, we expect that underpricing of non-sponsored IPOs are the greatest, VCs backed IPOs comes next, and governmental hybrid funds backed IPOs comes at last. In addition, we expect that the dual sponsorship of private VCs and government funds shows the least underpricing since the involvement of diverse VCs may improve decision making and thereby mitigates adverse selection problems. Cumming, Grilli, and Murtinu (2014) argue that different capitalists with more diverse backgrounds and expertise can perform due diligence complementarily.

For the purpose of this study, we use a sample of 230 newly listed IPOs in Korean market during the period of 2009 through 2014.

The rest of the paper is organized as follows. Section 2 explains VCs role in IPOs, IPO underpricing and the government role in VC funds. Section 3 develops hypothesis. Section 4 reports empirical models that this research examines the data presented in section 5. Section 6 analyzes the result and section 7 concludes the paper.

## **2. Prior Literatures**

### **VCs' role in IPOs**

VCs provide capital to small companies raised from several institutions including pension funds, governments, insurance companies, and banks. Since they obtain annual management fee and percentage from the profits they make, VCs usually monitor the management of the portfolio companies to enhance their profitability. In order to properly influence the management of the portfolio companies, VCs negotiate complex rights with complex mechanisms at the time of their investment. Often VCs have the rights to replace senior management of the invested companies through participating on the board of directors (Hochberg 2012).

Gompers (1995) analyzed the VCs' investment structures with the sample of 794 samples of VC-backed firms. VCs usually invest in the firms in very early stage and in an advanced technology industry. 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 from 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 considers VCs have a certification role by reducing information asymmetry (Gompers 1995). Megginson and Wiess (1991) empirically concludes that VC-backed firms appoint reputable underwriters and outside auditors for IPOs in order to increase the certification roles.

Even after the IPO, as most VCs continue to hold their shares in the firms during the lock-up period, VCs' effects on firms' operating performance should reside within the firms which improves certification roles of VCs to other market participants (Jain and Kini 1995).

### **IPO Underpricing**

IPO underpricing is the basis of the excess returns on the first day on the market as proposed by Stoll and Curly (1970). Among the possible reasons that cause IPO underpricing, VCs impact on the invested firms is widely interested. Megginson and Weiss (1991) examined 320 VC-backed companies compared to 320 companies without VCs in the same industry. In the case of VC-backed companies, it takes 8.6 years to going public compared to the 12.2 years for the IPO without VCs. VC-backed IPOs shows 7.1% average excessive returns compared to the 11.9% averages for the IPOs without VCs. The differences confirm the certification roles of VCs; thus, VC-backed IPOs have less underpricing than non-VC-backed IPOs do. However, Lee and Wahal (2004) reported that VC-backed IPOs showed higher excess returns on the date of IPOs. That was due to the nature of VCs to increase their reputation through attracting stock investors with higher underpricing.

Regarding the government hybrid funds' financial impact on the portfolio companies especially on IPO underpricing, there is little evidence in the literature. Yet, Cumming et al. 2014 reports that governmental hybrid funds have greater exit profits than only regular VCs do due to the hybrid funds' compensation structure and efficient fund management by venture capitalists with more industry information from governments.

