Debt Maturity And Investment Efficiency Evidence From Korea

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ABSTRACT

This study empirically analyzes the effect of debt maturity on investment efficiency, which is measured by using McNichols and Stubben (2008). Debt maturity is measured using current debt ratio and dummy variable. Specifically, we will investigate how short-term debt affects investment efficiency. Additionally, we will investigate the relation between the short-term debt affects investment efficiency according to debt maturity group.

The results of this study are as follows. First, the short-term debt and investment efficiency were significantly positive (+) in both the total sample and the over-investment sample. Second, as a result of analyzing the maturity of debt by group according to the current debt ratio, the relationship between earnings quality and investment efficiency was significantly positive (+) in the short-term debt group. it is suggested that debt maturity and investment efficiency can be different for the total sample, over-investment sample, under-investment sample, and the relationship between earnings quality and investment efficiency can be differentiated by debt maturity group.

This study has following additional contributions in comparison with domestic prior studies related to investment efficiency. First, prior studies related to investment efficiency are mainly concerned with the quality of financial reporting. This study implies that the relationship between investment efficiency and quality of financial reporting, and the relationship between debt maturity and investment efficiency among the characteristics of debt. Second, from the results of the analysis of the debt maturity and investment efficiency, it is confirmed that the debt is operating as a mechanism to monitor the investment efficiency of the corporation. Third, the analysis of debt maturity group suggests that the relationship between earnings quality and investment efficiency may be differentiated by short and long debt levels during debt financing.

The limitations of this study are as follows. First, we might have not considered omitted other variables. Second, we might not have fully considered other proxies for the characteristics of the debt maturity and investment efficiency. Third, there may be a measurement error in the quality of earnings and investment efficiency. Finally, the relationship between debt maturity and investment efficiency can vary depending on the circumstances of the company. For example, specific debt contract provisions or national regulatory environment. Therefore, attention should be paid to the generalization of the results of this study.

Keywords: Short-Term Debt; Debt Maturity; Earnings Quality; Investment Efficiency

1. INTRODUCTION

This study empirically analyzed the relationship between debt maturity and investment efficiency using a sample of 6,827 firm - years from 2002 to 2014. The investment efficiency was measured by McNichols and Stubben (2008) method and the quality of earnings was measured by the Jones (1991) model. Debt maturity was measured by the ratio of current debt and current debt dummy variable.

Under perfect capital market assumptions, firms can maximize their corporate value by making optimal investments. However, the capital market is imperfect due to various constraints, and it is a reality that it cannot make optimal investment.

A number of theoretical foundations and studies have attempted to reconcile conflicting interests among capital market participants under these imperfect markets. The main theoretical foundation of the imperfect capital market is agency cost, reverse selection and moral hazard phenomenon due to information asymmetry (Oh & Shin, 2016).

In this study, we have focused on debt maturity structure as a mechanism to complement for the imperfection of capital markets, and it has been found that debt maturity structure plays a role in complementing the imperfection of capital markets (Kim, Kim & Cho, 2011; Park & Bae, 2011). On the other hand, the theoretical basis for hindering investment efficiency is agency problem due to the imperfection of capital market and reverse selection and moral hazard due to information asymmetry.

In sum, there is a possibility that the debt maturity structure can monitor ineffective investment phenomenon due to the imperfection of the capital market. However, there are few studies on the investment efficiency in terms of debt maturity structure. In addition to the quality of earnings, corporate governance, and ability to monitor investment efficiency, which have been identified in previous research, there is an additional contribution to the relationship between debt maturity and investment efficiency in relation to debt characteristics during capital financing. Therefore, this study empirically analyzed the relationship between debt maturity and investment efficiency.

The results of this study are as follows. First, the short-term debt and investment efficiency were significantly positive (+) in both the total sample and the over-investment sample. Second, as a result of analyzing the maturity of debt by group according to the current debt ratio, the relationship between earnings quality and investment efficiency was significantly positive (+) in the short-term debt group.

By the sample, both the total sample, the over-investment sample, and the under-investment sample are significant, and we find that the relationship between earnings quality and investment efficiency is stronger in the group with shorter debt maturity. However, in the group with longer debt maturity, the relationship between earnings quality and investment efficiency was significantly positive (+) only in the over-investment sample.

