

**WHAT'S IN A NAME AND WHEN DOES IT MATTER?
THE HOT AND COLD MARKET IMPACTS ON UNDERPRICING OF
CERTIFICATION, REPUTATION AND CONFLICTS OF INTEREST IN
VENTURE CAPITAL BACKED KOREAN IPOS**

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Abstract

This article analyses the impact of the participation of venture capital (VC) firms on underpricing in 372 businesses brought to IPO during the period 1999-2001 in KOSDAQ. Korea's second-tier stock market, KOSDAQ, has grown dramatically since 1999 and about half of the firms listed in KOSDAQ during this period were VC-backed, thus providing a good testing ground for empirical analysis. We measure VC participation in terms of pre IPO share-ownership by VC firms and attempt to differentiate IPO impacts between VCs grouped in terms of their reputation (measured by their dominance of the VC market, and by their affiliation in terms of ownership by banks and security companies). In estimating impacts we control for a wide range of variables which may affect the extent of underpricing. These include uncertainty inducing factors such as the age, size, profitability, leverage, and technical riskiness (measured by sector and R&D intensity) of the firm brought to IPO. We also control for market conditions using proxies for hot and cold market effects based on the numbers of contemporaneous IPOs, underpricing trends and market price movements. Finally in addition to allowing for the impact of underwriting quality we control for share overhang and price revision effects. We find that, controlling for other relevant factors, pre-IPO ownership by VCs has an insignificantly negative impact on underpricing in both hot and cold markets. However in cold markets reputational effects within the VC group do matter. In those conditions the top 3 VCs and those owned by or affiliated with banks are significantly associated with lower underpricing. The same is true for the quality of underwriting. However in hot market conditions none of these effects are present.

JEL Codes: G14; G20; G34

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A. Introduction

"What's in a name? That which we call a rose
By any other word would smell as sweet."

William Shakespeare *Romeo and Juliet* (II, ii, 1-2)

Numerous studies have documented the fact that in all countries IPOs are underpriced in the short-run (Loughran, Ritter et al, 2003). In the US, this 'underpricing discount' has averaged over 10%, since the 1960s reaching over 65% at the height of the stock market boom in 1999-2000 (Ritter, 2005). Among the 34 countries surveyed by Loughran and Ritter, only 4 countries showed less-than-10% initial returns, with no stock markets exhibiting negative initial returns. In the course of the eighties and nineties IPOs on the Korean Stock Exchange exhibited persistent underpricing between 57% and 60%, rates much higher in the USA (Kim et al., 1995; Kim et al., 2002). On the Korean Securities Dealers Automated Quotation exchange (KOSDAQ), the secondary stock market founded in 1996, our estimates suggest that underpricing reached 280% during the period from 1999 to March 2000 and 119% from then until the end of 2001.

The pervasive nature of underpricing has been explained in a number of ways related to problems of information asymmetry. Thus it has been seen as a signalling mechanism to combat the 'lemons problem' (Allen and Faulhaber, 1989; Grinblatt and Hwang, 1989; Welch, 1989), as a response to the 'winner's curse' faced by less-informed investors (Rock, 1986), and as a reward to investors for market information feedback (Barry, Gilson et al, 1998). In this paper, we focus on the role that reputable financial institutions may play in ameliorating these information asymmetry and signalling problems (Beatty and Ritter, 1986; Carter and Manaster 1990; Carter, Dark et al, 1998; Logue, Rogalski et al, 2002).

In this paper, we examine whether the names that these institutions associate with IPOs makes the IPO rose smell sweeter to investors. Put more prosaically and specifically we analyse the impact on underpricing of the participation of venture capital (VC) firms in 372 firms brought to IPO during the period 1999-2001 in KOSDAQ. Korea's second-tier stock market, KOSDAQ, has grown dramatically since 1999 and about half of the firms listed in KOSDAQ during this period were VC-backed, thus providing a good testing ground for empirical analysis. We measure VC participation in terms of pre IPO share-ownership by

VC firms and attempt to differentiate IPO impacts between VCs grouped in terms of their reputation (measured by their dominance of the VC market, and by their affiliation in terms of ownership by banks and security companies). In estimating impacts we control for a wide range of variables which may affecting the extent of underpricing. These include uncertainty inducing factors such as the age, size, profitability, leverage, and technical riskiness (measured by sector and R&D intensity) of the firm brought to IPO. We also control for market conditions using proxies for hot and cold market effects based on the numbers of contemporaneous IPOs, underpricing trends and market price movements. Finally in addition to allowing for the impact of underwriting quality we control for share overhang and price revision effects. We find that, controlling for other relevant factors, pre-IPO ownership by VCs has an insignificantly negative impact on underpricing in both hot and cold markets. However in cold markets reputational effects within the VC group do matter. In those conditions the top 3 VCs and those owned by or affiliated with banks are significantly associated with lower underpricing. The same is true for the quality of underwriting. However in hot market conditions none of these effects are present.

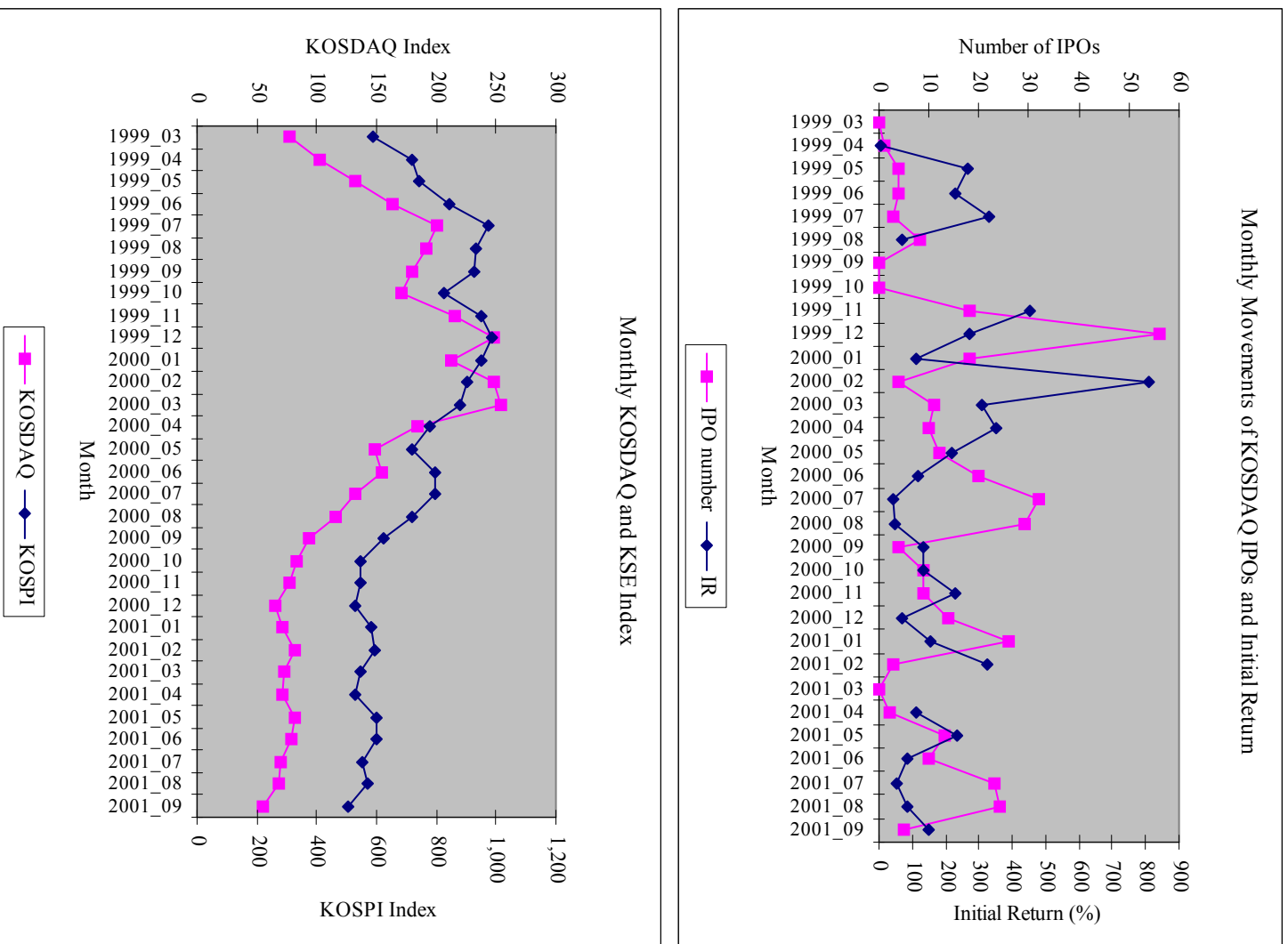
The article is organised as follows. Section B provides an institutional description of the venture capital industry and the IPO market in Korea in comparison to the USA and the UK. In Section C, we review the literature regarding underpricing. Section D describes the data set and discusses the methodology to be used. Section E describes the main characteristics of our IPO samples and reports the results of univariate tests on underpricing. Section F reports the results of multivariate analysis of underpricing. Section G concludes.

B. Institutional Background

B.1. IPOs Underpricing and Stock Market Movements: 1999-2001

Figure I shows monthly movements in the numbers of IPOs initial returns on the IPOs and movements in the KOSDAQ and KSE (Korean Stock Exchange) indices. The number of IPOs peaked in December 1999, fell sharply to February 2000 and then followed a series of lower peaks and troughs through to the end of the sample period. The IPO market was thus still able to attract more than 20 firms in some months after the crash of early 2000, unlike IPO markets in other major countries which witnessed a more consistent freeze. The initial return (or underpricing) follows the number of IPOs with a one to two month lag peaking in February 2000.

