제약회사의 현금흐름이 연구개발투자에 미치는 영향
-코스닥시장을 중심으로

Effect of Cash flow on the R&D investment of Pharmaceutical Companies
- focused on KOSDAQ market

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요약

본 연구는 우리나라 코스닥 제약회사를 대상으로 내·외부금융이 연구개발투자(R&D)에 미치는 영향을 분석하였다. 실증분석을 위한 표본은 2009년부터 2013년까지 상장된 기업들 중 코스닥 제약회사를 대상으로 하였으며 사용된 전체 표본은 5개년 자료로써 212개 관측치를 가진 불균형패널자료이다. 본 연구에 사용된 주요 변수들 중 개별기업 별 재무자료는 상장회사 협의회의 TS-2000, 금융감독원 전자공시 시스템의 각 기업 사업보고서, NICE신용평가정보의 KISVALUE-Ⅲ 등의 자료를 통해 직접 수집하였으며, 패널분석을 위해 STATA 12.0을 사용하였다. 연구결과, 첫째 내부금융(유동비율)은 연구개발투자에 긍정적인 영향을 미쳤다. 둘째, 외부금융(부채비율)은 연구개발투자에 부정적인 영향을 미쳤다. 본 연구는 자본시장에서 정보의 비대칭으로 인해 외부금융보다 내부금융이 더 선호됨을 알 수 있다. 즉, 제약기업의 연구개발투자 활성화를 위해 내부금융의 관리 및 정부의 정책적 지원이 필요함을 보여준다.

■ 중심어 : | 제약회사 | 연구개발투자 | 현금흐름 | 내부금융 | 외부금융 |

Abstract

The purpose of this study is to analyze the influence of the cash flow of pharmaceutical companies on R&D investment. 143 pharmaceutical companies listed in the KOSDAQ market from 2009 to 2013. Financial statements and comments in general and internal transactions were extracted from TS-2000 of the Korea Listed Company Association (KLCA), and data related to stock price was extracted from KISVALUE-Ⅲ of NICE Information Service Co., Ltd. STATA 12.0 was used as the statistical package for panel analysis. The summary of the findings and the interpretation of the significance of this are as follows: First, the current ratio (internal finance) had a positive influence on R&D investment. Second, the debt ratio (external finance) had a negative influence on R&D investment. The pharmaceutical company prefers internal funds to external funds due to the asymmetry of information in the loan markets. In other words, this shows why internal finances have a significant influence on R&D investment at pharmaceutical companies.

■ keyword : | Pharmaceutical Companies | R&D Investment | Cash Flow | Internal Finance | External Finance |

I. Introduction

Despite the worldwide economic depression and financial crisis, the pharmaceutical market is growing due to market expansion in Asia as well as Latin America. Moreover, with the global population-aging phenomenon, there is a rapid increase in the demand for cures for geriatric illnesses such as Alzheimer's disease, stroke, and Parkinson's disease. Expenditures in the medical service field are expected to grow significantly to promote and maintain health due to the popular desire for improved quality of life as well as increased income levels and changes in life patterns. The global pharmaceutical market size in 2010 was $874.6 billion, with an annual average growth of 6.2% between 2006 and 2010. The growth rate, which was 9% in 2003, slowed down by 2010 at 4 %.

R&D investment costs required for new drug development continue to increase, but the investment rate of return is decreasing. In 2001, it cost $800 million to develop and sell a drug, whereas in 2008 it cost $1.3 billion (an increase of 62.5%). Accordingly, related pharmaceutical companies are saving R&D investment costs by securing new products through licensing and M&A, and restructuring core portfolios by reorganizing internal pipelines.

The argument that R&D investment can be influenced by internal finances and internal cash flow originates from Arrow [1], who stated that high-risk investments such as technological innovation may face serious "moral hazard" issues and consequently restrict external financing availability. Moreover, Kamien and Schwartz [2] point out that internal financing from current profits and accumulated capital is extremely important for promoting R&D investment. Later, Stiglitz and Weiss [3], and Myers and Majluf [4] supported Arrow [1] in the argument that moral hazard and adverse selection issues can be more serious if R&D investment funds are financed from liabilities and the stock market.

