Managerial Over-optimism and Agency Costs of Debt: Evidence from High-tech IPO Firms in Korea

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ABSTRACT: We examine whether the combination of agency costs of debt and managerial optimism in high-tech IPOs creates inefficient R&D investment, thus undermining corporate value. We find that high-tech IPO firms with a high debt ratio exhibit a positive relationship between discretionary and future R&D expenses at the IPO point. We also find a negative relationship between discretionary R&D expenses and the long-term cumulative abnormal return. Furthermore, managerial optimism and agency costs of debt can increase during an IPO, reducing future value. Thus, a stock return decrease after an IPO may be influenced by management's psychological errors and shareholders' preferences for risky investments.

KEY WORDS: IPO, high-tech firm, discretionary R&D expense, managerial over-optimism, agency cost of debt

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I. Introduction

We examine whether the combination of agency costs of debt and managerial optimism in high-tech IPOs undermines corporate value. We expect that when a high-tech firm succeeds in an IPO, its managers show higher self-assurance and managerial optimism, resulting in inefficient R&D investment. In particular, managers of IPO firms with a high debt ratio are likely to continue their inefficient R&D expenditure, owing to agency problems (shareholders' risk preferences and motivation for overinvestment) and management's psychological errors. We classify high-tech IPO firms into those with high and low debt ratios and, for each group, analyze how managers' R&D spending behavior at the IPO point affects future R&D investment and stock returns.

Our study is based on two theories. The first is related to managers' self-assurance and managerial optimism and is based on behavioral finance, which studies the effect of psychology on investors' behavior, explaining that investors sometimes make unreasonable decisions because of psychological biases in their decision-making processes. Several prior studies show that psychological errors affect investors' financial decision-making processes (Barber and Odean, 2001; Ben-David et al., 2013; Cai and Vijh, 2007; Cordeiro, 2009; Lin et al., 2005; Malmendier and Tate, 2005, 2008;; Roll, 1986). The second theoretical background is related to shareholders' preferences for risky investments and their motivation for overinvesting and is based on agency costs of debt. Unlike agency problems between managers and shareholders, agency problems between creditors and shareholders can create incentives for shareholders to overinvest and prefer risk, thus reducing the corporate value of firms with a high debt ratio (Degryse et al., 2012; Jensen and Meckling, 1976; Leary and Roberts, 2010; Myers, 1977; Opler and Titman, 1994).

Based on these two theories, we assume that over-optimistic overinvestment by management occurs shortly after a successful IPO in high-tech firms with a high debt ratio. Qian et al. (2012) showed that R&D expenses that exceed market expectations (discretionary R&D expenses) may partly reflect managerial over-optimism. From a similar perspective, we measure the size of managerial optimism using discretionary R&D expenses in the IPO year, and analyze the effect of such expenses on future R&D investment and the long-term cumulative abnormal return after the IPO. We also analyze whether these effects differ between firms with high and low debt ratios.

The results of our empirical analysis confirm that for high-tech IPO firms with a high debt ratio, those with high discretionary R&D expenses show higher future R&D investment, but lower stock performance. Our results show that future value may decrease in high-tech IPO firms owing to agency costs of debt and managerial optimism.

II. Research Model

Our sample of firms is divided into those with high and low debt ratios. For each group, we apply a regression model to analyze the effect of discretionary R&D expenses on future investments and performance. In our regression model, $DiscR\&D_i$ denotes the discretionary R&D expenses in the IPO year for high-tech firms; $Post\ R\&D\ Invest_i$ is the total R&D expenditure for the two years following the IPO; $Long\ Term\ CAR_i$ denotes the size-adjusted cumulative abnormal return over 240 and 480 days after the IPO; and we define high- and low-leverage firms, following Ahn et al. (2006), to compute the industry-adjusted leverage. Specifically, we first compute the median leverage ratio for each industry in each year. Then, we divide the sample in each year based on firms with leverage ratios that are higher or lower than the industry median ratio. Specifically, we consider the dummy variable $LEV\ highD_i$, which takes the value one if a sample firm has a leverage ratio higher than the industry median ratio each year, and zero otherwise.

To test our main hypothesis that an overinvestment in R&D may undermine future corporate value in high-tech IPO firms with high agency costs of debt and managerial optimism, we consider models 1 and 2, focusing on the interaction terms between leverage and discretionary R&D expenses.