Figure 1 Monthly Movements in KOSDAQ IPOs and the KOSDAQ and KSE Stock Market Indices



Source: KOSDAQ (www.kosdaq.or.kr) and KSE (www.kse.or.kr)

A comparison of the top and bottom panels of Figure 1 shows that movements in the number of IPOs each month is more volatile than, but broadly consistent with, movements in the KOSDAQ and KOSPI indices. The peaks in underpricing coincide more closely with the recovery and peaks in the KOSDAQ index than with the number of IPOs. The KOSDAQ index reached its highest point in March 2000; three months after KOSDAQ recorded the highest number of IPOs. IPO numbers tend to rise when the indices are rising as IPOs sought to capture the ‘window of opportunity’ of rising markets (Aggarwal and Rivoli, 1990; Lowry and Schwert, 2002). However, while the KOSDAQ index continued to decline after March 2000 and did not recover to its previous highest level, firms continued to make their debut in KOSDAQ. In fact, 235 firms (63% in our sample) were taken public between May 2000 and September 2001.

In view of the movements in the rate of IPO activity over our sample period we present results for the whole period and for two periods split in March 2000, the first we term the hot period and the second from April 2000 we term the cold period. In the cold period both underpricing and stock market indices are below the peak values of February and March 2002.

B.2. Venture Capital Investment 1999-2002

The Korean venture capital industry experienced dramatic growth from the late 1990s and became the largest venture capital market relative to its economy in the Asian countries (OECD, 2003). In the period 1998-2001 Korea ranked third behind the USA and Canada in terms of venture capital investment as a share of GDP among the leading OECD countries. In the aftermath of the East Asian Financial Crisis and the subsequent restructuring of the Korean financial system venture capital commitment reached a peak of USD 1.1 billion in 2000 before succumbing to the worldwide financial bursting of the dot.com bubble.

Table I Descriptive Statistics of the Venture Capital Industry in USA, UK and Korea

	1999			2000			2001			2002		
	US	UK	Korea	US	UK	Korea	US	UK	Korea	US	UK	Korea
<i>A. Venture Capital Commitment (Million\$)</i>	62,770	9,386	431	105,800	13,434	1,133	37,940	19,828	597	7,670	12,600	440
<i>B. Disbursement by stage</i>												
% Seed and Start-up	6.1	8.5	0.4	3.0	6.2	12.4	1.9	8.0		1.4	5.9	
% Early stage	22.0	14.6	0.8	24.6	18.7	20.1	22.6	11.2		19.2	11.7	
% Expansion	56.1	65.2	97.8	57.3	71.2	67.2	57.2	66.1		62.7	67.0	
% Later stage	15.9	11.7	1.0	15.2	3.9	0.2	18.3	14.7		16.7	15.3	
Total (Million\$)	54,924	2,427	1,017	106,294	4,219	1,137	41,073	2,946	NA	21,224	2,686	NA
<i>C. Disbursement by industry (Number of Firms)</i>												
% Information Technology	51.0	29.7	71.3	54.4	50.3	64.2	58.0	38.3	66.3	58.8	31.4	
% Bio-technology/Medical	12.6	10.0	4.4	9.8	5.3	10.1	14.4	11.4	12.5	19.1	14.1	
% Non high-technology	36.4	60.3	24.3	35.8	44.3	25.7	27.6	50.3	21.2	22.1	54.5	
Total (Million\$)	4,499	1,109	136	6,459	1,182	567	3,847	1,307	208	2,514	1,196	NA

Sources: National Venture Capital Association (2001, 2002, 2003), European Venture Capital Association Yearbooks (2001, 2002, 2003), Korean Venture Capital Association (2001, 2002, 2003)

A noticeable characteristic of the Korean venture capital industry compared to the US is that venture capital investment tends to be concentrated in the expansion stage. Table I shows for example that in 1999, 97.8% (USD 994.8 million) was directed toward the expansion stage compared with 56.1% in the US. In 1999, very little venture capital was invested in the seed and start-up stages and the early stage (0.4 and 0.8%, respectively), but the proportion of these stages in venture capital investment soared in 2000, with 12.4% and 20.1% being invested coincident with the boom in IPOs and KOSDAQ. In that year seed funding was proportionately much higher than in either the US or the UK. Since this early stage funding is inherently riskier than later stage funding, this may predispose the system to display higher underpricing in that year.

Table I also shows that the Korean venture capital investment is relatively concentrated in firms in the two high tech sectors of information and bio technology and especially the former. Compared to the UK and the US, Korean venture capital is much less involved with low tech investment. Out of the total number of investee firms, information technology industries accounted for over two thirds in each year from 1999 to 2001. The proportion of the biotechnology firms that received venture capital funding increased from 4.4% in 1999 to 12.5% in 2001. Once again this may relate to higher levels of underpricing on KOSDAQ in that year. More generally the higher R&D intensity of high tech IPOs means that they present greater uncertainty of outcomes to investors (Guo, Lev and Shi, 2006). In view of these differences in risk profile between high and low technology ventures, we distinguish between them in our subsequent analysis and also include direct measures of R&D activity for each IPO firm in our sample.

C. Hypothesis Development

C.1. Information Asymmetry Underpricing and Irrational Behaviour

The dominant approach to the analysis of underpricing centres around problems of information asymmetry and problems of signalling. For example, to separate themselves from the lower-quality issuers who bring ‘lemons’ to the market, it has been argued that higher quality issuers who are better informed than investors will price the IPO below its true value. Lower quality issuers will find it hard to imitate. This kind of signal can be reinforced by the announcement of high dividends (earnings) after IPO (Allen and Faulhaber, 1989), ensuring positive analyst coverage (Chemmanur and Fulghieri 1998), future issuing activities by selling additional shares on more favourable conditions (Welch, 1989), and retained ownership (Grinblatt and Hwang, 1989). In the latter case issuers are able to get back the costs of IPO underpricing by selling the shares

they retained at a higher price after IPO. Alternatively when some investors have better or different information than others, IPO stocks may be also be underpriced to maintain the market. Thus in Rock's (1986) "winner's curse" model, well-informed investors will only subscribe to issues that are sufficiently underpriced relative to the firms' true value to earn an abnormal return. Less-informed investors will be allocated all of the undesirable relatively overpriced issues avoided by well-informed investors. The less informed group will withdraw from the market unless underpricing is available to offset this 'winners curse' risk. Where issuers want to obtain information about market demand and the "bookbuilding" method is used for setting the offer price, issuers may underprice IPOs to induce regular investors to reveal their information about their truthful valuations on the firms. (Benveniste and Spindt, 1989). When revealed market demand is high, the offer price will be set higher than the original price. The price that investors extract to supply this information will however be either underpricing and/or higher share allocation (Ritter, 1998; Chang and Kim, 2006).

It is important to note that these approaches are fundamentally based around notions of rational behaviour by stock market actors. The growth in underpricing associated with the stock market boom of the 1990s has led to other explanations in which underpricing is interpreted as the outcome of irrational behaviour. Thus Aggarwal and Rivoli (1990) argue that high levels of underpricing are caused by "market fads" which can be defined as temporary overvaluation of firms by investors in the early IPO stage. Higher levels of noise trading are likely to happen not in accordance with rational expectation on the firms' value, but according to irrational over-optimism. Similarly Rajan and Servaes (1997) attribute higher underpricing in bull markets to over-optimism about earnings potential and long-term growth prospects which may become self reinforcing through contagion effects and changes in bookbuilding behaviour (Loughran and Ritter (2002) and Lowry and Schwert (2002)) Empirical analysis of the determinants of underpricing must therefore be sensitive to the market background against which they occur not least to avoid aggregation biases by combining observations over differing market conditions.

C.2. Information Asymmetry Certification and Reputation Effects: Advisers, Venture Capitalists and Underwriters

C.2.1 Auditors Financial Advisers and Underwriter Quality

An important strand of the signalling literature emphasises the information content of “reputation” and the role that certain institutions involved in the issuing process can play in certifying the quality of firms brought to IPO. Here issuers attempt to alleviate the degree of information asymmetry by signalling quality through the use of highly prestigious underwriters, auditors or financial advisors in the process of IPO. Titman and Truman (1986) suggest that the employment of a prestigious auditor or other financial advisors to the issuing company may be interpreted by investors as a positive signal of issue value, leading to less underpricing. Holland and Horton (1993) examine the relation between the reputations of the professional advisors involved in IPO (specifically, the sponsor, the accountant and the auditor) and short-term performance. They find that more reputable financial advisors are linked to lower initial returns. Similar results obtain for underwriter quality (Kim, Kish and Vasconcellos, 2002; Carter, Dark et al, 1998; Carter and Manaster, 1990)

C.2.3 Venture Capitalists: Certification and Conflicts of Interest Effects

In addition to the reputational effects of financial advisers a significant literature has focussed on the role of venture capitalists (VCs) in certifying and hence signalling IPO quality. This literature has also focussed on potential conflicts of interest which may arise as a result of venture capital involvement when venture capital firms are affiliated with other institutions involved in underwriting or investing in IPO firms (Barry, Muscarella et al., 1990; Megginson and Weiss, 1991; Admati and Pfleiderer 1994; Espenlaub, Garrett et.al., 1999; Francis and Hasan, 2001; Gompers and Lerner, 1999; Gompers, 1996; Chan, Siegel et al., 1990; Bessler and Kurth, 2003; Hamao, Packer et al., 2000; Hellman and Puri 2000a, 2000b; Jain and Kini, 2000; Rindermann, 2002; Lee and Wahal, 2004; Li and Masulis, 2003).