The rest of the paper is as follows. Section II shows prior literature and develops the research hypothesis. Section III presents the research design. Section IV reports the empirical results. Section V sets forth the conclusion.

2. PRIOR LITERATURE AND HYPOTHESES DEVELOPMENT

2.1 Debt Maturity

The role of debt to reduce managerial discretion and monitor and supervise their investment decisions has been discussed in previous studies (Myers, 1977; Jensen, 1986). Research has also been reported supporting the fact that debt reduces over-investment (D'Mello & Miranda, 2010).

Shortening the debt maturity indicates that firms can be more appropriately controlled. This is because short-term debt is often renegotiated through expiration or new debt contracts (Ortiz-Molina & Penas, 2008).

Shin (2013) examined the effects of debt maturity on leverage in the context of under-investment and liquidity risk. As a result of analysis, it was shown that shortening the maturity of the debt mitigated the under-investment problem.

2.2 Investment Efficiency

The higher the quality of earnings, the more likely managers can make better investment decisions by recognizing better projects, leading to improved investment efficiency (Bushman & Smith, 2001; Biddle & Hilary, 2006; Biddle, Hilary & Verdi, 2009; McNichols & Stubben, 2008).

Chen, Hope, Li and Wang (2011) analyzed the relevance of the quality of earnings for over-investment & under-investment, focusing on private firms in emerging markets.

Similarly, Garcia-Lara, Garcia-Osma and Pemalva (2010) report that conservatism in accounting can reduce both over-investment and under-investment.

Based on the prior literature, we hypothesize as follows:

H_1: There is a positive association between the use of short-term debt and investment efficiency.

H_{1-1}: There is a negative association between the use of short-term debt and over-investment.

H_{1-2}: There is a negative association between the use of short-term debt and under-investment.

H_2: According to debt maturity, the association between the use of short-term debt and investment efficiency will be different.

H_{2-1}: According to debt maturity, the association between the use of short-term debt and over-investment will be different.

H_{2-2}: According to debt maturity, the association between the use of short-term debt and under-investment will be different.

3. RESEARCH DESIGN

3.1 Regression Models

To test Hypothesis 1 - Hypothesis 2, we use a multivariate regression model to investigate whether debt maturity enhances investment efficiency as we have expected. Regression models are as follows.

$$INV\_EF_{it} = \beta_0 + \beta_1 STDR_{it}\ (or\ STDDUM_{it}) + \beta_2 ABSDACC_{it} + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \beta_5 LOSSDUM_{it} + \beta_6 TA_{it} + \beta_7 STD\_OCF_{it} + \beta_8 AGE_{it} + \beta_9 SLASCK_{it} + \beta_{10} OWN_{it} + \beta_{11} FOR_{it} + \beta_{12} BIG_{it} + \sum YD + \sum ID + \varepsilon_{it} \quad (1)$$

Variable Definitions

Dependent Variables

INV_EF	=	investment efficiency, the absolute value of the residual measured as McNichols and Stubben (2008) multiplied by (-1)

Independent Variables

STDR	=	current debt ratio, (current debt / total assets)
STDDUM	=	current debt dummy variable

Control Variables

ABSDACC	=	earnings quality, the absolute value of the residual measured as Jones model (1991) by multiplied by (-1)
SIZE	=	firm size, the nature logarithm of total assets
LEV	=	debt ratio, (long-term debt / total assets)
LOSSDUM	=	loss dummy variable
TA	=	tangible asset ratio, (property+ plant+equipment / total assets)
STD_OCF	=	the standard deviation of operating cash flow for five years from period t-4 to period t
AGE	=	the natural logarithm of firm age
SLACK	=	cash / total assets

OWN	=	ownership
FOR	=	foreign ownership
BIG4	=	1 if annual financial statement is audited by a big4 auditor, and 0 otherwise
YD	=	year dummy
ID	=	industry dummy
ε_{it}	=	residual

Based on prior literature, we predict a positive (+) association between STDR (or STDDUM) and INV_EF. Control variables are ABSDACC, SIZE, LEV, LOSSDUM, TA, STD_OCF, AGE, SLACK, OWN, FOR, BIG4 (Biddle et al., 2009; Chen et al., 2011; Cho & Kang, 2016). We included SIZE to control firm size effect and omitted variables effect (Francis, La Fonde, Olsson & Schipper, 2005).