According to the financing constraints hypothesis, there is a cost gap between internal and external funds due to information asymmetry in the imperfect capital market, causing a firm's investment decisions to be influenced by internal cash flow. Financing constraints refer to a situation where there are constraints in making an investment that may have been completed if internal funds could have been used, but is abandoned due to the limited availability of external funds or the cost of external financing [5]. In other words, in such a situation of financial constraints, internal funds are used first as a priority for the investment. Therefore, investment expenditures are sensitive to the amount of internal cash flow. According to the financing constraints hypothesis, the existence of a premium due to information asymmetry in the external capital market results in the issue of adverse selection, in which profitable projects are abandoned due to high external financing costs [3][4]. In particular, if other conditions are equal, firms with more abundant internal cash flow can make necessary investments smoothly; those without this may underinvest.

Shin [6] reported that the regression coefficients of cash flow and liquidity are statistically significant, and their influence is greater in a single company than a chaebol conglomerate. Lee [7] analyzed the influence of the debt-equity ratio on investments made by regional public hospitals listed in Korea. The result showed that the debt-equity ratio generally tends to have a negative influence on regional public hospitals, but such negative influence is greater among firms with low growth opportunities. This agrees with the free cash flow hypothesis that high debt-equity ratios may suppress overinvestment by

eliminating a firm's free cash flow.

As can be seen above, a firm's R&D investment tends to depend largely on internal cash flow when there are issues such as information asymmetry. Moreover, the investment scale may be influenced by the fluctuation of internal cash flow, and the R&D investment scale is adjusted over the long run based on internal cash flow as the source of funding. Therefore, firms using a mechanism that can stabilize internal cash flow despite low cash retention can secure continuous financing for R&D investment. Thus, internal cash flow stabilization relieves the problem of R&D discontinuity or reluctance so that the investment outcome becomes beneficial in increasing market concentration or securing long-term corporate competitiveness, ultimately resulting in a positive influence on enterprise value. This study aims to clarify the factors that have a positive influence on the R&D investment of pharmaceutical companies. It analyzes the influence of the financial structure of KOSDAQ pharmaceutical companies on R&D investment.

II. Materials and Methods

1. Methods

The period of the empirical analysis is from 2009 to 2013, considering the period after the influence of the financial crisis. The targeted firms for analysis are those listed on the stock exchange, and they are all of firm level. Financial statements and comments in general and internal transactions were extracted from TS-2000 of the Korea Listed Company Association (KLCA), and data related to stock price is extracted from KISVALUE-Ⅲ of NICE Information Service Co., Ltd. STATA 12.0 was used as the statistical package for panel analysis. Thus, this study collected data from the Data Analysis, Retrieval and Transfer System of the Financial Supervisory Service. Ultimately, 212 firm-year data of 46 firms (unbalanced panel data) were included in the sample.

2. Variables and Measurements

2.1 Dependent Variables

R&D investment is often used as an index that can measure the degree of a firm's pursuit of innovation and the manager's pursuit of risk. R&D intensity was used as a dependent variable to eliminate errors due to relative difference according to sales of each firm [8].

2.2 Independent Variables

Internal finance: It was reviewed in the previous section that there is information asymmetry between the supplier and demander of funds in the capital market, and therefore internal financing is more preferable than external financing. This ratio is included to measure the liquidity level formed by a firm's internal financing. This study used current ratio as the proxy variable for liquidity.

External finance: Firms with many liabilities have little capacity for investment in long-term projects with a long payback period [9][10]. However, David, Hitt [11] came up with the result that higher debt-equity ratio increases the manager's risk appetite and efforts, thereby increasing R&D investment. This study used debt-equity ratio.

2.3 Control Variables

Profitability: A firm's performance is a variable closely related to R&D investment; thus, if a firm has abundant resources, the capacity for R&D investment increases. Hoskisson, Hitt [12] discovered that profits generated by a firm have a positive correlation with R&D investment. This study used ROI as the proxy

variables of profitability.