Certification Effects

The certification role of VC involvement in IPO firms is linked to the various features of their practice which may signal that the firms they invest in are of relatively high quality. As a result to attract investors at IPO they require less money to be left on the table through underpricing. This effect is based on the use of various investment control and resource allocation mechanisms designed to reduce the risks associated with start up businesses especially in the high

return technology based sectors deemed to be attractive to VCs and in which venture capitalists often invest through risk spreading syndicates in which one or more venture capitalists play the leading role (Admati and Pfleiderer, 1994; Lerner, 1994). VC backed IPOs, it is argued, will be of higher quality or lower uncertainty in performance because of VC investment and monitoring and support strategies for their portfolio firms. These strategies include staged financing linked to performance and convertible debt instruments for effective monitoring and incentive alignment. (Sahlman, 1990; Gompers, 1995; Gompers and Lerner, 1996; Cornelli and Yosha, 1997). In addition firm quality may be improved by specialist strategic VC guidance, identification and recruitment and incentivisation of top management, and by specialist VC network support (Kortum and Lerner 1998; Hellmann and Puri, 2000a; Stuart, Hoang et al. 1999). Finally it is argued that venture capitalists have an incentive to bring good quality firms to IPO because they are “repeated players” in the IPO market who require IPO to exit their investments. As a result venture capitalists will invest in careful screening, selecting and monitoring of investee firms, to avoid losing their reputation by taking the poorly qualified firms to the IPO market (Espenlaub and Garrett, 1999; Jain and Kini, 2000).

For all these reasons it might be expected that in the Korean stock market, venture capitalists’ involvement in the ownership of IPO firms will send a positive signal to the capital markets. In a stock market such as KOSDAQ, which has a short track record, public investors will, it could be argued, have less accumulated information about the high-technology focused IPOs that prevailed during the period of our research. In our empirical analysis, if these effects predominate we would expect venture capital-backed IPOs to be less underpriced, compared with IPOs which are not backed by venture capital.

Heterogeneity in VC Quality, VC affiliation and Conflicts of Interest

While there is a body of literature proposing the certifying role of venture capitalists, another body of literature stresses potential offsetting effects arising from heterogeneity amongst venture capital firms and from conflicts of interest.

Gompers (1996) observed that venture capitalists caught up in rising markets would bring firms to market prematurely to satisfy their need for exit even if this timing was less than appropriate given the maturity of the business. Thus in rising markets the certifying role is weakened. He also observed that within the VC sector newer venture capitalists were, in general, more prone to do this. This behaviour termed ‘grandstanding’ leads younger VC companies to bring IPOs to the public market earlier than more established firms in order to raise their own profile. IPOs sponsored by inexperienced and younger venture capitalist should therefore be more underpriced.

Korea's venture capitalist market has a relatively short history. The majority of firms were established after the regulatory changes in 1998, which were designed to encourage the foundation of more venture capital companies in order to promote technology financing. The likelihood of grandstanding effects may therefore be substantial. In addition, variations in venture capital quality are likely to be present so that the impact of venture capital presence on underpricing is likely to be influenced by investor perceptions of VC quality. Of around Korean 120 venture capital companies, only around 20 appear in the ownership section of the IPO prospectus of IPO firms. Thus leadership in terms of market share may be taken as a signal of VC quality.

In a market in which historically a few key banks and security firms have dominated affairs and have established reputations VC affiliation with them may lead to less underpricing than when these affiliations are not present. Thus IPOs backed by venture capitalist firms which differ according to their ownership may have different impacts on underpricing. (Gompers and Lerner, 1999; Hamao, Packer et al., 2000; Li and Masulis, 2003; Bessler and Kurth, 2003).

Conflicts of interests arise when these affiliations lead to differences in motivation in IPO pricing and where financial market structures lead to multiple interconnections between investment banking, underwriting and venture capital functions and the role of institutions as both investors and promoters of IPOs. Gompers and Lerner (1999) focus on the conflicts of interest that can occur between underwriters who hold an equity stake in IPO firms through venture capital subsidiaries and investors. They note the possibility that, when investment banks (security firms in the Korean context) underwrite IPO businesses in which they have shares through a venture capital subsidiary, they may incur conflicts of interest between investors and themselves. An investment bank (security firm) has an incentive to set a high price for IPO shares as an agent of the IPO firm. This incentive is strengthened when it has ownership rights in the IPO company. However, the investment bank (security firm) has an offsetting concern about losing its reputation by pricing the IPO firms too high and weakening its links with institutional and other investors who are their long-term clients on the demand-side. The IPO offer will be thus be the outcome of several conflicting concerns. When investors anticipate this conflict of interests, they will require a discount on the IPO pricing to reflect the uncertainty it creates, which will result in a higher underpricing. This will reinforce the self-interested tendency for underwriters to underprice in order to avoid expensive buy-ins. VC affiliation with investment banks (security firms) involved in the underpricing process should lead to higher underpricing. To the extent that the need to underprice is weakened in bull markets with typically

excess demand then we would expect this effect to be weakened or offset in those circumstances. In empirical analysis, it is therefore important to both identify VCs affiliated with investment banks (security firms) and analyse effects allowing for hot and cold market conditions.

The argument for a distinct certification role of “bank-affiliated” venture capitalists depends upon their particular “information advantage” over other financial institutions based on specialist personnel linked to client fund transmission, the screening of loan applicants, monitoring client firms’ managerial performance and profits, and enforcing specific contracts that are designed to modify managerial behaviour (Hellman et.al.,2003; Calomiris and Ramirez, 1996). Banks which also hold shares in clients can reduce the agency costs associated with debt (Prowse, 1990; Aoki, 1994) and may be more willing to provide funding for long-term investment (Edwards and Fischer, 1994). As Aoki (2000) has argued relational financing in bank based financial systems makes the banks’ role in gathering information central. It generates ‘informational rents’, which in our context can be translated into positive reputational effects.

If all these certifying and value-adding functions of banks are recognised in the market, IPO firms backed by banks-affiliated venture capital companies should be expected to experience less underpricing than those which are not.

Uncertainty and Underpricing: Control and other Variables

It is well known that variables other than the outside ownership and reputational factors that we have discussed so far can affect underpricing. In particular a range of factors are associated with uncertainty in firm performance and the motivation of the original entrepreneurial owners. These may both predispose venture capitalists to focus on certain types of firms whose underlying characteristics may be reflected, in relatively high or low levels of underpricing and produce misleading estimates of the impact of VC involvement unless their impact is controlled for (Rindermann, 2002; Gompers and Lerner, 2001; Lee and Wahal, 2004; Daily et.al., 2003). Both small business size and youth are associated with uncertainty in business performance, as are high levels of leverage. Each may be expected to lead to higher underpricing (Carter et al., 1998; Ibbotson et al., 1994; Megginson and Weiss, 1991). Similarly high technology and R&D intensive businesses are more risky than other types of IPO (Guo et al., 2006) with similar implications for underpricing. Finally, pre-IPO profitability should be a positive signal of quality as should the extent to which the CEO of an IPO firm holds equity and is committed to its retention post-IPO. Both should lead to lower underpricing although the evidence on the CEO effect is mixed (Beatty, 1989; Kim et al., 1995). We include variables for each of these effects in our empirical analysis.

In addition to these variables relating to the characteristics of the IPO firm two other variables arising from the IPO process have been identified as factors affecting the degree of underpricing. Benveniste and Spindt (1989) argue that, where the bookbuilding method is used for setting the offer price, security firms may underprice IPOs in order to induce regular investors to reveal their information about their truthful valuations of the firm. To encourage investor honesty, these firms then compensate investors by underpricing and must underprice issues for which favourable information is revealed by more than those for which unfavourable information is revealed. This leads to a prediction that there will only be partial adjustment of the offer price from that contained in the preliminary prospectus to that contained in the final prospectus. In other words, the IPOs for which the offer price is revised upwards will be more underpriced than those for which the offer price is revised downwards (Barry, Gilson et al, 1998; Loughran and Ritter, 2002).

A second factor which may be related to underpricing arises from the possibility of retaining shares which can then be used to realise gains when the after market effects have occurred (Bradley and Jordan, 2002). When underpricing occurs, undervalued shares include only the ones actually sold to investors. The insiders' retained shares are valued at aftermarket prices. Therefore, the economic cost per retained share (the dilution cost) decreases and economic gain increases with increases in 'overhang', where share overhang is defined as the ratio of pre-IPO shares retained in a firm relative to the number of shares filed for sale to the public. As a result, it is likely the firms with greater overhang will allow for greater underpricing. In a related vein Loughran and Ritter (2002) argue that when underpricing occurs, insiders recognise that share value has been diluted. However, these same insiders also generally experience an unexpected increase in wealth. Accordingly, the existing shareholders are willing to "leave money on the table" for new shareholders, when the wealth impact can more than offset the dilution as overhang rises. Once again it is expected that higher overhang is associated with higher underpricing.

We therefore allow for both price revision and overhang effects in our empirical analysis.

D. Data and Variables

D.1. Data Sources

Our primary sources are the IPO prospectuses of 372 going public firms filed with the Korean Financial Supervisory Service (FSS) prior to IPO¹. The IPO

prospectuses include data on market capitalisation; gross spreads; underwriting costs; the name of the underwriter; the history, business and operation of the firm; the ownership structure at the time of IPO; names of venture capital companies that participated in the ownership and the number and percentage of shares they own. IPO firms must report the identity and the shareholdings of venture capitalists (and other large shareholders) if they hold at least 5% of the total shares at IPO². In addition to data from the prospectuses we used data generously supplied by FSS on the turnover underwriting activities of Korean security firms for the period of 1998~2000, which enabled the calculation of their market shares in the Korean IPO which we use as reputation indicators.

Daily stock prices for each IPO firm were generously supplied by Tong-Yang Securities Co who also made available annual financial statements for the IPO firms.

The IPO offer price of each IPO firm and the daily KOSDAQ index were supplied by KOSDAQ. The Korean Stock Exchange provided us with daily KOSPI (Korea Stock Price Index) data. The IPO numbers in each year in KOSDAQ and KSE were obtained from the annual report published by the Korea Securities Dealers Association (KSDA) and the KOSDAQ website (<http://www.kosdaq.or.kr>). Information on the institutional identity of each venture capital company, i.e., the parent investor of the venture capital company was generously provided by the KVCA (Korean Venture Capital Association). The two-digit Korean Industry Classification (KIC) codes that we use to classify the 372 firms into various industry groups were obtained from the website of Ministry of Commerce, Industry and Energy (<http://www.mocie.go.kr>).