3.2 Measures of Investment Efficiency (McNichols & Stubben 2008)

In this study, investment efficiency was measured by McNichols and Stubben (2008). Expressed the following equation (2), inefficient investment are the values obtained by subtracting predicted value measured by equation (2). This means the residuals measured by McNichols and Stubben (2008). In this study, the absolute value of the residual is used to analyze the magnitude of investment efficiency. We use the value multiplied by -1 to match the direction of the interest variable and the dependent variable. Thus, the greater value means that investment is more efficient.

$$INVEST_{it} = \beta_0 + \beta_1 Q_{it-1} + \beta_2 Q_{it-1} * Quartile2_{it-1} + \beta_3 Q_{it-1} * Quartile3_{it-1} + \beta_4 Q_{it-1} * Quartile4_{it-1} + \beta_5 CF_{it} + \beta_6 GROWTH_{it} + \beta_7 INVEST_{it-1} + \varepsilon_{it} \quad (2)$$

Variable Definitions

i and t denote firm, year, respectively.

$INVEST_{it}$	=	capital investment for t
Q_{it-1}	=	Tobin's Q for t-1
		$Q_{it-1} * Quartile2(3,4)_{it-1}$; Tobin's Q for t-1 * dummy variable with a value of 1 if Tobin's Q belongs to the second (third, fourth) quartile by year-industy
CF_{it}	=	operating cash flow for t / tangible assets for t-1
$GROWTH_{it-1}$	=	growth ratio for t-1, the nature logarithm of total assets for t-1 diveded by total assets for t-2
$INVEST_{it-1}$	=	capital investment for t-1
ε_{it}	=	residual

3.3. Sample Selection

We employ the data collected from 2002 to 2014 from the Korean stock market. We first eliminate the quoted non-financial December firms for which financial and stock data cannot be collected from Fn-Guide. Those firms whose year-ends are not on December 31 are excluded because of data homogeneity. Financial firms are also eliminated since the nature of the business is different from our sample. The final sample for regression analyses is 6,827 firm-year observations. We winsorize each of the variables at the 1st and 99th percentiles to minimize the effect of outliers except dummy variables. Panel A of Table 1 presents the distribution across fiscal years in our sample. Panel B of Table 1 shows the distribution by industry in our sample, of which Cokes & Chemical (11.03%), Professional services (9.35%), Retail & Whole sales (8.33%), & Metallic (7.91%) are the most representative industries.

Table 1. Distributions over the sample period

Panel A: Distribution across fiscal years

Year	Frequency	Percent (%)
2002	404	5.92
2003	429	6.28
2004	444	6.50
2005	461	6.75
2006	477	6.99
2007	498	7.29
2008	516	7.56
2009	547	8.01
2010	568	8.32
2011	598	8.76
2012	620	9.08
2013	628	9.20
2014	637	9.33
Total	6,827	100

Panel B: Industry Distribution

Industry	Frequency	Percent (%)
Food, Beverage	376	5.51
Fiber, Clothes, Leathers	276	4.04
Timber, Pulp, Furniture	314	4.60
Cokes, Chemical	753	11.03
Medical Manufacturing	333	4.88
Rubber & Plastic	204	2.99
Non-Metallic	236	3.46
Metallic	540	7.91
Pc, Medical	462	6.77
Machine & Electronic	499	7.31
Other Transportation	478	7.00
Construction	372	5.45
Retail & Whole Sales	569	8.33
Transportation Service	228	3.34
Publishing, Broadcasting	487	7.13
Professional Services	638	9.35
Other	62	0.91
Total	6,827	100

4. EMPIRICAL RESULTS

4.1 Descriptive Statistics

Table 2 presents descriptive statistics of all variables used in regression analyses. The means (medians) of INV_EF and STDR are -0.079 (-0.039), 0.312 (0.298), respectively.