### **Government hybrid funds**

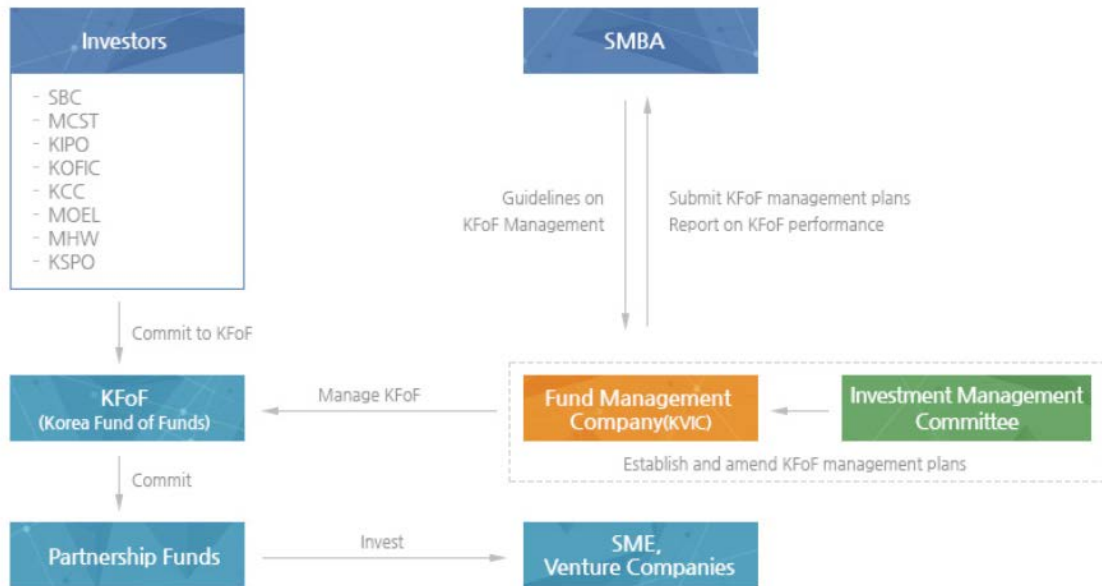
Since governments around the world have channeled public funds to high potential ventures through private sector VCs, the financing vehicles carried by independent venture capital firms to allocate public financial support are termed 'hybrid funds' (OECD, 1997).

Jaaskelainen et al. (2012) analyzed hybrid fund's profit distribution and compensation structure used to improve expected returns in markets. From their model, current compensation structures of hybrid venture capitals can only resolve relatively modest market failures and needs modifications in order to attract highly competent investors who are willing to invest in market failure areas. Yet, Cumming et al. (2014) report that hybrid funds in EU countries have effective compensation structure so they have good IPO exits in markets.

Korean government contemplated an 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. The Korea fund of funds have been created as one of the governmental solutions in order to support early stage venture firms in financial crisis and IT bubble burst in the early 2000s. With the objectives of achieving balanced economic development through helping venture companies and creating more sustainable jobs, KFoFs were established based on the Special Measures for the Promotion of Venture Businesses Act of 1997. The Act consists of the definitions of venture companies, requirements of venture businesses, measures of capital supply, the establishment of Korea Venture Fund, and several restrictions. 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 the year of 2005 in order to help industries which private investors are not much interested in.

**Figure 1**  
KFoFs Operation Structure

• Operation Structure



(Source : Korea Venture Investment Corporation)

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 who are in charge of each put their budget to KFoFs as LPs in separate accounts in order to maintain independence. KFoFs are managed by KVIC with the LP’s guidelines only by investing in other funds as an indirect investment and hybrid funds to the venture firms. The total KFoFs’ fund size is two trillion won (about 1.7 billion US dollars) as of May 2015. Also, it does not distribute the dividends during the fund duration but reinvest to other partner funds until the year of 2035 when the fund is retired.



**Table 1****Status of KFoFs**

Category		Ventures	Angels	Cultures	IP	Movies	Futures	Healthcare	Urban	Tourism	Sports	Extras	'15.09
Partnership Funds	Total Amounts	71,968	1,573	10,378	7,620	790	625	860	85	44	109	-	94,052
	KFoFs Amounts	16,181	1,462	4,233	2,235	420	302	166	43	26	55	-	25,123
Partnership Funds Investment	No. of portfolio firms	3,919	275	1,745	504	167	59	19	4	-	2	-	6,694
	Total Amounts	62,291	438	15,021	6,748	1,155	467	812	31	-	20	-	86,983