Growth: Firms with increased sales can be considered to have higher growth than those with the same or decreased sales, and these firms are likely to carry out more active R&D activities as a strategy to lead the market[13]. Therefore, this study also assumed that firms with high growth will be more active in R&D investment, and used the rate of sales increase as the proxy variable for growth.

Major shareholders: 1 major shareholder refers to the shareholder with the most shares owned by him or herself as well as his or her family, relatives, and affiliate persons. The major shareholder information announced in the distribution of shareholding size in the business report in the relevant settlement term was used to determine the shareholding ratio of major shareholders.

Business scale: Business scale is a significant factor that influences R&D investment. In other words, the bigger the size, the greater the efficiency of asset utilization (9), as well as greater motivation for risky investments such as R&D [10]. Therefore,

business scale was controlled in this study[14].

Firm age: The longer the term after the firm was established and listed, the higher the possibility that investment decisions will be long-term. In this study, the years listed (years passed after the firm was listed) was controlled instead of years established.

3. Research Model

We applied the research model for the empirical analysis as follows:

$$Q = \alpha + \beta_1 LIQ + \beta_2 LEV + \beta_3 ROI + \beta_4 SG \\ + \beta_5 OWN + \beta_6 SIZE + \beta_7 YEAR + \mu_i + \epsilon$$

Ⅲ. Results

[Table 2] shows the descriptive statistics of key variables of all firms used in the empirical analysis. The dependent variable of R&D investment (RD) appeared to be approximately 7.97%, and the maximum and minimum values show that there are

Table 1. Summary of Variables

Variable			Definition
Dependent	R&D investment intensity	RD	(research costs+ordinary development costs)/sales × 100
Independent	Liquidity	LIQ	(current assets/ current liabilities) × 100
	Leverage	LEV	(total liabilities /equity capital) × 100
Control	Profitability	ROI	(current net income/total assets) × 100
	Growth	SG	(current sales/previous term sales) × 100
	Major shareholders	OWN	(ordinary shares owned by major shareholders/total ordinary shares) × 100
	Business scale	SIZE	$\ln(total\,assets)$
	Firm age	YEAR	$\ln(years\,passed\,after\,the\,firm\,was\,listed)$

Table 2. Descriptive Statistics

	Obs	Mean	RD	LIQ	LEV	ROI	SG	OWN	SIZE	YEAR
RD	212	7.97	1							
LIQ	212	435.60	0.272*	1						
LEV	212	53.23	0.026	0.068	1					
ROI	212	4.13	0.303*	0.085	−0.077	1				
SG	212	11.32	0.0428	−0.385*	−0.009	−0.587*	1			
OWN	212	42.23	−0.358*	0.263*	−0.123*	−0.044	−0.064	1		
SIZE	212	8.12	0.171*	0.102	0.069	−0.260*	0.205*	−0.105	1	
YEAR	212	1.30	−0.089	−0.181*	−0.026	−0.063	0.108*	−0.085	0.375*	1

**p⟨0.01, **p⟨0.05, *p⟨0.1

considerable gaps among firms. The average of liquidity (LIQ) was the highest with 435.60, and the maximum and minimum values show that there are considerable gaps among firms.

The following correlations among the dependent variables and between the dependent variables and independent variables are significant: RD and ROI (.303), SIZE (.171) are significantly positively correlated; RD and OWN (-.358) is significantly negatively correlated.

We suggested a fixed effects model based on the Hausman test results. This study conducted a panel analysis with the dependent variable of R&D investment and independent variables related cash flow such as the current ratio, debt-equity ratio.

Liquidity (LIQ) and R&D investment ratio showed a statistically significant positive relationship. Leverage (LEV) is a financial ratio that measures a firm's leverage. If this ratio is high, the firm's leverage is high, as interest costs due to a firm's use of debt are low, thereby enabling the firm to make more extensive R&D investments[Table 3].