D.3. The Calculation of Initial Returns

To estimate the effect of underpricing, initial returns are generally calculated as price change from the offer price to the first day closing price of the IPO stock (Barry, Muscarella et al, 1990; Megginson and Weiss, 1991).

However, the closing price on the first day is not an appropriate measure for calculating initial returns in our KOSDAQ samples, because in our sample period KOSDAQ regulated daily price movements to stay within a band of plus or minus 12% until July 24 2000, and within 100% from July 25 2000. In many IPOs the closing price on the first day of trading reaches these upper limits. Moreover it often keeps on hitting the daily limit for several days in a row.

(Kim and Park, 2002; Berkman and Lee, 2002). Therefore, instead of using the first-day return as the initial return (underpricing), we calculate it as the difference between the offer price and the closing price on the first day that the IPO stock did not hit the daily upper limit (Kim and Park 2002). Since the return is calculated over several days we adjust it by the movement in the KOSDAQ index between the first day of trading and the first day that the IPO stock did not hit the daily upper limit. Accordingly, the initial return is defined as

$$IR_{it} = \frac{P_{it} - P_{i0}}{P_{i0}} - \frac{KQ_{it} - KQ_{i0}}{KQ_{i0}}$$

Where P_{i0} is the offer price of an IPO firm i , P_{it} is the closing price on the first day that the IPO firm did not hit the daily upper limit, KQ_{i0} is the KOSDAQ index on the first day of the IPO stock trading, and KQ_{it} is the KOSDAQ index on the first day that the IPO firm did not hit the daily upper limit.

D.4. Variables

Measures of VC-Backing and VC Reputation

The presence of VC-backing for an IPO is proxied by a dummy variable (VC) which takes the value of 1 when a venture capital company has at least a 5% shareholding. To pick up reputational effects we design a dummy variable which has the value of 1 when one of the “Big Three” venture capital companies [Korean Technology Bank (KTB), Korean Technology Investment (KTI), Korean Development Bank Capital (KDBC)] backs an IPO firm as the lead venture capitalists³.

Measures of Institutional Affiliation

We devise two mutually exclusive dummy variables that take the value of 1 if the lead venture capitalist of an IPO firm is affiliated respectively with a bank or investment bank (security company). Furthermore, in order to capture the effect of direct bank ownership and security firm ownership in an IPO firm respectively we compute two further dummy variables. The first takes the value of 1 when there is one or more significant bank shareholdings (i.e. 5% or over) in the IPO firm at the offer date and zero otherwise, and the second takes the value 1 when at least one investment bank (security company) has a significant share ownership in the IPO firm and zero otherwise⁴.

Underwriter Reputation

Following Megginson and Weiss (1990) and Beatty (1989) we construct a dummy variable set equal to 1 when the underwriter is one of the largest 3 underwriters in Korea and set equal to zero otherwise⁵.

IPO Firm Related Uncertainty

To control for size effects, we employ the natural logarithm of gross proceeds. In a similar way, to control for age effects, we employ the natural logarithm of age at the time of IPO. We also include as variables the shareholdings of the CEO, profitability (EBIT / total assets), the liquidity ratio (total debt / total asset), and R&D intensity (R&D expenditure / total asset) either at or in the last accounting period prior to IPO. High technology sector effects are captured by a dummy variable which equals to 1 if an IPO firm belongs to a high-tech industry and zero otherwise⁶.

Hot and Cold Stock Market Effects

To capture stock market effects, we employ three variables: the number of all IPOs in KOSDAQ in the last month prior to an IPO, the average level of underpricing of the last three IPOs prior to a sample IPO, and the 20-day cumulative market index return prior to IPO. These variables are expected to have a positive relationship with underpricing. We also divide our sample period at March 2000 and carry out univariate and multivariate analyses for the whole period and each of these subperiods up to and following the end of that month.

Share overhang and Price Revision

We measure share overhang as the ratio of pre-IPO shares retained in a firm relative to the number of shares filed for sale to the public. We measure price revision as the ratio of change from original offer price to final offer price.

E. Univariate and Bivariate Analysis

E.1. IPO Firms: The Characteristics of VC and Non-VC backed IPOs

Table II provides a detailed analysis of the characteristics of the IPO firms grouped by VC-backed and non-VC-backed status. In Panel A, a comparison of the size and age of the firms shows that VC-backed IPOs are smaller and younger than those of non-VC-backed IPOs. The age of firms of VC-backed IPOs is, on average, 9.6 years, whereas that of non-VC-backed IPOs is 14.2, with the difference being significant at the 1% level under both the parametric and non-parametric tests. VC-backed firms also have significantly younger CEOs (47.7 years) than non-VC-backed firms (53.0 years). The smaller size of VC-backed firms over non-VC-backed IPOs is reflected in various types of size-related figures: total assets, total debt, turnover, EBIT, and number of employees all of which are significantly different between the groups. For instance, the total asset size of VC-backed IPOs (17.5 BW⁷) is significantly lower than that of non-VC-backed IPOs (78.4 BW) and the turnover of VC-backed IPOs (22.1 BW) is less than a third of that of non-VC-backed IPOs (67.0 BW) and they also have lower total profits measured as earnings before tax and interest (EBIT). They are however more profitable in the last year before IPO (EBIT / Total asset: 15.4% vs. 13.8%). There is, however, not a statistically significant difference in leverage (Total debt/Total asset) or in number of members of the board of directors between the groups. The R&D investment of VC-backed IPOs (843.1 MW) is significantly higher than that of non-VC-backed IPOs (672.9 MW) on the basis of the non-parametric test. Not surprisingly this result combined with the fact that VC-backed IPOs are as we have seen relatively small means that they have significantly higher R&D intensity. Thus their R&D / Total Asset ratio is 7.7% compared with 2.8% for non-VC-backed IPOs. This difference no doubt reflects in part the fact that venture capital backing was more prevalent in high-tech industries such as electronics and ICT which tend to have higher R&D investment than other low-tech industries.

Our univariate analysis also shows that VC-backed IPO recorded higher initial returns compared to non-VC-backed IPOs. The average initial return of VC-backed IPOs was 202.3%, while that of non-VC-backed IPOs was 149.3%. This difference is significant at 10% on both a parametric and non-parametric basis. However, the presence of the differences between these groups of IPOs in terms of size and age in particular means that we would expect these inter-group differences to reflect in part at least the higher uncertainty of the VC backed

group, and the importance of allowing for these effects in our multivariate regression analysis.

Panel B compares offering statistics between VC-backed IPOs and non-VC-backed IPOs. As might be expected from panel A, VC-backed IPOs have smaller market capitalisation volume and gross proceeds than non-VC-backed IPOs. Thus the market capitalisation (offer price multiplied by the number of shares offered), of VC-backed IPOs (54.8 BW) is significantly smaller than that of non-VC-backed IPOs (98.4 BW) and the proceeds figures show that VC-backed IPOs attracted a lower amount of money at IPO (11.6 BW) than non-VC-backed IPOs (16.5 BW). Given these smaller gross proceeds, VC-backed IPO firms paid less underwriting fees (368.8 MW) relative to non-VC-backed IPOs firms (374.3 MW). The lower book-to-market ratio of VC-backed IPOs (0.3) relative to non-VC-backed IPOs (0.6) reflects the findings in Panel A that VC-backed IPOs recorded greater initial returns than did non-VC-backed IPOs. Non-VC backed IPOs were less costly in terms of underwriters' fees in both absolute terms and relative to gross proceeds although only the latter difference was statistically significant. Both the overhang and price revision variables are significantly higher for VC backed IPOs. Since we expect both these variables to also be associated independently with underpricing, it is important to allow for their impact in identifying the impact of VC backing per se.

Table II Descriptive Firm and Offering Statistics of All, VC-backed and non-VC-backed IPOs on KOSDAQ 1999~2001

BM and MW indicate billion Won and million Won (Korean currency), respectively. Asterisks denote significance at the level of 1% (***), 5% (**), and 10% (*).

	All	VC-backed IPOs	Non VC-T-Backed IPOs	T-statistic		Mann-Whitney U	
	Mean	Mean	Mean				
	Median	Median	Median				
<i>A. Firm Characteristics</i>							
Age (Year)	12.1 9.7	9.6 8.1	14.2 11.9	-5.7	***	-5.6	***
Total asset (BW)	50.0 14.9	17.5 12.8	78.4 18.1	-2.5	**	-4.5	***
Total debt (BW)	33.6 7.5	9.4 6.1	54.7 8.5	-2.1	**	-3.8	***
Turnover (BW)	46.1 16.7	22.1 13.9	67.0 20.3	-3.3	***	-4.2	***
EBIT (BW)	2.8 1.9	2.4 1.8	3.1 2.1	-0.8		-2.8	***
EBIT / Total asset (%)	14.6 13.1	15.4 13.9	13.8 11.8	1.3		2.1	**
Total debt / Total asset (%)	49.3 50.1	49.6 50.1	49.1 49.8	0.3		0.3	
R&D (MW)	752.2 240.6	843.1 364.6	672.9 118.8	0.8		4.0	***
R&D intensity(R&D/Total Asset) (%)	5.1 1.0	7.7 2.9	2.8 0.3	4.1	***	5.1	***
Age of CEO	50.5 49.4	47.7 46.4	53.0 53.2	-5.6	***	-5.3	***
Number of board of directors	6.6 6.0	6.3 6.0	6.9 6.0	-2.2	**	-0.8	
Number of employees	180.7 93.0	105.0 77.0	246.4 115.0	-3.9	***	-5.0	***
Initial return (%)	174.0 105.2	202.3 119.4	149.3 100.0	2.1	**	1.8	*
<i>B. Offering Statistics</i>							
Market value of equity (BW)	78.1 27.4	54.8 33.5	98.4 22.5	-1.2		-3.6	***
Gross proceeds (BW)	14.2 6.7	11.6 7.6	16.5 5.4	-1.4		-2.9	***
Book-to-market ratio	0.4 0.3	0.3 0.2	0.6 0.4	-6.4	***	-7.2	***
Underwriting Fees (MW)	371.7 237.3	368.8 261.7	374.3 210.0	-0.1		-1.8	*
Underwriting Fees / Gross Proceeds(%)	3.9 3.8	3.6 3.5	4.1 4.0	-2.2	**	-2.3	**
Price revision (%)	13.4 12.5	23.2 20.0	4.8 0.0	5.0	***	5.3	***
Share overhang	3.4 3.8	3.6 3.9	3.3 3.6	2.4	**	2.3	**
Number of observations	(372)	(173)	(199)				

Source: IPO prospectuses and financial data provided by Korean Information System

E.2. The Ownership Structure of VC backed and Non-VC backed IPO firms

Table III is based on an analysis of shareholdings of 5% or more in VC backed and Non-VC backed groups of IPO firms at the date of the offering as disclosed in the IPO prospectus. We separately identify seven types of holder; CEO, CEO family, board of directors as a whole, venture capitalists, other industrial companies (corporate venture holders) commercial banks, and investment banks (security firms).