The average SIZE is 26.560. The mean leverage (LEV) is 47.6%. The mean TA and STD_OCF are is 0.344 and 0.120, respectively. Firms with loss are about 20%. The mean AGE and SLACK are is 2.682 and 0.054, respectively. The means (medians) of ownership (OWN) and foreign ownership (FOR) are 42.50% (42.50%) and 10.20% (3.40%), respectively. Firms audited by BIG4 are about 69%.

Table 2. Descriptive Statistics (N=6,827)

Variable	Mean	Std. Dev.	25th percentile	Median	75th percentile
INV_EF	-0.079	0.096	-0.091	-0.039	-0.017
STDR	0.312	0.163	0.188	0.298	0.419
STDDUM	0.500	0.500	0.000	1.000	1.000
ABSDACC	-0.056	0.060	-0.074	-0.037	-0.016
SIZE	26.560	1.491	25.503	26.299	27.360
LEV	0.476	0.248	0.297	0.467	0.624
LOSSDUM	0.202	0.401	0.000	0.000	0.000
TA	0.344	0.216	0.192	0.331	0.473
STD_OCF	0.120	0.078	0.066	0.101	0.151
AGE	2.682	0.885	2.303	2.890	3.367
SLACK	0.054	0.060	0.012	0.034	0.073
OWN	0.425	0.164	0.308	0.425	0.534
FOR	0.102	0.144	0.004	0.034	0.145
OWN	0.692	0.462	0.000	1.000	1.000

Variable Definitions

INV_EF	=	investment efficiency, the absolute value of the residual measured as McNichols and Stubben (2008) multiplied by (-1)
STDR	=	current debt ratio, (current debt / total assets)
STDDUM	=	current debt dummy variable
ABSDACC	=	earnings quality, the absolute value of the residual measured as Jones model (1991) by multiplied by (-1)
SIZE	=	firm size, the nature logarithm of total assets
LEV	=	debt ratio, (long-term debt / total assets)
LOSSDUM	=	loss dummy variable
TA	=	tangible asset ratio, (property + plant + equipment / total assets)
STD_OCF	=	standard deviation of operating cash flow for five years from period t-4 to period t
AGE	=	the natural logarithm of firm age
SLACK	=	cash / total assets
OWN	=	ownership
FOR	=	foreign ownership
BIG4	=	1 if annual financial statement is audited by a big4 auditor, and 0 otherwise

4.2 Correlation Analysis

Table 3 presents pearson correlations among regression variables. The relation between the current debt ratio (STDR) and the current debt dummy variable (STDDUM) and the dependent variable, investment efficiency (INF_EF), showed negative (-) direction and not significant. These results were obtained without controlling the influence of other variables on investment efficiency. Therefore, we perform multivariate regression analysis including several control variables.

Table 3. Pearson Correlations

	(2)	(3)	(4)	(5)	(6)	(7)
(1) INV_EF	-0.008	-0.016	0.107***	0.035***	0.041***	-0.006
(2) STDR		0.806***	-0.180***	-0.039***	0.706***	0.228***
(3) STDDUM			-0.128***	-0.022*	0.592***	0.175***
(4)ABSDACC				0.173***	-0.172***	-0.143***
(5)SIZE					0.177***	-0.134***
(6)LEV						0.176***

	(8)	(9)	(10)	(11)	(12)	(13	(14)
(1) INV_EF	0.232***	-0.079***	0.056***	-0.078***	0.045***	-0.028**	-0.038***
(2) STDR	0.036***	0.218***	-0.015	-0.091***	-0.093***	-0.152***	-0.014
(3) STDDUM	0.011	0.172***	-0.042***	-0.067***	-0.072***	-0.135***	0.006
(4)ABSDACC	0.119***	-0.304***	0.049***	-0.097***	0.060***	0.086***	0.069***
(5)SIZE	0.106***	-0.177***	0.073***	-0.077***	-0.079***	0.478***	0.378***
(6)LEV	0.295***	0.169***	-0.003	-0.097***	-0.105***	-0.102***	0.039***
(7)LOSSDUM	0.004	0.135***	0.072***	-0.068***	-0.097***	-0.159***	-0.069***
8)TA		-0.088***	0.038***	-0.211***	0.029**	-0.025**	-0.016
(9)STD_OCF			-0.105**	0.116**	-0.055**	-0.089**	-0.084**
(10)AGE				-0.085**	-0.125**	-0.009	-0.033**
(11)SLACK					-0.061	0.122	0.035
(12)OWN						-0.145**	0.015
(13)FOR							0.252**
(14)BIG4							