Ⅳ. Discussion

This study conducted a financial analysis on the factors influencing R&D investment in the KOSDAQ

pharmaceutical companies. TS-2000 was used for the analysis data in this study. The study was conducted in targeting the 'medical substance and drug manufacturing industries' between 2009 and 2013.

First, it was found in this study that the higher liquidity ratio, the greater the R&D investment. The results of this study are similar to the research findings by Grabowski and Vernon [15], Vernon [16] on pharmaceutical companies, as well as research by Kamien and Schwartz [2], Himmelberg and Petersen [17], Bhagat and Welch [18] on the manufacturing and financial industries. The current ratio is an index that determines a company's ability to pay short-term debts; a high current ratio indicates that the company has significant liquidity, and thus has ability to generate cash easily. Moreover, greater liquidity implies that the company has the cash to make active R&D investments.

When external capital markets are unstable, the fluctuations of a company's internal finances are likely to affect all components of R&D investment. When internal finances decline, funding-constrained companies will reduce their accumulation of assets. The degree of this asset reduction will be influenced by the ease of their disposition or the size of the adjustment costs.

R&D investment requires relatively high adjustment costs. Therefore, R&D that requires

Table 3. Panel Regression

	Coef.	S.E	Coef.	S.E	Coef.	S.E
LIQ	0.0015**	0.0007			0.0018**	0.0009
LEV			−0.0028*	0.0020	−0.0031*	0.0026
ROI	−0.0041	0.0482	−0.0048	0.0484	−0.0048	0.04821
SG	−0.0122**	0.0071	−0.015**	0.0060	−0.0150**	0.0064
OWN	0.0521***	0.0162	0.0570***	0.0211	0.05701***	0.0192
SIZE	3.1231**	1.2313	3.1591**	1.2342	3.1592**	1.3413
YEAR	2.0112**	0.9552	2.0713**	0.9551	2.0712**	0.9541
Constant	−19.43**	9.2321	−21.33**	9.214	−25.43**	9.914
Adj	0.141		0.162		0.176	
Obs	212		212		212	
N	46		46		46	

***p<0.01, **p<0.05, *p<0.1

liquidity will be restricted when internal finances are reduced, even though it may be a relatively small amount compared to the fixed or inventory investment requirements of the decrement of the total investment. Moreover, as the company tends not to disclose the elements or progress of its R&D to the suppliers of external funds, receiving external financing will be more difficult and the cost of such external funds may be higher than internal funds [19]. This could lead to a phenomenon where the company prefers internal funds to external funds due to the asymmetry of information in the loan markets. In other words, this shows why internal finances have a significant influence on R&D investment at pharmaceutical companies.

Second, the leverage of pharmaceutical companies has a negative influence on R&D investment. This finding is consistent with the prediction that, if a company faces a financial risk, it will be passive in R&D investment due to its financial difficulties. This conclusion is similar to the findings of the research by Baysinger and Hoskisson [9], Kochhar and David [10], Hoskisson and Hitt [12] R&D investment is an intangible asset that contributes to the future growth of a company, and strategic decision making is extremely important as R&D has a high risk of failure, unlike general facilities investment [20]. It is necessary to examine the ability of a company to afford external financing, generally determined by the available financial resources within the company [10]. In other words, a company's capital structure has a significant influence on R&D investment, and its debt ratio that represents its capital structure influences its capital financing. Therefore, a company with high debt ratio will often reduce investment in R&D due to a concern about potential financial difficulties caused by default, and face detrimental loan conditions such as high interest rates or onerous security requirements [21].

The limitations of the present research are described below. Such limitations should be considered when understanding and applying the results, and are significant in providing a direction for future studies. While carrying out the present research, there was a limitation in accurately measuring the size of R&D expenditure. There were several errors regarding units, recording omissions, non-reflection of corrections, etc. in the R&D expenditure data. In addition, there were several cases where the R&D expenditure recorded in the financial statements did not correspond to the R&D expenditure recorded in the footnotes of the audit reports, and thus correction and supplementation works would be required. However, because it was difficult to either verify the data or obtain the corrected and supplemented data, we used data from TS2000. Addressing this problem with data should be undertaken in future research.

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