By construction the VC backed group has a higher proportion of VC holdings. In both groups of IPOs, however, the largest single significant shareholder is the CEO and there is no difference between the groups in the typical size of this holding which accounts for just less than a third of all the shares. In the case of VC backed IPOs, this is, on average, twice the typical VC holding of 15.1%. This latter figure is quite low, when compared with the average holding of US venture capitalist at IPO (holdings of over a third are for instance reported in Megginson and Weiss (1991)). Board of directors holdings excluding the CEO do not differ significantly between VC-backed IPOs (7.8%) and non-VC-backed IPOs (9.7%). However, the average shareholdings of the CEO's family do show a significant difference (6.1% for VC-backed IPOs, 13.0% for non-VC-backed IPOs). As a result the sum of shareholdings of CEO, CEO family and the Board does differ significantly (VC-backed IPOs (46.2%) and non-VC-backed IPOs (54.4%))

Table III Ownership Structure of Pre-IPO

Asterisks denote significance at the level of 1% (***), 5% (**), and 10% (*).

	<i>VC-Backed IPOs'</i>	<i>Non VC-Backed IPOs'</i>	T-statistic	Mann-Whitney U
CEO stake (%)	32.2 32.8	31.9 31.7	0.18	0.65
CEO's family stake (%)	6.1 1.4	13.0 5.7	-4.60 ***	-3.13 ***
Board of directors stake (%)	7.8 4.2	9.7 2.3	-1.35	-0.86
Insider stake (%) (CEO+ family + BoD)	46.2 48.0	54.4 57.1	-3.05 ***	-3.41 ***
Corporate stake (%)	5.2 0.0	14.0 0.0	-4.00 ***	-3.74 ***
Venture capitalists stake (%)	15.1 13.5	0.0 0.0	26.06 ***	18.00 ***
Banks stake (%)	1.3 0.0	0.7 0.0	1.25	2.11 **
Security company stake (%)	1.6 0.0	2.2 0.0	-0.88	-0.16

Source: IPO prospectuses

Corporate stakes accounted for only 5.2% of total shareholdings of VC-backed IPOs compared with 14.0% of those of non-VC-backed group. This difference is significant at the 1% level. Banks and security firms have small holdings of 2% or less and the differences between the groups are significant only on the basis of a non-parametric test suggesting higher bank holdings in VC-backed-IPOs. Non-VC-backed firms appear therefore to be more closely held in family terms and have higher holdings by other non-financial companies in their equity.

E.3. Underpricing: The effects of VC-backing, market conditions, age, size and sector

Table IV compares underpricing between VC and Non-VC backed firms, stock market conditions, firm age, firm size and the sector of the IPO. The first row replicates, for comparison purposes, our overall underpricing result from Table III.

Table IV shows that IPO firms brought to the stock market in the hot issue period (up until March 2000) recorded significantly higher initial returns (2.80)

on average than those (1.19) in the cold issue market (after March 2000). This result clearly shows that initial returns are closely correlated with market conditions, as argued in Ibbotson, Sindelar et al. (1994) and Lowry and Schwert (2002). Market conditions thus seem to influence the initial returns in the bank-based Korean system much as in other stock market based financial systems.

The initial returns of young firms (2.05) are statistically significantly higher than those of old firms (1.43). This is consistent with the view that investors require a greater risk premium for young firms that generally have more uncertain prospects than established firms. The average initial return of the small market capitalisation group (1.98) also turns out to be statistically significantly higher than that of large market capitalisation group (1.50). This evidence also appears to show that investors demand a higher risk premium on the IPOs of small firms that are recognised as more uncertain and risky than big firms.

Table IV Underpricing by Different Types of IPOs on KOSDAQ 1999-2001

KOSDAQ IPO samples are divided into two groups respectively as: (1) VC-backed Firms (when any venture capitalist owns 5% or more of total shares of an IPO firm) and Non-VC-backed Firms; (2) Hot Market issue (when an IPO was listed in KOSDAQ in the period up to March 2000) and Cold Market issue (after March 2000); (3) Young firms (when the age of firm is equal to or less than the median value, 9.6 years) and Old firms; (4) Small firms (when the market capitalisation calculated as the offer price multiplied by the number of shares is equal to or less than the median value, 2.4 billion Won) and Big firms; (5) High-tech firms (which include Other Machinery and Equipment (KIC 29), Computers and Office Machinery (30) Electrical Machinery and Apparatuses (31) Electronic Components, Radio, Television (32) Medical, Precision and Optical Instruments (33), and Computer and Related Activities (72) as was defined in Chapter 4) and Non-high-tech firms. These different types of groupings apply to the remaining parts of the chapter. Asterisks denote significance levels at the level 1% (***), 5% (**), and 10% (*).

	Mean	Median	Mean	Median	T-statistic	Mann-Whitney U	
(A) Venture-capital-backing							
	VC-backed		Non-VC-backed				
Underpricing (No. IPOs)	2.02 (173)	1.19	1.49 (199)	1.00	2.15	**	1.79 *
(B) Hot Market Issue							
	Hot Market		Cold Market				
Underpricing (No. IPOs)	2.80 (127)	2.14	1.19 (245)	0.89	6.54	***	6.20 ***
(C) Age							
	Young		Old				
Underpricing (No. IPOs)	2.05 (186)	1.23	1.43 (186)	1.00	2.50	**	2.45 **
(D) Market Capitalisation							
	Small		Big				
Underpricing (No. IPOs)	1.98 (186)	1.36	1.50 (186)	0.82	1.96	*	4.15 ***
(E) Industry							
	High-tech		Non-high-tech				
Underpricing (No. IPOs)	1.77 (232)	1.07	1.70 (140)	1.00	0.28		0.01

Source: Korean Information System, IPO prospectuses

There is, however, no significant difference in initial returns for high-tech and non-high-tech companies. The underpricing of the high-tech industry group is 1.77, compared with 1.70 for the non-high-tech group. This is an interesting result, because high-tech stocks (especially relating to information and communication technology) showed a higher initial return than non-high-tech stocks in late 1990s and the first-quarter of 2000 in the US (Schultz and Zaman, 2001).

E.4. Underpricing by VC-backed and non-VC-backed IPOs: Bivariate Analysis

In this section, we display a bivariate analysis of underpricing by VC-backed IPOs and non-VC-backed IPOs respectively cross-classified by market condition, age, market capitalisation and industry.

Panel A of Table V shows that the initial return of VC-backed firms is statistically significantly higher in the hot market (3.61) than in the cold market (1.11). Although the initial return of non-VC-backed firms is also higher in the hot market (2.00) than in the cold market (1.25), the difference of the initial returns is not as severe as in the case of VC-backed firms. But, the difference is still significant at the 5% level. This tendency for the initial return to be higher in the hot market regardless of VC-backing clearly shows that the high initial returns of the whole sample in KOSDAQ might be driven by the overreaction of investors in the hot market (Kim and Park, 2002). However, the final two rows of Panel A show that VC backed firms were significantly more underpriced than Non-VC backed firms in only the hot market. VC backing has no significant impact in the cold period. In Panel B, young firms show higher returns than old firms in both VC-backed and non-VC-backed IPOs. The initial return of young firms in the VC-backing group is 2.37, compared with 1.41 of old firms in the same group. The difference of the initial returns is significant at the 5% level using the t-test. For non-VC-backed firms, the difference of initial returns between young firms (1.58) and old firms (1.44) is no less acute than the case of VC-backed firms, but the difference is only significant at the 10% level using the Mann-Whitney test. The final two rows of Panel B show, however, that VC backing only has an effect on underpricing within the younger group. It does not appear to have an impact amongst older firms. In Panel C we find that small firms have statistically significantly higher underpricing than large firms for both the VC-backed and the non-VC-backed firms. Moreover, as the results in the final two rows of the Panel show VC backing is associated with higher underpricing irrespective of size.

Table V IPO Underpricing by VC-backing and Non-VC-backing Classified by State of the Market, Age, Market Capitalisation and Industry on KOSDAQ 1999~2001

Asterisks denote significance levels at the level of 1% (***), 5% (**), and 10% (*).