**Table 2****Status of Partner Funds**

Year	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15					Total
											1st.	2nd.	3rd.	On-	Etc.	
No. of Partnership funds application (A)	66	64	75	62	114	95	75	78	86	123	38	27	20	20	2	945
No. of Partnership funds permitted	26	30	37	30	54	41	38	35	61	52	18	11	10	18	1	462
No. of Partnership funds established (B)	24	26	32	26	48	37	34	30	57	50	14	-	1	9	-	388
Ratios (B/A)	36%	41%	43%	42%	42%	39%	45%	38%	66%	41%	37%	0%	5%	45%	0%	41%
Amounts of Partnership funds applied (A)	4,450	4,496	7,044	4,766	12,568	8,740	7,247	9,879	9,256	13,553	4,330	2,859	2,025	939	600	92,752
Amounts of Partnership permitted	1,946	2,024	2,696	2,002	4,201	2,449	2,928	3,409	6,524	5,086	1,820	1,085	917	767	300	38,154
Amounts of Partnership funds invested actually (B)	1,831	1,494	2,476	1,730	3,751	2,130	2,528	2,691	5,494	4,891	1,500	-	142	489	-	31,147
Ratios (B/A)	41%	33%	35%	36%	30%	24%	35%	27%	59%	36%	35%	0%	7%	52%	0%	33%

### 3. Hypothesis

There are mixed results regarding the involvement of regular VCs and governmental hybrid funds backed IPO underpricing. Maula and Murray 2003 reports that governmental involvement needs better rewards to outside investors on IPOs in order to justify its participation because the government makes an investment decision to the specific firms or industries in presumably failed markets. In order to participate and earn higher profits in riskier investment, outside investors are reluctant to invest in the companies without a perception of high return through IPO underpricing or expected higher growth after IPOs. Yet, there is another evidence that governmental hybrid funds do not have to attract market participants to the IPOs through sacrificing their investment profits as follows. First, the government may improve the screening process by obtaining many experts' opinions in order to mitigate the risks of funds. Also, they may reduce information asymmetry between insiders and investors through various governmental resources, networks, and industry expertise so that they can signal outsiders their portfolio as desirable investments (Cumming et al., 2014).

Besides, related to the VCs role in IPOs, Megginson and Wiess (1991) conclude that VCs increase certification role by incorporating reputable auditors and underwriters in order to decrease information asymmetry; thus, they reduce IPO underpricing. On the other hand, VCs lead more underpricing in order to attract stock investors and make a better exit. Also, some may argue that VCs are in lack of industry expertise because many of them primarily invest only in the new technology concepts that yet to be well known to the public; thus, VCs may lead bigger underpricing than others (Gompers, 1995).

Therefore, we can expect the non-sponsored IPOs have the greatest underpricing due to the information asymmetry between insiders and outside market participants. Even though there is mixed argument relating to the VCs and hybrid funds impact on underpricing, we expect VCs backed IPOs show bigger underpricing compared to hybrid funds backed ones due to the bigger certification from the government resources. In addition, we expect that the dual

sponsorship of private VCs and government funds shows the least underpricing since the involvement of diverse VCs may improve decision making and thereby mitigates adverse selection problems.

**H1. KFoF's involvement in IPO market will reduce the degree of underpricing.**

In addition to H1, we expect the more number of KFoFs are involved, the more resources of them are used in order to maintain the venture firm's performance. Therefore, we expect that number of KFoFs has a negative impact on IPO underpricing.

**H2. The more number of KFoFs have involved, the lesser IPO underpricing have shown the companies.**

Also, many prior kinds of literature show that the shares hold by VCs send an important signal to the IPO market. Filatotchev and Bishop (2002) show that share ownership interests of non-executive directors are positively associated with IPO underpricing in U.K due to the reduced information asymmetry gave the separation of ownership. Likewise, we expect that the share ownership of KFoFs is negatively related to the degree of IPO underpricing.

**H3. The share ownership of KFoFs is negatively related to the degree of IPO underpricing.**

#### 4. Empirical Models

In order to compare the difference in IPO underpricing among different types of sponsorships, we constructed regression model (1) and (2):

**For H1.**

$$\text{(Model 1) } \textit{Underpricing} = \alpha_0 + \alpha_1 \textit{KFoFs\_only(dummy)} + \alpha_2 \textit{VCs\_KFoFs(dummy)} + \alpha_3 \textit{Size} + \alpha_4 \textit{Lev} + \alpha_5 \textit{Roe} + \alpha_6 \textit{Age} \quad (1)$$

$$\text{(Model 2) } \textit{Underpricing} = \alpha_0 + \alpha_1 \textit{No\_VC\_KFoFs(dummy)} + \alpha_2 \textit{KFoFs\_only(dummy)} + \alpha_3 \textit{VCs\_KFoFs(dummy)} + \alpha_4 \textit{Size} + \alpha_5 \textit{Lev} + \alpha_6 \textit{Roe} + \alpha_8 \textit{Age} \quad (2)$$