1) Please refer to Table 2 for variable definitions.
2) ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively (two-tailed).

4.3 Multivariate Results[1]

Using models (1), we perform a multivariate regression analysis to test whether debt maturity (STDR or STDDUM) is associated with investment efficiency. Table 4 shows the results from the regression model in equation (1) using full sample. The coefficient (β_1) on STDR (STDDUM) is significantly positive (+) at 5% (5%) with INV_EF. Cosistent with our prediction, firms with higher use of short-term debt enhances investment efficiency.

Table 5 shows the results from the regression model in equation (1) using over-investment sample. The coefficient (β_1) on STDR (STDDUM) is significantly positive (+) at 5% (5%) with INV_EF. Table 6 shows the results from the regression model in equation (1) using under-investment sample. The coefficient (β_1) on STDR (STDDUM) is positive (+) and not significant with INV_EF.

As we have seen above, in the total sample and the over-investment sample are significant, but in under-investment sample is not significant. As a result, the relationship between debt maturity and investment efficiency can be deduced to be strongly significant in the over-investment sample.

[1] STDR has a high correlation with STDDRUM and LEV. According to Hair, Black, Babin & Anderson (2010), the presence of a high correlation is an indication of multicollinearity measured by the variance inflation factor (VIF). The variance inflation factor (VIF) of the independent variables used in the regression analysis of this study was less than 3.28 and not more than 10, the problem of multicollinearity is not serious. Generally, when the variance inflation factor (VIF) exceeds 10, the problem of multicollinearity is considered serious. In other words, the result of regression analysis from Tables 4 to 9 show that the multicollinear problem is not serious.

Table 4. Debt maturity and Investment efficiency: Total sample

$$INV_{EF_{it}} = \beta_0 + \beta_1 STDR_{it}\ (or\ STDDUM_{it}) + \beta_2 ABSDACC_{it} + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \beta_5 LOSSDUM_{it} + \beta_6 TA_{it} + \beta_7 STD_{OCF_{it}} + \beta_8 AGE_{it} + \beta_9 SLASCK_{it} + \beta_{10} OWN_{it} + \beta_{11} FOR_{it} + \beta_{12} BIG_{it} + \sum YD + \sum ID + \varepsilon_{it} \quad (1)$$

Variables	Independent Variable Current debt ratio		Independent Variable Current debt dummy	
	Coefficient	t-value	Coefficient	t-value
INTERCEPT	-1.266	-8.800***	-1.217	-8.640***
STDR	0.126	2.090**		
STDDUM			0.020	1.700**
ABSDACC	0.325	2.760***	0.327	2.780***
SIZE	0.014	2.600***	0.013	2.390**
LEV	-0.027	-0.640	0.008	0.220
LOSSDUM	0.014	0.870	0.016	1.030
TA	0.276	7.530***	0.263	7.340***
STD_OCF	-0.182	-2.080**	-0.172	-1.970**
AGE	0.001	0.090	0.001	0.140
SLACK	0.135	1.210	0.115	1.040
OWN	-0.054	-1.360	-0.055	-1.370
FOR	-0.030	-0.580	-0.027	-0.530
BIG4	-0.006	-0.440	-0.006	-0.440
YD	yes		yes	
ID	yes		yes	
No.	6,827		6,827	
F-VALUE	45.93***		45.80***	
ADJ R-SQ	19.71%		19.67%	

1) Please refer to Table 2 for variable definitions.
2) ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively (two-tailed).