	Mean	Median	Mean	Median	T-statistic	Mann-Whitney U
Panel A: Hot Market Issue						
	Hot market		Cold market			
VC-backing (No. IPOs)	3.61 (63)	2.38	1.11 (110)	0.76	6.51	*** 6.73 ***
Non-VC-backing (No. IPOs)	2.00 (64)	1.34	1.25 (135)	1.00	2.48	** 2.07 **
T-statistic	2.84	***	-0.74			
MW U	3.50	***	0.84			
Panel B: Age						
	Young		Old			
VC-backing (No. IPOs)	2.37 (111)	1.22	1.41 (62)	1.07	2.25	** 1.30
Non-VC-backing (No. IPOs)	1.58 (75)	1.24	1.44 (124)	0.93	0.44	1.68 *
T-statistic	2.01	**	-0.10			
MW U	0.79		1.07			
Panel C: Market Capitalisation						
	Small		Big			
VC-backing (No. IPOs)	2.42 (67)	1.84	1.77 (106)	0.93	1.55	3.59 ***
Non-VC-backing (No. IPOs)	1.73 (119)	1.20	1.14 (80)	0.61	2.03	** 2.97 ***
T-statistic	2.07	**	1.70	*		
MW U	2.51	**	1.54			
Panel D: Industry						
	High-tech		Non-high-tech			
VC-backing (No. IPOs)	1.93 (133)	1.19	2.34 (40)	1.17	-0.84	-1.22
Non-VC-backing (No. IPOs)	1.55 (99)	1.02	1.44 (100)	0.98	0.38	0.39
T-statistic	1.17		2.15	**		
MW U	0.78		2.15	**		

Source: Korean Information System, IPO prospectuses

Finally, Panel D shows insignificant differences in the average initial return between high-tech firms and non-high-tech firms whether or not they are VC backed. However, within the high-tech group there is significantly higher underpricing in the VC-backed group. Thus the VC backed group are associated with those high tech IPOs displaying the highest initial returns.

E.5. Underpricing by Types of Institutional Affiliation of the VC-backers of IPO firms

Table VI repeats the analysis of the previous section but this time in the context of testing for differences *within* the VC backed group distinguishing between bank-affiliated VC-backed IPOs, security company-affiliated VC-backed IPOs, other institution-affiliated VC-backed IPOs (excluding bank-affiliated and security company-affiliated) and non-VC-backed IPOs. The initial returns are compared among these four groups for all IPO firms, cross classified by whether their IPO firms were brought to market in the hot or cold market periods, respectively.

The first row of Table VI shows that the initial return of the bank-affiliated group is 2.33, followed by 2.06 of the other institution-affiliated, 1.49 for the non-VC-backed and 1.29 for the security company-affiliated group. The difference of the initial returns is, however, significant only between other institution-affiliated VC and non-VC-backed. There is thus no evidence of certifying effects on this basis.

Table VI Underpricing by Institutional Type of VC-backing on KOSDAQ 1999~2001

Note 1) Significance of mean difference between groups (Kruskal-Wallis test)⁸

Note 2) Significance of mean difference between hot and cold markets for each group (Mann-Whitney test)

	Bank-affiliated VC		Security Company-affiliated VC		Other Institution-affiliated VC		Non-VC-backed		Significance ¹⁾
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	
(A) Total									
	(a)		(b)		(c)		(d)		
Underpricing	2.33	1.26	1.29	1.19	2.06	1.15	1.49	1.00	c>d at 10%
(No. IPOs)	(32)		(19)		(122)		(199)		
(B) Hot Market									
	(e)		(f)		(g)		(h)		
Underpricing	4.68	4.43	1.48	2.00	3.54	2.38	2.00	1.34	e>f at 5% e>g at 10% e>h at 1% g>h at 1%
(No. IPOs)	(13)		(5)		(45)		(64)		
(C) Cold Market									
	(i)		(j)		(k)		(l)		
Underpricing	0.72	0.58	1.22	0.86	1.19	0.89	1.25	1.00	
(No. IPOs)	(19)		(14)		(77)		(135)		
Significance ²⁾	e>i at 1%				g>k at 1%		h>l at 5%		

Source: Korean Information System, IPO prospectuses

The second panel shows that in the hot market bank-affiliation is statistically significantly associated with higher underpricing than in any of the other three groups. The final panel shows that there are no significant differences in the cold market. The final row of the Table shows that for each group of VC firms, except for those which are investment bank (security firm) affiliated, underpricing was higher in the hot than the cold market. So all these groups were affected in the same direction by the market conditions.

F. Multivariate Analysis

F.1. Multivariate Regression Models

We construct three regression models. In estimating each we regress independent dummy variables capturing VC backing effects and our other reputation ownership and control variables against underpricing (initial returns).

Model 1 tests for the impact of VC-backing. Model 2 tests for the impact of VC-reputation. Model 3 tests for the institutional affiliation of VC-backing. Each of the three regressions is estimated with a constant term and include the variables controlling respectively for the effect of IPO company characteristics, offering characteristics and stock market conditions. All results presented are shown with heteroskedastic robust standard errors. The three regression models are estimated for three time periods: the whole sample from April 1999 to end September 2001; the hot market sub period from April 1999 to end March 2000; the cold market subperiod from April 2000 to September 2001.

F.2. Results

In Table VII, in the whole sample taking all three regression models together we find that none of the VC reputational backing or affiliation variables has a statistically significant effect upon underpricing. Thus in a multivariate context for the whole period the univariate findings of VC related certifying or reputational effects disappear. Only the investment bank (security company) affiliated indicator shows an impact that is statistically significant. It is however the opposite of that predicted by the literature since in Model 3 its presence reduces underpricing. Underwriter reputation has an insignificantly but correctly signed negative impact.

As far as the control variables are concerned, a number of clear findings emerge. Age and gross proceeds are significantly negatively related to underpricing in all three model specifications. The age and size results are thus consistent with the negative impact of maturity and scale on underpricing as a result of lower uncertainty. CEO stake is also negatively related to underpricing in some runs but becomes insignificant when other share ownership variables are added. The table also shows that proximate stock market conditions are closely related to underpricing. The cumulative market index return has a strong positive relationship with underpricing. As was also expected, offer price revision is positively related to underpricing at the 1% level. Overhang has no effect. Cumulative share price movements have the expected positive sign and are significant, whilst contemporary pricing movements are, as predicted, positive but insignificantly so. Profitability leverage and R&D also have the expected signs but are statistically insignificant.

Table VII OLS Regression on Underpricing for KOSDAQ IPOs in the Whole Market

Regression for underpricing in the whole market. Variables are defined as are specified in the table. All coefficients' t-statistics in the parentheses are heteroskedasticity consistent. Asterisks beside t-statistics *, **, *** denote significance at 10%, 5%, 1% level, respectively.

	Model 1			Model 2			Model 3		
Age (ln)	-0.36	(-1.93)	*	-0.36	(-1.86)	*	-0.41	(-2.16)	**
Gross proceeds (ln)	-0.42	(-4.38)	***	-0.43	(-4.24)	***	-0.43	(-4.36)	***
CEO stake	-0.98	(-1.76)	*	-0.97	(-1.87)	*	-0.82	(-1.43)	
EBIT / Total asset	-0.48	(-0.47)		-0.45	(-0.48)		-0.23	(-0.21)	
Total debt / Total asset	1.34	(1.59)		1.34	(1.57)		1.36	(1.55)	
High tech dummy	-0.08	(-0.30)		-0.08	(-0.32)		-0.10	(-0.38)	
R&D intensity(R&D expenditure/Total asset)	1.40	(0.87)		1.41	(0.90)		1.52	(0.96)	
IPO Number of last month prior to IPO	-0.01	(-1.44)		-0.01	(-1.44)		-0.01	(-1.43)	
Contemporary underpricing	0.12	(1.41)		0.12	(1.43)		0.11	(1.30)	
Cumulative market index return (20 day)	3.44	(3.55)	***	3.42	(3.56)	***	3.45	(3.63)	***
Share overhang	0.15	(1.43)		0.15	(1.42)		0.15	(1.42)	
Price revision	1.34	(3.33)	***	1.34	(3.24)	***	1.33	(3.08)	***
VC-backed	0.00	(0.02)							
Top 3 tier VCs-backed				0.07	(0.18)				
Bank-affiliated VC-backed							0.15	(0.29)	
Security company-affiliated VC-backed							-0.61	(-2.01)	**
Bank has shareholding							-0.02	(-0.06)	
Security company has shareholding							0.42	(0.88)	
Top 3 tier underwriters involved	-0.20	(-0.57)		-0.19	(-0.57)		-0.17	(-0.48)	
Constant	11.64	(4.27)	***	11.66	(4.10)	***	11.81	(4.36)	***
Probability > F	0.00			0.00			0.00		
Adjusted R-square	0.22			0.22			0.23		
No. of IPOs	372			372			372		

Disaggregating the results by time period yields important differences and suggests that the overall period results aggregate across two rather different market regimes. In Table VIII covering the hot market period, the regression results for the VC backing, affiliation and reputational variables are generally consistent with those of the whole market period yielding insignificant effects. Once again the investment bank (security company) variable is statistically significantly negatively related to underpricing. Stock market situation variables are as before also positively related to underpricing. The cumulative market index return is very strongly related to the underpricing (coefficients ranging from 4.74 to 4.85 with t-statistics from 2.16 to 2.22). Price revision is also found to have a strongly positive relationship with underpricing. Amongst the control variables, the most notable change is the increased value and significance of the coefficients on age. In hot market conditions it appears that maturity becomes a more potent indicator of reduced uncertainty. Size, on the other hand, becomes insignificant. The other variables are similar in size and significance as they were for the whole period estimation.

In the cold market period results shown in Table VIII, the most striking change in the regression results is in the behaviour of the VC ownership variable. Although the significance of VC-backing per se remains insignificant in Model 1, in the other two models, the VC-reputation and bank-affiliated VC variables exhibit significantly negative coefficients. Bank shareholding is also found to reduce underpricing at the 10% level. Security company affiliation effects disappear whilst the underwriter reputational variable becomes significant and with the expected negative sign. It thus appears that in the more stable conditions of the cold market there are as predicted by the certification and reputation models significant effects leading to reduced underpricing linked to bank affiliated VC backing, VC reputation and underwriter reputation.