Model 1:

$$PostR\&D\ \ Invest_i = \beta_0 + \beta_1 DiscR\&D_i + \beta_2 DiscR\&D_i * LEV\ \ highD_i + \beta_3 LEV\ \ highD_i + \beta_4 DA\_K_i + \beta_5 OWNER_i + \beta_6 UWRANK_i + \beta_7 PROCEEDS_i + \beta_8 LogSALES_i + \beta_9 BTM_i + \beta_{10} CFO_i + \beta_{11} AGE_i + \beta_{12} AUDITOR_i + \beta_{13} MARKET_i + \sum YEAR\_D_i + \varepsilon_i \quad (1)$$

Model 2:

$$LongTerm\ \ CAR_i = \beta_0 + \beta_1 DiscR\&D_i + \beta_2 DiscR\&D_i * LEV\ \ highD_i + \beta_3 LEV\ \ highD_i + \beta_4 DA\_K_i + \beta_5 OWNER_i + \beta_6 UWRANK_i + \beta_7 PROCEEDS_i + \beta_8 LogSALES_i + \beta_9 BTM_i + \beta_{10} CFO_i + \beta_{11} AGE_i + \beta_{12} AUDITOR_i + \beta_{13} MARKET_i + \sum YEAR\_D_i + \varepsilon_i \quad (2)$$

To calculate the discretionary R&D expenses in the IPO year, we follow Qian et al. (2012). Specifically, we deduct the estimated normal R&D expenses, reflecting the characteristics of individual firms within the same industry, from the actual R&D expenses. First, using Eq. (3), we classify the sample of listed firms by year and industry and obtain residuals, which we define as the discretionary R&D expenses (*Disc* $RDI_{i,j,t}$) of firm *i* in industry *j* in year *t*. Next, for our event study, we use the discretionary R&D expenses in the IPO year for high-tech firms that have succeeded with an IPO. In Eq. (3), *RDIi,j,t* denotes the R&D expenses of firm *i* in industry *j* in year *t*, *CASHi,j,t* is the cash equivalents held by firm *i* in industry *j* at the end of year *t*, Δ*Salesi,j,t* denotes the sales in year *t* less those in year t – 1 for firm *i* in industry *j*, *Qi,j,t* is the sum of the market value of the shares and the book value of the liabilities, divided by the book value of the total assets for firm *i* in industry *j* at the end of year *t*, *Leveragei,j,t* is the debt ratio of firm *i* in industry *j* in year *t*, and *ATAi,j,t* is the average total assets of firm *i* in industry *j* in year *t*:

$$\frac{RD_{i,j,t}}{ATA_{i,j,t}} = \alpha_0 + \alpha_1 \frac{1}{ATA_{i,j,t}} + \alpha_2 \frac{RD_{i,j,t-1}}{ATA_{i,j,t}} + \alpha_3 \frac{Cash_{i,j,t}}{ATA_{i,j,t}} + \alpha_4 \frac{\Delta SALES_{i,j,t}}{ATA_{i,j,t}} + \alpha_5 Q_{i,j,t} + \alpha_6 Leverage_{i,j,t} + \varepsilon_{i,j,t}, \quad (3)$$

$$DiscRD_{i,j,t} = \varepsilon_{i,j,t}. \quad (4)$$

We use high-tech firms' R&D expenses in the two years after the IPO as a measure of future R&D investment behavior. In other words, we calculate future R&D investment as a natural logarithm of total R&D expenses (i.e., expenses recorded as assets and expenses) in the two years following the IPO, divided by the total assets at the end of the IPO year, and adding one, as shown in Eq. (5). Here, $R\&D_{i,t}$ indicates the R&D expenses of firm *i* in year *t* following an IPO, and $Asset_{i,0}$ indicates total assets at the end of the IPO year:

$$Post\ \ R\&D\ \ Invest_i = Ln\left[\frac{\sum_{t=1}^{2} R\&D_{i,t}}{Assets_{i,0}} + 1\right]. \quad (5)$$

We calculate the long-term rate of return using the cumulative abnormal returns over 240 and 480 days after the IPO. First, in Eq. (6), we calculate the daily excess return (*ARi,d*) of firm *i* on trading day *d* by deducting the over-scale rate of return of the portfolio from the firm's stock return. Second, in Eq. (7), we calculate the cumulative abnormal return from day 1 after the IPO to trading day *k* for firm *i* by accumulating the daily excess rates of return.