Underpricing stands for IPO underpricing which is calculated as the first closing price minus the listed issue price divided by the listed issue price. *VCs\_only* are dummy variable; if only VCs are involved the IPOs, it takes the value of 1, otherwise, it is 0. *KFoFs\_only* are dummy variable; if only VCs are involved the IPOs, it takes the value of 1, otherwise, it is 0. *VCs\_KFoFs* are the dummy variable; if the VCs and KFoFs are involved the company's IPO altogether, it takes the value of 1, otherwise, it is 0. *No\_VCs\_KFoFs* are the dummy variable; if there are no VCs and KFoFs involved the company's IPO altogether, it takes the value of 1, otherwise, it is 0.

We constructed following model (3) through (7) for H2 and H3.

H2 examines whether the more numbers of each fund backed the IPOs have more impacts on the underpricing.

**For H2.**  $Underpricing = \alpha_0 + \alpha_1 No. \text{ of allKFoFs}(=1) + \alpha_2 No. \text{ of allKFoFs}(=2) + \alpha_3 No. \text{ of allKFoFs}(=3) + \alpha_4 No. \text{ of allKFoFs}(=4) + \alpha_5 No. \text{ of allKFoFs}(=5) + \alpha_6 Size + \alpha_7 Lev + \alpha_8 Roe + \alpha_9 Age$  (3)

No. of all KFoFs is the sum of numbers of all KFoFs involved in the IPOs whether regular VCs also involved or not.

**For H3.**

**(Model 1)**  $Underpricing = \alpha_0 + \alpha_1 VCs\_only\_Shares + \alpha_2 KFoFs\_only\_Shares + \alpha_3 VCs\_KFoFs\_Shares + \alpha_4 No\_VCs\_KFoFs\_Shares + \alpha_5 Size + \alpha_6 Lev + \alpha_7 Roe + \alpha_8 Age$  (4)

**(Model 2)**  $Underpricing = \alpha_0 + \alpha_1 All\_VCs\_Shares + \alpha_2 All\_KFoFs\_Shares + \alpha_3 Size + \alpha_4 Lev + \alpha_5 Roe + \alpha_6 Age$  (5)

Model 1 measures the different impacts of the number of KFoFs on IPO underpricing by dividing each participant's ownership shares into VCs only, KFoFs only, and VCs and KFoFs together. VCs\_only\_Shares is the sum of ownership percentages of only VCs involved in the IPOs. KFoFs\_only\_Shares is the sum of ownership percentages of only KFoFs involved in the IPOs. VCs\_KFoFs\_Shares is the sum of ownership percentages of both VCs and KFoFs at the same time involved in IPOs. No\_VCs\_KFoFs\_Shares is the sum of ownership percentages of investors other than VCs and KFoFs for each IPO.

Model 2 measures the different influences of the numbers of KFoFs involved in IPOs on underpricing by dividing each participant's ownership shares into VCs and KFoFs. All\_VCs\_Shares is the sum of ownership percentages in all VCs involved, and ALL\_KFoFs\_Shares is the sum of ownership percentages in all KFoFs are involved for each IPO.

We include several control variables for all models. Size represents means total assets divided by the product of the issue price and the number of issued shares. Lev refers to the debt level, expressed by the year-end asset/liability ratio prior to listing. Roe stands for the return of equity. Age is the firms' age in months between founding dates and IPO dates.

## 5. DATA

Our sample consists 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.

**Table 3**

Number of Newly Listed IPOs on the KOSDAQ during the period of 2009-2014 (Excluding financial and insurance industries)

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 only (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 are not identified investors' information.