Table 5. Debt maturity and Investment efficiency: Over-Investment sample

$$INV_{EF_{it}} = \beta_0 + \beta_1 STDR_{it}\ (or\ STDDUM_{it}) + \beta_2 ABSDACC_{it} + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \beta_5 LOSSDUM_{it} + \beta_6 TA_{it} + \beta_7 STD_{OCF_{it}} + \beta_8 AGE_{it} + \beta_9 SLASCK_{it} + \beta_{10} OWN_{it} + \beta_{11} FOR_{it} + \beta_{12} BIG_{it} + \sum YD + \sum ID + \varepsilon_{it} \quad (1)$$

Variables	Independent Variable Current debt ratio		Independent Variable Current debt dummy	
	Coefficient	t-value	Coefficient	t-value
INTERCEPT	-1.349	-5.990***	-1.261	-5.700***
STDR	0.229	2.560**		
STDDUM			0.039	1.970**
ABSDACC	0.619	3.500***	0.627	3.550***
SIZE	0.016	1.870*	0.014	1.610
LEV	-0.048	-0.770	0.013	0.240
LOSSDUM	0.027	1.140	0.031	1.280
TA	0.398	7.440***	0.376	7.170***
STD_OCF	-0.183	-1.350	-0.171	-1.260
AGE	0.004	0.340	0.005	0.380
SLACK	0.037	0.210	-0.002	-0.010
OWN	-0.021	-0.350	-0.021	-0.340
FOR	-0.026	-0.320	-0.023	-0.280
BIG4	0.008	0.360	0.008	0.390
YD	yes		yes	
ID	yes		yes	
No.	2,399		2,399	
F-VALUE	19.57***		19.38***	
ADJ R-SQ	18.72%		18.57%	

1) Please refer to Table 2 for variable definitions.
2) ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively (two-tailed).

Table 6. Debt maturity and Investment efficiency: Under-Investment sample

$$INV_{EF_{it}} = \beta_0 + \beta_1 STDR_{it}\ (or\ STDDUM_{it}) + \beta_2 ABSDACC_{it} + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \beta_5 LOSSDUM_{it} + \beta_6 TA_{it} + \beta_7 STD_{OCF_{it}} + \beta_8 AGE_{it} + \beta_9 SLASCK_{it} + \beta_{10} OWN_{it} + \beta_{11} FOR_{it} + \beta_{12} BIG_{it} + \sum YD + \sum ID + \varepsilon_{it} \quad (1)$$

Variables	Independent Variable Current debt ratio		Independent Variable Current debt dummy	
	Coefficient	t-value	Coefficient	t-value
INTERCEPT	-1.244	-6.640***	-1.225	-6.68***
STDR	0.051	0.620		
STDDUM			0.009	0.430
ABSDACC	0.113	0.710	0.113	0.710
SIZE	0.014	2.060**	0.014	2.010**
LEV	-0.024	-0.400	-0.010	-0.200
LOSSDUM	0.001	0.000	0.001	0.050
TA	0170	3.350***	0.165	3.340***
STD_OCF	-0.166	-1.450	-0.161	-1.410
AGE	-0.003	-0.250	-0.002	-0.230
SLACK	0.184	1.260	0.177	1.220
OWN	-0.073	-1.380	-0.074	-1.390
FOR	-0.032	-0.490	-0.030	-0.470
BIG4	-0.019	-0.990	-0.019	-1.000
YD	yes		yes	
ID	yes		yes	
No.	4,428		4,428	
F-VALUE	28.85***		28.84***	
ADJ R-SQ	21.39%		21.38%	

1) Please refer to Table 2 for variable definitions.
2) ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively (two-tailed).

Table 7-9 shows the results of total sample, over-investment sample, and under-investment sample, in which the relationship between the quality of earnings and investment efficiency varies according to the maturity level of the debt.

In previous studies, it was reported that the quality of earnings and investment efficiency were positively related (Biddle et al., 2009; Chen et al., 2011). Additionally, in this study we consider the relationship between earnings quality and investment efficiency to be differentiated according to debt maturity and analyze the sample according to debt maturity level.