$$AR_{i,d} = R_{i,d} - SIZE\ \ R_{P,d}, \quad (6)$$

$$CAR_i[1,K] = \sum_{d=1}^{K} AR_{i,d}. \tag{7}$$

Based on prior studies, we insert factors into the regression model that may affect the stock return after an IPO. Here, *DA_Ki* indicates the discretionary accrual in the IPO year of firm i, measured using the method of Kothari et al. (2005) (Teoh et al., 1998), and $OWNER_i$ indicates the largest shareholders' and related parties' shares at the end of the IPO year (Yeh et al., 2008); $UWRANK_i$ is a binary variable, taking the value one when the underwriter of the IPO is one of the top five (based on sales) underwriters, and zero otherwise (Carter and Manaster, 1990); $PRODCEEDS_i$ is a natural logarithm of the IPO offering price, multiplied by the number of offered shares (Masulis and Korwar, 1986); $LogSALES_i$ is the logarithm of revenue (unit 1 billion won) in the IPO year (Banz, 1981); BTM_i is the ratio of book value to market value at the end of the IPO year (Denis, 1994; Jung et al., 1996); CFO_i is the ratio of operating cash flow at the end of the IPO year divided by the total assets at the beginning of the IPO year (Ritter and Welch, 2002); AGE_i is the logarithm of the firm age (Clark, 2002); $AUDITOR_i$ is a binary variable, taking the value one if the auditor is a member of the Big 4, and zero otherwise (Menon and Williams, 1991); and $MARKET_i$ is a dummy variable that takes the value one if the IPO market is the KOSDAQ and zero if it is the KOSPI.

III. Empirical Results

Our sample includes firms that meet the following criteria:
(1) firms initially listed on the Korea Exchange between 2001 and 2015;
(2) firms in the high-tech industry;
(3) firms that were not delisted within three years of their IPO;
(4) firms whose settlement month is December; and
(5) firms that have data available on FnGuide.

Our final sample includes 464 firms. Panel A in Table 1 presents the sample distributions based on the high-tech industry type. Panel B presents technical statistics of the variables used in our study. The average of *Post_R&D_Invest* is 0.062, indicating that a high-tech firm invests, on average, 6.2% of its total assets in the two years following a successful IPO. *CAR[1,240]* and *CAR[1,480]* represent the size-adjusted cumulative abnormal returns over 240 and 480 days, respectively, after an IPO, with averages of –0.094 and –0.130, respectively. These negative averages indicate that high-tech firms show low performance, on average, after an IPO. The variable *DiscR&D* indicates the discretionary R&D expenses in the

IPO year, and *LEV* is the ratio of debt to total assets. We divide the sample firms into those with high and low debt ratios based on the industry median value in each year. Then, we determine whether the effects of discretionary R&D expenses at the time of the IPO on future investments and future performance differ by group. Other variables include the control variables noted in Models 1 and 2.

<<Table 1 here>>

Table 2 presents the effect of an increase in discretionary R&D expenses at the IPO point on future R&D investment behavior and future stock performance. We expect that if the overinvestment in R&D at the IPO point is due to managerial optimism, R&D investment after the IPO will increase, but future corporate performance will decrease. Panel A of Table 2 presents the effect of discretionary R&D expenses at the IPO point on future R&D investment. Our results show that the regression coefficient of *DiscR&D* is 1.050 (t = 10.035) and is statistically significant at the 1% level. Panel B presents the effect of discretionary R&D expenses at the IPO point on the long-term cumulative abnormal returns over 240 and 480 days after an IPO. The results show that none of the regression coefficients of *DiscR&D* are statistically different from zero. Overall, our results from Table 3 indicate that an increase in the discretionary R&D expenses at the IPO point is likely to result in overinvestment, owing to managerial optimism.

<<Table 2 here>>

Tables 3 and 4 present the results of our analysis on whether overinvestment behavior at the IPO point based on managers' self-assurance is stronger in firms with a high debt ratio, which may experience agency problems between its creditors and owners. Agency problems include risk incentives and overinvestment incentives. We expect that for high-tech firms with a high debt ratio, the combination of agency costs of debt and managerial optimism at the IPO point motivates managers to overinvest in R&D expenses with great uncertainty, resulting in reduced corporate value.