The main changes in the other variables are that age and size have the correct negative signs as uncertainty reducing factors although in this case it is size which is statistically significant. The price revision positive impact is reinforced as is the impact of the proximate stock price movement variables. The number of IPOs in the previous month becomes significantly negative.

Table VIII OLS Regression on Underpricing for KOSDAQ IPOs in the Hot and Cold Markets

Regression for underpricing in the hot market and the cold market that are divided by whether the IPO were listed before/after April 2000. Variables are defined as are specified in the table. All coefficients' t-statistics in the parentheses are heteroskedasticity consistent. Asterisks beside t-statistics *, **, *** denote significance at 10%, 5%, 1% level, respectively.

	Hot Market						Cold Market					
	Model 1		Model 2		Model 3		Model 1		Model 2		Model 3	
Age (ln)	-1.24	(-2.75) ***	-1.24	(-2.72) ***	-1.23	(-2.72) ***	0.03	(0.23)	0.03	(0.23)	0.03	(0.22)
Gross proceeds (ln)	-0.18	(-0.96)	-0.18	(-0.95)	-0.14	(-0.79)	-0.61	(-5.95) ***	-0.60	(-5.96) ***	-0.63	(-5.99) ***
CEO stake	-1.88	(-1.36)	-1.77	(-1.61)	-1.58	(-1.24)	-0.23	(-0.64)	-0.28	(-0.78)	-0.24	(-0.64)
EBIT / Total asset	1.10	(0.48)	1.18	(0.56)	0.99	(0.41)	0.47	(0.99)	0.28	(0.54)	0.49	(0.98)
Total debt / Total asset	2.14	(1.22)	2.13	(1.22)	2.16	(1.09)	-0.27	(-0.88)	-0.23	(-0.77)	-0.17	(-0.54)
High-tech dummy	0.50	(0.93)	0.47	(0.84)	0.45	(0.84)	-0.27	(-1.35)	-0.28	(-1.46)	-0.27	(-1.40)
R&D intensity(R&D expenditure/Total asset)	2.75	(0.93)	2.76	(1.01)	2.87	(1.02)	0.61	(0.85)	0.50	(0.69)	0.57	(0.77)
IPO Number of last month prior to IPO	-0.02	(-1.52)	-0.02	(-1.48)	-0.02	(-1.47)	-0.04	(-3.87) ***	-0.04	(-3.88) ***	-0.04	(-3.88) ***
Contemporary underpricing	-0.21	(-1.62)	-0.20	(-1.64)	-0.20	(-1.70) *	0.25	(3.74) ***	0.25	(3.87) ***	0.25	(3.93) ***
Cumulative market index return (20 day)	4.85	(2.21) **	4.91	(2.22) **	4.74	(2.16) **	1.18	(2.92) ***	1.29	(3.17) ***	1.11	(2.71) ***
Share overhang	0.20	(1.12)	0.19	(1.05)	0.19	(1.02)	-0.01	(-0.13)	0.00	(-0.01)	0.00	(0.01)
Price revision	2.53	(1.94) *	2.54	(1.92) *	2.35	(1.61)	0.97	(3.12) ***	1.00	(3.03) ***	0.98	(3.04) ***
VC-backed	0.00	(0.00)					-0.08	(-0.51)				
Top 3 tier VCs-backed			0.27	(0.34)					-0.39	(-2.00) **		
Bank-affiliated VC-backed					0.71	(0.62)					-0.29	(-1.86) *
Security company-affiliated VC-backed					-1.77	(-2.34) **					0.10	(0.39)
A bank has shareholding					0.30	(0.28)					-0.38	(-1.91) *
A security company has shareholding					0.44	(0.36)					0.23	(1.35)
Top 3 tier underwriters involved	0.22	(0.27)	0.20	(0.26)	0.30	(0.35)	-0.33	(-2.04) **	-0.36	(-2.27) **	-0.32	(-2.05) **
Constant	8.48	(1.56)	8.49	(1.54)	7.35	(1.45)	15.88	(6.46) ***	15.74	(6.43) ***	16.25	(6.44) ***
Probability > F	0.00		0.00		0.00		0.00		0.00		0.00	
Adjusted R-square	0.29		0.29		0.31		0.38		0.39		0.39	
No. of IPOs	127		127		127		245		245		245	

It seems that, in hot market contagion conditions where the demand for shares exceeds the supply, the certifying and reputation effects predicted to be associated with VC backing and various reputational variables associated with underwriter reputation and bank backing count for nothing. There is nothing in a name and any IPO rose smells just as sweet. A name does not matter in hot markets. In the cold market, the scope for a reputable financial player's name to sweeten an IPO rose can lower the degree of underpricing (Carter and Manaster, 1990). The significantly negative relationship of bank-affiliated VC, VC reputation and underwriter reputation to underpricing in cold markets is thus consistent with the predictions of the reputational and certifying predictions of the information asymmetry models. These models do not hold however in the hot market.

G. Conclusion

In this paper we tested the propositions that VC-backing, the reputation of venture capitalists and the institutional affiliation of VC-backers would reduce IPO underpricing. We tested these propositions on a large sample of IPOs on KOSDAQ over the period of 1999~2001. Our analysis controlled for a wide range of control and other variables that affect underpricing and we distinguished two sub-periods of analysis corresponding to hot and cold market conditions. We found that the hypothesized venture capital participation and reputational effects occurred only in cold market conditions and that the whole period results represented the aggregation of two rather different regimes. In the hot market, it appears that names make very little difference as everyone is swept up in the contagion. Only maturity and investment bank (security company) backing afforded any downward pressure on underpricing, and overall underpricing was at its peak. In the cold market behaviour more consistent with the conventional asymmetric pricing models emerges the name does matter.

Notes

¹ We do not consider in this paper venture capital investments realised by M&A or other exit routes other than IPO.

² If the venture capitalists invest less than 5% in the IPO firm they do not appear in the ownership section of the IPO prospectus. Where the venture capitalists own less than a 5% share of an IPO firm, the firm is classified as 'non-VC-backed' in our analysis. Holdings of less than 5% may indicate that the venture capitalists are not interested in the management of the IPO firm as minor shareholders. In this case, they are considered as not contributing to the certification of the firm or adding value.

³ KTB, KTI and KDBC, account for the majority of Korean venture capital financing. Differences in the extent of VC-backing and the reputation of the venture capitalist have been proxied elsewhere by representation on the board of directors (Barry, Muscarella et al, 1990), pre- and post-issue equity shares owned by venture capitalists (Field and Hanka, 2000), the number of venture capitalists having equity position in the IPO firm (Gompers, 1995), the age of lead venture capitalist at the time of IPO (Gompers, 1996) or in the same spirit as here by a dummy variable representing market share of IPOs (Beatty, 1989).

⁴ There were no cases in the sample when both a security firm and a bank held a significant shareholding as defined in this study.

⁵ The big three underwriters Investment and Security, Daishin Securities and Samsung Securities Co. account for over 50% of the market where we measure the market share by dividing the whole gross proceeds of the IPO firms sponsored by an underwriter by the sum of the gross proceeds of all the IPO firms.

⁶ The classification of high-tech industry and non-high-tech industry follows that in Loughran and Ritter (2001). The high-tech industries include Other Machinery and Equipment (Korean Industry Classification Code 29), Computers and Office Machinery (30) Electrical Machinery and Apparatuses (31) Electronic Components, Radio, Television (32) Medical, Precision and Optical Instruments (33), Computer and Related Activities (72).

⁷ BW: Billion Won, MW: Million Won

⁸ In this and following tables where comparisons are made across more than two categories we use the non-parametric Kruskal-Wallis test. If, and only if, this test reveals the presence of statistically significant differences across the groups as a whole a simple extension permits a series of tests of all pair wise comparisons across the groups (Conover, 1980, pp 229-237). The results of such pair wise tests are reported accordingly.

References

- Admati, A. R. and Pfleiderer, P., 1994, Robust Financial Contracting and the Role of Venture Capitalists, *Journal of Finance*, 49, 371-402.
- Aggarwal, R. and P. Rivoli, 1990, Fads in the initial public offering market?, *Financial Management*, 19, 45-57.
- Allen, F. and Faulhaber, G., 1989, Signalling by Underpricing in the IPO Market, *Journal of Financial Economics*, 23, 303-323.
- Aoki, M., 2000, Information, corporate governance, and institutional diversity: competitiveness in Japan, the USA, and the transitional economies (Oxford: Oxford University Press).
- Aoki, M. and Patrick, H., 1994, The Japanese main bank system: its relevance for developing and transforming economies (Oxford: Oxford University Press).
- Barry, C. B., Muscarella, C. J., Peavy III, J. W. and Vetsuypens, M. R., 1990, The Role of Venture Capital in the Creation of Public Companies: Evidence from the Going Public Process, *Journal of Financial Economics*, 27, 447-471.
- Barry, C., Gilson R., and Ritter, J. R., 1998, Initial Public Offerings and Fraud on the Market, Working Paper, Texas Christian University, Stanford University and University of Florida.
- Beatty, R., 1989, Auditor Reputation and the Pricing of IPOs, *Accounting Review*, 64, 693-709.
- Beatty, R. and Ritter J. R., 1986, Investment Banking, Reputation, and the Underpricing of Initial Public Offerings, *Journal of Financial Economics*, 15, 213-232.
- Benveniste, L. M. and Spindt, P. A., 1989, How Investment Bankers Determine the Offer Price and Allocation of New Issues, *Journal of Financial Economics*, 24, 343-362.
- Berkman, H. and Lee, J. B. T., 2002, The Effectiveness of Price Limits in an Emerging Market: Evidence from the Korean Stock Exchange, *Pacific-Basin Finance Journal*, 10, 517-530
- Bessler, W. and Kurth, A., 2003, The Performance of Venture-Backed IPOs in Germany: Exit Strategies, Lock-up Periods, and Bank Ownership, European Financial Management Association 2004 Basel Meeting Paper.