Table 7 (Table 9) show that the relationship between earnings quality and investment efficiency is significant at the 5% (10%) level in the group where the current debt ratio is higher than the median. Table 8 present that the relationship between earnings quality and investment efficiency is significant at the 5% (5%) level in the group where the current debt ratio is higher (lower) than the median.

This implies that the relationship between earnings quality and investment efficiency can be different depending on over-investment sample, under-investment sample and the sample of debt maturity ratio.

Table 7. Earnings quality and Investment efficiency due to debt maturity: Total sample

$$INV_{EF_{it}} = \beta_0 + \beta_1 ABSDACC_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 LOSSDUM_{it} + \beta_5 TA_{it} + \beta_6 STD_{OCF_{it}} + \beta_7 AGE_{it} + \beta_8 SLASCK_{it} + \beta_9 OWN_{it} + \beta_{10} FOR_{it} + \beta_{11} BIG_{it} + \sum YD + \sum ID + \varepsilon_{it} \quad (1)$$

Variables	Current debt ratio > median		Current debt dummy < median	
	Coefficient	t-value	Coefficient	t-value
INTERCEPT	-1.307	-6.590***	-1.164	-5.720***
ABSDACC	0.328	2.130**	0.240	1.270
SIZE	0.017	2.300**	0.010	1.250
LEV	-0.037	-0.770	0.071	1.180
LOSSDUM	-0.008	-0.390	0.061	2.240**
TA	0.257	5.080***	0.276	5.240***
STD_OCF	-0.159	-1.390	-0.206	-1.480
AGE	0.002	0.180	0.001	0.040
SLACK	0.255	1.440	0.089	0.610
OWN	-0.060	-1.060	-0.031	-0.540
FOR	-0.104	-1.300	0.028	0.410
BIG4	-0.014	-0.730	0.004	0.190
YD	3,416		3,411	
ID	26.26***		22.18***	
No.	20.39%		18.76%	
F-VALUE	-1.307		-6.590***	
ADJ R-SQ	0.328		2.130**	

1) Please refer to Table 2 for variable definitions.
2) ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively (two-tailed).

Table 8. Earnings quality and Investment efficiency due to debt maturity: Over-Investment sample

$$INV_{EF_{it}} = \beta_0 + \beta_1 ABSDACC_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 LOSSDUM_{it} + \beta_5 TA_{it} + \beta_6 STD_{OCF_{it}} + \beta_7 AGE_{it} + \beta_8 SLASCK_{it} + \beta_9 OWN_{it} + \beta_{10} FOR_{it} + \beta_{11} BIG_{it} + \sum YD + \sum ID + \varepsilon_{it} \quad (1)$$

Variables	Current debt ratio > median		Current debt dummy < median	
	Coefficient	t-value	Coefficient	t-value
INTERCEPT	-1.559	-4.990***	-1.002	-3.110***
ABSDACC	0.543	2.360**	0.621	2.190**
SIZE	0.023	1.960**	0.007	0.570
LEV	-0.085	-1.250	0.126	1.380
LOSSDUM	-0.017	-0.570	0.108	2.650***
TA	0.392	5.410***	0.374	4.730***
STD_OCF	-0.126	-0.700	-0.286	-1.350
AGE	0.016	0.940	-0.007	-0.380
SLACK	0.282	1.060	-0.039	-0.170
OWN	0.018	0.210	-0.030	-0.330
FOR	-0.267	-2.020**	0.128	1.140
BIG4	0.007	0.240	0.006	0.200
YD	yes		yes	
ID	yes		yes	
No.	1,201		1,198	
F-VALUE	12.54***		9.09***	
ADJ R-SQ	21.33%		16.40%	

1) Please refer to Table 2 for variable definitions.
2) ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively (two-tailed).