**Table 4**

Sample Selection

Sample Selection Criteria	Number of Firms
Total IPO listed in KOSDAQ during 2009-2014	300
- Firms in financial and insurance industry	22
- Firms listed on the KOSDAQ previously	8
- Firms with insufficient data	40
= Final Sample	230

**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
Frequency Missing	2			

During the period, the number of IPOs backed by KFoFs is 60, which includes 26 IPOs backed by only KFoFs without VCs. On the year of 2012, there are relatively fewer IPOs due to the global economic crisis; however, the number of IPOs has been increasing afterward. We manually collected shareholders' information from each firm's securities report on IPOs available in Korean Financial Supervisory Service. On each firm's securities report, there is information of shareholders who holds at least 5% of total equity shares. Then, we compare the data from the lists to the venture capital lists and their funds list from Korean Venture Capital Association and KFoFs partnership lists from Korean Venture Investment Corporation. The relevant financial statement data are obtained from KIS Value database and Fn guide. After deleting observation with firms listed on the KOSDAQ before and missing values, we obtain a final sample of 230 issuers from 2009 to 2014.

**Table 6**  
Descriptive Statistics

Variable	N	Mean (t value)	Standard Deviation	Minimum	Maximum
underpricing	261	0.3590 (12.54***)	0.4624	-0.23	1.6468
VC_only	68	0.2527 (9.52***)	0.4354	0	1
KFoFs_only	26	0.0966 (5.35***)	0.2960	0	1
VC_KFoFs	34	0.1263 (6.23***)	0.3329	0	1
No_VC_KFoFs	142	0.5278 (17.31***)	0.5001	0	1
VC_only_numbers	68	0.4089 (8.03***)	0.8353	0	5
KFoFs_only_numbers	26	0.1449 (4.55***)	0.5231	0	5
VC_KFoFs_numbers	34	0.9330 (11.02***)	1.3886	0	10
No_VC_KFoFs_numbers	142	3.1037 (29.33***)	1.7385	0	15
VC_onlyshares	68	5.7604 (5.84***)	16.1754	0	100
KFoFs_onlyshares	26	1.2098 (4.56***)	4.3500	0	35
VC_KFoFs_shares	34	9.1521 (9.34***)	16.0712	0	96
No_VC_KFoFs_shares	142	62.7787 (42.24***)	24.4196	0	100
size	241	0.5173 (12.52***)	0.6413	0	5.01907
lev	241	106.7618 (9.48***)	175.3988	5.31	2550.63
roe	241	17.6473 (16.32***)	16.8258	-68.52	142.3500
Age(in month)	278	140.082 (18.17***)	128.569	1.0	1379.00

This table reports the descriptive statistics for the sample of IPO underpricing backed by VCs only, KFoFs only, and VCs and KFoFs at the same time in terms of whether one is invested, how many numbers of them are invested, and how many percentages of shares they are acquired. \*\*\* indicate significance at 1% levels, respectively.