Table 3 presents the relationship between discretionary R&D expenses at the IPO point and future R&D investments after an IPO by dividing the overall sample into two sub-samples by leverage level. The regression coefficient of discretionary R&D expenses (*DiscR&D*) is 1.220 (t = 8.602) and is statistically significant at the 1% level. However, the coefficient for $DiscR\&D_{i,t} \times LEV\ highD_{i,t}$ does not appear to be statistically significant.

Table 4 presents the relationship between discretionary R&D expenses at the IPO point and the cumulative abnormal returns over 240 days and 480 days after an IPO for the sub-samples classified by leverage level. The coefficients for *DiscR&D* in Models (1) and (2) are not statistically significant. However, both coefficients for $DiscR\&D_{i,t}$ × $LEV\ highD_{i,t}$ are negative and significant. Overall, the results of Tables 3 and 4 show that when a high-tech firm with a high debt ratio succeeds with an IPO, managers tend to overinvest in R&D, owing to increased managerial optimism and risk incentives, possibly reducing future corporate value.

<<Tables 3 and 4 here>>

IV. Conclusion

We study an unusual phenomenon of a decrease in high-tech firms' stock returns, partly due to managerial optimism and agency costs of debt, after completing a successful IPO. Our results show that high-tech firms with a high debt ratio have a statistically significant and negative relationship between discretionary R&D expenses at the IPO point and future stock returns. These results suggest that agency costs of debt and managerial optimism can increase in high-tech IPO firms, thus undermining the firm's future value. Our study contributes to the existing literature by showing that the psychological errors of managers during IPOs of high-tech firms can lead to inefficient R&D investment. In firms with high debt ratios, this optimistic overinvestment by managers, combined with shareholders' preferences for risky investments, can reduce corporate value.

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Tables

Table 1. Sample distribution and technical statistics
Panel A. High-tech IPO firms' industry types

High-tech industry type	Number of samples
1. Medicine	67
2. Electronics, computer, telecommunications	294
3. Other high-tech industries (Automobile, shipbuilding, airline, etc.,)	103
Total	464

Panel B. Technical statistics

	Average	Standard deviation	Minimum value	25th pctl.	50th pctl.	75th pctl.	Maximum value
Post R&D_Invest	0.062	0.083	–0.089	–0.401	–0.009	0.522	0.491
CAR [1, 240] $_{i,t}$	–0.094	0.554	–1.289	–0.460	0.077	0.628	1.282
CAR [1, 480] $_{i,t}$	–0.130	0.731	–1.874	0.003	0.035	0.094	1.649
$DiscR\&D_{i,t}$	0.001	0.033	–0.067	–0.018	–0.004	0.014	0.106
$LEV_{i,t}$	0.370	0.195	0.024	0.219	0.348	0.501	0.974
$DA\_K_{i,t}$	0.216	0.418	–0.657	–0.022	0.126	0.302	2.767
$OWNER_{i,t}$	0.426	0.146	0.112	0.317	0.410	0.527	0.891
$UWRANK_{i,t}$	0.341	0.474	0.000	0.000	0.000	1.000	1.000
$PROCEEDS_{i,t}$	16.183	1.007	13.899	15.465	16.074	16.796	20.249
$LogSALES_{i,t}$	1.567	0.519	0.029	1.245	1.507	1.866	3.907
$BTM_{i,t}$	0.772	0.462	0.123	0.426	0.661	1.052	2.480
$CFO_{i,t}$	0.098	0.216	–0.678	–0.006	0.093	0.203	0.869
$AGE_{i,t}$	1.027	0.258	0.301	0.845	1.041	1.204	1.763
$AUDITOR_{i,t}$	0.515	0.500	0.000	0.000	1.000	1.000	1.000
$MARKET_{i,t}$	0.899	0.302	0.000	1.000	1.000	1.000	1.000