Table 9. Earnings quality and Investment efficiency due to debt maturity: Under-Investment sample

$$INV_{EF_{it}} = \beta_0 + \beta_1 ABSDACC_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 LOSSDUM_{it} + \beta_5 TA_{it} + \beta_6 STD_{OCF_{it}} + \beta_7 AGE_{it} + \beta_8 SLASCK_{it} + \beta_9 OWN_{it} + \beta_{10} FOR_{it} + \beta_{11} BIG_{it} + \sum YD + \sum ID + \varepsilon_{it} \quad (1)$$

Variables	Current debt ratio > median		Current debt dummy < median	
	Coefficient	t-value	Coefficient	t-value
INTERCEPT	-1.174	-4.510***	-1.311	-4.960***
ABSDACC	0.265	1.690*	-0.150	-0.590
SIZE	0.014	1.460	0.014	1.460
LEV	0.011	0.170	-0.031	-0.390
LOSSDUM	-0.003	-0.120	0.009	0.240
TA	0.155	2.170**	0.189	2.660***
STD_OCF	-0.150	-1.010	-0.166	-0.890
AGE	-0.009	-0.580	0.003	0.170
SLACK	0.193	0.810	0.170	0.910
OWN	-0.100	-1.330	-0.046	-0.600
FOR	0.005	0.050	-0.050	-0.570
BIG4	-0.030	-1.140	-0.003	-0.090
YD	yes		yes	
ID	yes		yes	
No.	2,216		2,212	
F-VALUE	15.23***		14.95***	
ADJ R-SQ	20.26%		21.68%	

1) Please refer to Table 2 for variable definitions.
2) ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively (two-tailed).

5. CONCLUSION

This study empirically analyzes the relationship between debt maturity and investment efficiency. We examine how investment efficiency varies with debt maturity, additionally classify the group into median value according to the debt maturity level, and analyze the relationship between the quality of the earnings and the investment efficiency by the debt maturity group.

In this study, we analyze the non-financial firms listed on the Korea Stock Exchange at the end of December, 2002–2014. The investment efficiency was measured by multiplying the absolute value of the residual estimated by the McNichols and Stubben (2008) method by –1 and the quality of earnings (ABSDACC) was measured by multiplying the absolute value of the residual estimated by the modified Jones model (1991) by –1. Debt maturity was measured by the current debt ratio (current debt / total asset) and current debt dummy variable. The current debt dummy variable is defined as a dummy variable that is 1 if the current debt ratio is greater than the median, or 0 otherwise.

The results of this study are as follows. First, the debt maturity and investment efficiency were significantly positive (+) in both the total sample and the over-investment sample (Fuensanta & Juan, 2014). This means that the shorter the debt maturity, the higher the investment efficiency. The relationship between debt and investment efficiency is mainly found in the over-investment sample, which is consistent with previous studies (D'Mello & Miranda, 2010). Second, as a result of analyzing the maturity of debt by group according to the current debt ratio, the relationship between earnings quality and investment efficiency was significantly positive (+) in the short-term debt group.

By the sample, both the total sample, the over-investment sample, and the under-investment sample are significant, and we find that the relationship between earnings quality and investment efficiency is stronger in the group with shorter debt maturity. However, in the group with longer debt maturity, the relationship between earnings quality and investment efficiency was significantly positive (+) only in the over-investment sample.

In sum, it is suggested that debt maturity and investment efficiency can be different for the total sample, over-investment sample, under-investment sample, and the relationship between earnings quality and investment efficiency can be differentiated by debt maturity group.

This study has following additional contributions in comparison with domestic prior studies related to investment efficiency. First, prior studies related to investment efficiency are mainly concerned with the quality of financial reporting. This study implies that the relationship between investment efficiency and quality of financial reporting, and the relationship between debt maturity and investment efficiency among the characteristics of debt. Second, from the results of the analysis of the debt maturity and investment efficiency, it is confirmed that the debt is operating as a mechanism to monitor the investment efficiency of the corporation. Third, the analysis of debt maturity group suggests that the relationship between earnings quality and investment efficiency may be differentiated by short and long debt levels during debt financing.

The limitations of this study are as follows. First, we might have not considered omitted other variables. Second, we might not have fully considered other proxies for the characteristics of the debt maturity and investment efficiency. Third, there may be a measurement error in the quality of earnings and investment efficiency. Finally, the relationship between debt maturity and investment efficiency can vary depending on the circumstances of the company. For example, specific debt contract provisions or national regulatory environment. Therefore, attention should be paid to the generalization of the results of this study.

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