**Table 7**

## Pearson Correlation Coefficients

	1	2	3	4	5	6	7	8	9	10	11
1	1	-0.0527	0.07858	0.04173	-0.0367	0.08763	0.03557	0.0109	-0.09327	0.04717	-0.09044
		0.3965	0.2057	0.5021	0.5551	0.1581	0.5673	0.8608	0.1329	0.4479	0.1451
2	-0.0527	1	-0.5979	-0.34588	-0.40221	-0.51858	-0.29359	-0.71184	-0.37727	-0.29463	-0.60329
	0.3965		<.0001***	<.0001***	<.0001***	<.0001***	<.0001***	<.0001***	<.0001***	<.0001***	<.0001***
3	0.07858	-0.5979	1	-0.19026	-0.22124	0.83292	-0.16149	0.24407	0.61341	-0.16206	0.44108
	0.2057	<.0001***		0.0017***	0.0003***	<.0001***	0.0080***	<.0001***	<.0001***	0.0077***	<.0001***
4	0.04173	-0.34588	-0.19026	1	-0.12442	-0.16042	0.84882	0.13379	-0.11671	0.85182	0.06861
	0.5021	<.0001***	0.0017***		0.0414**	0.0084**	<.0001***	0.0282**	0.0559*	<.0001***	0.2621
5	-0.0367	-0.40221	-0.22124	-0.12442	1	-0.17313	-0.10561	0.62371	-0.13571	-0.10598	0.26206
	0.5551	<.0001***	0.0003***	0.0414**		0.0044**	0.0838*	<.0001***	0.0260**	0.0827**	<.0001***
6	0.08763	-0.51858	0.83292	-0.16042	-0.17313	1	-0.13617	0.36464	0.67997	-0.13665	0.50102
	0.1581	<.0001***	<.0001***	0.0084**	0.0044**		0.0255**	<.0001***	<.0001***	0.0250**	<.0001***
7	0.03557	-0.29359	-0.16149	0.84882	-0.10561	-0.13617	1	0.21886	-0.09906	0.94153	0.11738
	0.5673	<.0001***	0.008**	<.0001***	0.0838*	0.0255**		0.0003***	0.105	<.0001***	0.0545*
8	0.0109	-0.71184	0.24407	0.13379	0.62371	0.36464	0.21886	1	0.20669	0.19627	0.58934
	0.8608	<.0001***	<.0001***	0.0282**	<.0001***	<.0001***	0.0003***		0.0006***	0.0012***	<.0001***
9	-0.09327	-0.37727	0.61341	-0.11671	-0.13571	0.67997	-0.09906	0.20669	1	-0.09941	0.78751
	0.1329	<.0001***	<.0001***	0.0559*	0.0260**	<.0001***	0.1050	0.0006***		0.1038	<.0001***
10	0.04717	-0.29463	-0.16206	0.85182	-0.10598	-0.13665	0.94153	0.19627	-0.09941	1	0.13272
	0.4479	<.0001***	0.0077***	<.0001***	0.0827**	0.0250**	<.0001***	0.0012***	0.1038		0.0295**
11	-0.09044	-0.60329	0.44108	0.06861	0.26206	0.50102	0.11738	0.58934	0.78751	0.13272	1
	0.1451	<.0001***	<.0001***	0.2621	<.0001***	<.0001***	0.0545*	<.0001***	<.0001***	0.0295**	

This table reports the Pearson Correlation Coefficients of all variables used in the research. 1: underpricing, 2: No\_VC\_KFoFs, 3: VCs\_Only, 4: KFoFs\_Only, 5: VCS\_KFoFs at the same time, 6: the number of VCs\_Only, 7: the number of KFoFs\_Only, 8: the number of VCs\_KFoFs at the same time, 9: the shares percentage of VCs\_Only, 10: the shares percentage of KFoFs\_Only, 11: the shares percentage of VCs\_KFoFs at the same time. \*\*\*, \*\*, \* indicate significance at 1%, 5%, and 10% levels, respectively.

## 6. Empirical results

Table 8 shows the results for testing the first hypotheses. From the model I, KFoFs only backed IPOs and VCs and KFoFs backed IPOs at the same time show less underpricing compared to only VCs backed IPOs as hypothesized. IPOs with VCs and KFoFs at the same time shows the greatest negative impact on IPO underpricing as we expected. From the model II, compared to VCs only sponsored IPOs, the KFoFs only sponsorship to IPOs and VCs and KFoFs sponsorship has more negative impact on IPO underpricing. Also, the dual sponsorship shows the greatest negative impact on IPO underpricing. Yet, no sponsorship shows also a negative impact on IPO underpricing compared to VCs only sponsorship. In general, results are consistent with H1.

**Table 8**

Regression of IPO underpricing backed by (model 1) KFoFs only, and VCs and KFoFs together compared to VCs only sponsorship, (model 2) including no sponsorship.