- Bradley, D. J. and Jordan, B. D., 2002, Partial Adjustment to Public Information and IPO Underpricing, *Journal of Financial and Quantitative Analysis*, 37, 595-616.
- Calomiris, C. W. and Ramirez, C. D., 1996, Financing the American Corporation: The Changing Menu of Financial Relationships, NBER Working Papers, National Bureau of Economic Research H0079.
- Carter, R., Dark, F. and Singh, A., 1998, Underwriter Reputation, Initial Returns, and the Long-Run Performance of IPO Stocks, *Journal of Finance*, 53, 285-311.
- Carter, R. and Manaster, S., 1990, Initial Public Offerings and Underwriter Reputation, *Journal of Finance*, 45, 1045-1068.
- Chan, Y. S., Siegel, D. and Thakor, A. V., 1990, Learning, Corporate Control and Performance Requirements in Venture Capital Contracts, *International Economic Review*, 31, 365-381
- Chemmanur, T. and Fulghieri, P., 1998, A Theory of the Going-Public Decision, *Review of Financial Studies*, 12, 249-279,
- Conover, W. J., 1980, *Practical Nonparametric Statistics* (John Wiley & Sons, New York).
- Cornelli, F. and Yosha, O., 1997, Stage Financing and the Role of Convertible Debt, Discussion Paper, Centre for Economic Policy Research 1735.
- Daily, M. D., Trevis Certo, S., Dalton, D. R. and Roengpitya, R., 2003, IPO Underpricing: A Meta-Analysis and Research Synthesis, *Entrepreneurship Theory and Practice* Spring, 271-295
- Edwards, J. and Fischer, K., 1994, *Banks, Finance and Investment in Germany* (Cambridge: Cambridge University Press).
- Espenlaub, S., Garrett, I. and Wei, P. M., 1999, Conflicts of Interest and the Performance of Venture-Capital-Backed IPOs: A Preliminary Look at the UK, *Venture Capital*, 1, 325-349.
- European Venture Capital Association, 2001, *EVCA 2000 Yearbook*.
- European Venture Capital Association, 2002, *EVCA 2001 Yearbook*.
- European Venture Capital Association, 2003, *EVCA 2002 Yearbook*.
- Field, L. and Hanka, G., 2000, The Expiration of IPO Share Lockups, *Journal of Finance*, 56, 471-501.

- Francis, B. B. and Hasan, I., 2001, Underpricing of Venture and Non Venture Capital IPOs: An Empirical Investigation, *Journal of Financial Services Research*, 19, 99-113.
- Gompers, P. and Lerner, J., 1996, The use of covenants: An empirical analysis of venture partnership agreements, *Journal of Law and Economics*, 39, 463-498.
- Gompers, P. and Lerner, J., 1999, Conflict of Interest in the Issuance of Public Securities: Evidence from Venture Capital, *Journal of Law and Economics*, 42, 1-28.
- Gompers, P., 1995, Optimal Investment, Monitoring, and the Staging of Venture Capital, *Journal of Finance*, 50, 1461-1489.
- Gompers, P., 1996, Grandstanding in the Venture Capital Industry, *Journal of Financial Economics*, 42, 133-156.
- Gompers, P., and Lerner, J., 2001, *The Money of Invention: How Venture Capital Creates New Wealth* (Boston: Harvard Business School Publishing).
- Grinblatt, M. and Hwang, C., 1989, Signalling and the Pricing of New Issues, *Journal of Finance*, 44, 383-420.
- Guo, R. J., Lev, B. and Shi, C., 2006, Explaining the Short and Long Term IPO Anomalies in the USA by R&D, *Journal of Business Finance & Accounting*, 33, 550-579.
- Hamao, Y., Packer, F. and Ritter, J. R., 2000, Institutional Affiliation and the Role of Venture Capital: Evidence from Initial Public Offerings in Japan, *Pacific-Basin Financial Journal*, 8, 529-558.
- Hellmann, T., Lindsey, L. and Puri, M., 2003, *Building Relationships Early: Banks in Venture Capital*, Working paper, Stanford University
- Hellmann, T. and Puri, M., 2000a, The Interaction between Product Market and Financing Strategy: The Role of Venture Capital, *Review of Financial Studies*, 13, 959-984.
- Hellmann, T. and Puri, M., 2000b, Venture Capital and the Professionalisation of Start-up Firms: Empirical Evidence, *Journal of Finance*, 57, 169-197.
- Holland, K. and Horton, J., 1993, Initial Public Offerings on the Unlisted Securities Market: the Impact of Professional Advisers, *Accounting and Business Research*, 24, 19-34.

- Ibbotson, R. G., Sindelar, J. and Ritter, J. R., 1994, The Market's Problems with the Pricing of Initial Public Offerings, *Journal of Applied Corporate Finance*, 7, 66-74.
- Jain, B. A. and Kini, O., 2000, Does the Presence of Venture Capitalists Improve the Survival Profile of IPO Firms?, *Journal of Business Finance and Accounting*, 27, 1139-1183.
- Kim, J. B., Krinsky, I. and Lee, J., 1995, The Aftermarket Performance of Initial Public Offerings in Korea, *Pacific-Basin Financial Journal*, 3, 429-448.
- Kim, J. I. and Park, I. U., 2002. Stock Market Condition and Pricing of Initial Public Offerings: A Theory and Evidence from the KOSDAQ Stock Market, *Korean Economic Review*, 18, 349-371.
- Kim, B-J, Kish, R.J. and Vasconcellos, G.M. 2002 'The Korean IPO Market: Initial Returns Review of Pacific Basin Financial Markets and Policies Vol. 5, No.2 219-253
- Korean Venture Capital Association, 2001, 2000 Korean Venture Capital Yearbook.
- Korean Venture Capital Association, 2002, 2001 Korean Venture Capital Yearbook.
- Korean Venture Capital Association, 2003, 2002 Korean Venture Capital Yearbook.
- KOSDAQ, <http://www.kosdaq.or.kr>.
- KOSDAQ, 2003, Comparison of Major Yearly Statistics between KOSDAQ and KSE, www.kosdaq.or.kr.
- Korean Stock Exchange, www.kse.or.kr.
- Kortum, S. and Lerner, J., 1998, Does Venture Capital Spur Innovation?, NBER Working Papers, National Bureau of Economic Research 6846.
- Lee, P. M. and Wahal, S., 2004, Grandstanding, Certification and the Underpricing of Venture Backed IPOs, *Journal of Financial Economics*, 73, 375-407
- Lerner, J., 1994, The syndication of venture capital investments, *Financial Management*, 23, 16-27.
- Li, X. and Masulis, R. W., 2003, Venture Capital Investments by IPO Underwriters: Certification or Conflict of Interest?, Working paper, University of Miami and Vanderbilt University.

- Logue, D., Rogalski, R. J., Seward, J. K. and Foster-Johnson, L., 2002, What is Special about the Roles of Underwriter Reputation and Market Activities in Initial Public Offerings?, *Journal of Business*, 75, 213-243
- London Stock Exchange, 2002, Market Statistics, www.londonstockexchange.com.
- Loughran, T. and Ritter, J. R., 2002, Why Don't Issuers Get Upset about Leaving Money On the Table in IPOs?, *Review of Financial Studies*, 15, 413-443.
- Lowry, M. and Schwert, G. W., 2002, IPO Market Cycles: Bubbles or Sequential Learning?, *Journal of Finance*, 57, 1171-1200.
- Meggison, W. L. and Weiss, K. A., 1991, Venture Capitalist Certification in Initial Public Offerings, *Journal of Finance*, 46, 879-903.
- Ministry of Commerce, Industry and Energy, <http://www.mocie.go.kr>.
- National Venture Capital Association, 2001, 2000 National Venture Capital Association Yearbook.
- National Venture Capital Association, 2002, 2001 National Venture Capital Association Yearbook.
- National Venture Capital Association, 2003, 2002 National Venture Capital Association Yearbook.
- NASDAQ Newsroom, 2003, Market Performance, www.nasdaqnews.com.
- OECD, 2003, Venture Capital Policy Review: United States, Working Paper, Science, Technology and Industry Department.
- Prowse, S., 1990, Institutional Investment Patterns and Corporate Financial Behaviour in the United States and Japan, *Journal of Financial Economics*, 27, 43-66.
- Rajan, R., and Servaes, H., 1997, Analyst Following of Initial Public Offerings, *Journal of Finance*, 52, 507-529.
- Rindermann, G., 2002, Venture Capitalist Participation and Post-Issue Performance of IPO Firms: Empirical Evidence from France, Germany and U.K., Working Paper, University of Munster.
- Ritter, J. R., 1998, Initial Public Offerings. In D. Logue and J. Seward (eds) *Contemporary Finance Digest Vol. 2 No. 1*, 5-30.
- Rock, K., 1986, Why New Issues Are Underpriced, *Journal of Financial Economics*, 15, 187-212.

- Sahlman, W. A., 1990, The Structure and Governance of Venture-Capital Organizations, *Journal of Financial Economics*, 27, 473-521.
- Schultz, P. and Zaman, M., 2001, Do the individuals closest to internet firms believe they are overvalued?, *Journal of Financial Economics*, 59, 347-381.
- Stuart, T. E., Hoang, H. and Hybels, R. C., 1999, Inter-organisational Endorsements and the Performance of Entrepreneurial Ventures, *Administrative Science Quarterly*, 44, 315-349.
- Titman, S. and Trueman. B., 1986, Information Quality and the Valuation of New Issues, *Journal of Accounting and Economics*, 8, 159-172.
- Welch, I., 1989, Seasoned Offerings, Imitation Costs, and the Underpricing of Initial Public Offerings, *Journal of Finance*, 44, 421-449..