Table 2. Regression analysis of the effect of R&D expenses

	Dependent variables					
	Panel A. Future R&D investment		Panel B Long-term cumulative abnormal return			
	Post R&D invest$_{i,t}$		*CAR* [1, 240] $_{i,t}$		*CAR* [1, 480] $_{i,t}$	
	Coeff	(t-stat)	Coeff	(t-stat)	Coeff	(t-stat)
Intercept$_{i,t}$	0.247	(3.204)***	1.604	(2.822)***	2.319	(3.125)***
DiscR&D$_{i,t}$	1.050	(10.034)***	–0.886	(–1.149)	-0.708	(-0.703)
LEV$_{i,t}$	–0.085	(–3.880)***	0.042	(0.257)	-0.204	(-0.962)
DA_K$_{i,t}$	0.012	(1.271)	0.037	(0.545)	-0.064	(-0.720)
OWNER$_{i,t}$	–0.048	(–1.878)*	0.044	(0.232)	0.075	(0.303)
UWRANK$_{i,t}$	0.000	(–0.058)	0.015	(0.281)	-0.014	(-0.199)
PROCEEDS$_{i,t}$	–0.008	(–1.586)	–0.140	(–3.592)***	-0.198	(-3.895)***
LogSALES$_{i,t}$	0.001	(0.129)	0.149	(1.868)*	0.121	(1.161)
BTM$_{i,t}$	–0.027	(–3.350)***	–0.252	(–4.265)***	0.018	(0.234)
CFO$_{i,t}$	–0.009	(–0.493)	0.156	(1.187)	0.184	(1.074)
AGE$_{i,t}$	–0.006	(–0.443)	0.426	(4.088)***	0.565	(4.154)***
AUDITOR$_{i,t}$	0.003	(0.446)	–0.084	(–1.531)	-0.007	(-0.102)
MARKET$_{i,t}$	0.025	(2.238)**	0.081	(0.966)	0.022	(0.204)
N		464		464		464
Adjusted R^2		0.253		0.083		0.081

Notes: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 3. Regression analysis of the relationship between discretionary R&D expenses and future R&D investment

	Dependent Variables: Post R&D Invest	
	Coeff	(t-stat)
Intercept$_i$	0.157	(2.185)**
DiscR&D$_i$	1.220	(8.602)***
DiscR&D$_i$ × LEV highD$_i$	−0.216	(−1.045)
LEV highD$_i$	−0.013	(−1.701)*
DA_K$_i$	0.013	(1.401)
OWNER$_i$	−0.038	(−1.525)
UWRANK$_i$	0.000	(0.056)
PROCEEDS$_i$	−0.003	(−0.694)
LogSALES$_i$	−0.017	(−1.757)*
BTM$_i$	−0.024	(−3.028)***
CFO$_i$	0.010	(0.608)
AGE$_i$	−0.004	(−0.281)
AUDITOR$_i$	0.007	(0.915)
MARKET$_i$	0.027	(2.430)**
N	*464*	
Adjusted R^2	*0.090*	

Notes: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4. Regression analysis of the relationship between discretionary R&D expenses and long-term cumulative abnormal return

	Dependent Variables: Long-term cumulative abnormal return			
	(1) *CAR* [1, 240]		(2) *CAR* [1, 480]	
	Coeff	(t-stat)	Coeff	(t-stat)
$Intercept_i$	1.850	(3.466)***	2.454	(3.484)***
$DiscR\&D_i$	0.177	(0.168)	0.617	(0.445)
$DiscR\&D_i \times LEV\ highD_i$	−1.175	(−1.998)**	−1.839	(−1.801)*
$LEV\ highD_i$	−0.085	(−1.522)	−0.160	(−2.187)**
DA_K_i	0.024	(0.359)	−0.083	(−0.940)
$OWNER_i$	0.020	(0.108)	0.077	(0.312)
$UWRANK_i$	0.003	(0.061)	−0.021	(−0.297)
$PROCEEDS_i$	−0.153	(−4.113)***	−0.206	(−4.190)***
$LogSALES_i$	0.204	(2.878)***	0.149	(1.591)
BTM_i	−0.264	(−4.516)***	−0.004	(−0.053)
CFO_i	0.095	(0.765)	0.151	(0.923)
AGE_i	0.402	(3.923)***	0.547	(4.048)***
$AUDITOR_i$	−0.096	(−1.774)*	−0.015	(−0.216)
$MARKET_i$	0.089	(1.084)	0.034	(0.316)
N	*464*		*464*	
Adjusted R^2	*0.090*		*0.091*	

Notes: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.