	Model I	Model II
intercept	0.53872 <sup>***</sup> (0.0001)	0.62535 <sup>***</sup> (<.0001)
<b>No_VC_KFoFs</b>		<b>- 0.15622<sup>**</sup></b> <b>(0.0485)</b>
<b>KFoFs_only</b>	<b>- 0.01551</b> <b>(0.8957)</b>	<b>- 0.05177</b> <b>(0.6479)</b>
<b>VCs_KFoFs</b>	<b>- 0.19507<sup>*</sup></b> <b>(0.0725)</b>	<b>- 0.21111<sup>**</sup></b> <b>(0.0445)</b>
size	- 0.14369 (0.1311)	0.00005 (0.8680)
lev	- 0.00027 (0.1570)	- 0.11562 <sup>**</sup> (0.0198)
roe	- 0.00300 (0.3212)	- 0.00023 (0.1977)
age	0.00086 (0.1193)	- 0.00205 (0.2942)

This table reports the results of IPO underpricing difference between KFoFs only, and VCs and KFoFs at the same time, compared to VCs only. Underpricing stands for IPO underpricing, which is calculated as the first closing price minus the listed issue price divided by the listed issue price. VCs\_only are dummy variable; if only VCs are involved the IPOs, it takes the value of 1, otherwise, it is 0. KFoFs\_only are dummy variable; if only VCs are involved the IPOs, it takes the value of 1, otherwise, it is 0. VCs\_KFoFs are the dummy variable; if the VCs and KFoFs are involved the company's IPO altogether, it takes the value of 1, otherwise, it is 0. No\_VCs\_KFoFs are the dummy variable; if there are no VCs and KFoFs involved the company's IPO altogether, it takes the value of 1, otherwise, it is 0. Size represents means total assets divided by the product of the issue price and the number of issued shares. Lev refers to the debt level, expressed by the year-end asset/liability ratio prior to listing. Roe stands for the return of equity. Age is the firms' age between founding dates and IPO dates. \*\*\*, \*\*, \* indicate significance at 1%, 5%, and 10% levels, respectively.

For the second hypothesis, we examine the relationship between underpricing and the number of KFoFs involved in the IPOs. Table 9 shows the results. The number of KFoFs backed IPOs has negative impacts on IPO underpricing in overall, especially in the case of one KFoFs is sponsored IPO underpricing is reduced significantly. The results support H2.

**Table 9**

Regression of IPO underpricing by different numbers of KFoFs involved.

	Coefficients with p-value
intercept	0.51400*** (0.0003)
<b>No. of KFoFs=1</b>	<b>- 0.17536*</b> <b>(0.0933)</b>
<b>No. of KFoFs=2</b>	<b>0.04384</b> <b>(0.5275)</b>
<b>No. of KFoFs=3</b>	<b>- 0.16000</b> <b>(0.1641)</b>
<b>No. of KFoFs=4</b>	<b>- 0.10869</b> <b>(0.3681)</b>
<b>No. of KFoFs=5</b>	<b>- 0.04058</b> <b>(0.5625)</b>
size	- 0.15232 (0.1114)
lev	- 0.00022 (0.2522)
roe	- 0.00113 (0.7109)
age	0.00078 (0.1553)

This table reports the results of IPO underpricing difference between numbers involved by KFoFs. No. of KFoFs is categorical variables, which stands for the number of KFoFs involved in IPOs. Size represents means total assets divided by the product of the issue price and the number of issued shares. Lev refers to the debt level, expressed by the year-end asset/liability ratio prior to listing. Model 1 measures the different influences of the numbers of KFoFs involved in IPOs on underpricing whether other VCs are involved at the same time, or not. No. of allKFoFs is the sum of numbers of all KFoFs involved in the IPOs whether regular VCs also involved or not. No. of KFoFs\_only is the sum of numbers of KFoFs only when KFoFs are only involved in the IPOs. Size represents means total assets divided by the product of the issue price and the number of issued shares. Lev refers to the debt level, expressed by the year-end asset/liability ratio prior to listing. Roe stands for the return of equity. Age is the firms' age between founding dates and IPO dates. \*\*\*, \*\*, \* indicate significance at 1%, 5%, and 10% levels, respectively.

For the third hypothesis, we examine the relationship between underpricing and the shares percentage of KFoFs ownership. Table 10 shows the results. In the first model, we divided all ownership percentages of sponsored IPO firms into three categories; VCs only shares, KFoFs only shares, and VCs and KFoFs shares at the same time. Among the categories, VCs and

KFoFs dual sponsorship ownership is negatively related to the IPO underpricing. The result supports for H3, but other categories are statistically insignificant. In model 2, we compare VCs shares and KFoFs shares for the impacts on IPO underpricing. Both of them are negatively related to the underpricing and KFoFs shares are more negatively related; however, both numbers are insignificant. In sum, it seems that ownership structure does not influence the degree of underpricing.

**Table 10**

Regression of IPO underpricing with different shares percentages of VCs only, KFoFs only, and VCs and KFoFs at the same time.

	Model I	Model II
intercept	0.53151*** (0.0007)	0.54305*** (0.0006)
<b>VCs_only_shares</b>	<b>0.00760</b> <b>(0.1434)</b>	
<b>KFoFs_only_shares</b>	<b>0.00939</b> <b>(0.2392)</b>	
<b>VCs_KFoFs_shares</b>	<b>- 0.00840*</b> <b>(0.0872)</b>	
<b>All_VCs_shares</b>		<b>- 0.00431</b> <b>(0.3460)</b>
<b>All_KFoFs_shares</b>		<b>- 0.00476</b> <b>(0.4723)</b>
size	- 0.15124 (0.1139)	- 0.14656 (0.1286)
lev	- 0.00027 (0.1581)	- 0.00028 (0.1496)
roe	- 0.00312 (0.3114)	- 0.00228 (0.4501)
age	0.00089 (0.1134)	0.00079 (0.1599)

This table reports the results of IPO underpricing difference between shares percentages involved by VCs only, KFoFs only, and VCs and KFoFs at the same time. Model 1 measures the different impacts of the number of KFoFs on IPO underpricing by dividing each participant's ownership shares into VCs only, KFoFs only, and VCs and KFoFs together. VCs\_only\_Shares is the sum of ownership percentages of only VCs involved in the IPOs. KFoFs\_only\_Shares is the sum of ownership percentages of only KFoFs involved in the IPOs. VCs\_KFoFs\_Shares is the sum of ownership percentages of both VCs and KFoFs at the same time involved in IPOs. No\_VCs\_KFoFs\_Shares is the sum of ownership percentages of investors other than VCs and KFoFs for each IPO. Model 2 measures the different influences of the numbers of KFoFs involved in IPOs on underpricing by dividing each participant's ownership shares into VCs and KFoFs. All\_VCs\_Shares is the sum of ownership percentages in all VCs involved, and ALL\_KFoFs\_Shares is the sum of ownership percentages in all KFoFs are involved for each IPO. Size represents means total assets divided by the product of the issue price and the number of issued shares. Lev refers to the debt level, expressed by the year-end asset/liability ratio prior to listing. Roe stands for the return of equity. Age is the firms' age between founding dates and IPO dates. \*\*\*, \*\*, \* indicate significance at 1%, 5%, and 10% levels, respectively.

## 7. Conclusion

IPO underpricing has been a subject of great interest from many researchers. Previous studies have focused on the underpricing of private venture capital backed IPOs. There is a significant gap in the literature as underpricing in government-backed IPOs has been largely ignored by the mainstream academic research. It is well known that IPO company association with specific venture type signals unique information to the capital markets. In this paper, we investigate whether the government sponsorship in IPO market produces a unique type of signal to the capital market. For this purpose, we examine underpricing of IPOs and compare government-backed IPOs with non-government backed IPOs in the Korean equity markets. We find that government sponsorship reduces the degree of IPO underpricing. In addition, we find that dual sponsorship of government and private VCs send a most credible signal to the market with respect to the value of the firm.

One important aspect of a firm's decision to go public is to receive a proper value for its shareholders. If IPOs are significantly underpriced, many eligible firms would be reluctant to choose an IPO as a means of raising capital. This study shows that government can play a very important role in resolving this problem. From the policy perspective, with a view to the role of the government, we believe that the capital market regulator should have a comprehensive model as a benchmark for determining the fair pricing of IPOs. It is important to note that the pricing of IPOs has long-term implications for policy makers, market intermediaries, as well as investors. The present study contributes to the capital market literature, especially for emerging economies.

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