Factors Affecting the Bond Interest Rate of South Korean Public Institutions

By

HAN, Ji Man

CAPSTONE PROJECT

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF PUBLIC MANAGEMENT

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Committee in charge:

Professor Lee, Jinsoo, Supervisor

Professor Lee, Junesoo

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EXECUTIVE SUMMARY

K-water, has seen a 10-fold increase in its debt equity ratio over the past decade. According to the theory of financial management, an increase in a company's debt equity ratio also increases the risk of bankruptcy, thus increasing the cost of financing the company. Thus these following questions were studied in this study. Does the bond interest rate rise when the debt ratio of public corporations increases? What are the other factors that affect the bond's interest rate?

In the first analysis, K-water & Korea Express Highway's the bond valuation yield was analyzed. According to the analysis of the bond valuation yield of the two companies, these two companies are still publicly notified of the same bond valuation yield as in the past, even though K-water's debt ratio is 100%p higher than that of the Korea Expressway Corp. Therefore, it is hard to say that there is a correlation between the debt equity ratio and the bond interest rate.

In the second analysis, the K-water and LH cases analyzed the correlation of factors affecting bond interest rates among various independent variables, such as market conditions and issuance amount, including the benchmark interest rate, in addition to the financial ratio. The analysis showed that the independent variables that affect the two companies were net issuance amount and maturity.

According to the above two analyses, the bond issue rate of public corporations is not related to the increase in financial risks such as debt-to-equity ratio. This means that even if the debt ratio of public corporations increases and the financial risk increases, the investor does not believe that the risk of bankruptcy of public corporations increases, in other words, the investor is seen as putting more importance on the government's supportability when investing in bonds of public

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1. Introduction

The Former South Korean government ordered South Korean public institutions to carry out many construction projects aimed at revitalizing the economy, which resulted in an increase from 168.5 trillion won to 505.3 trillion won in the debt of South Korean Public Institutions from 2008 to 2015 (Kim, 2017). Issuing bonds has increased these debts because bonds are the main source of raising funds for public institutions. As of October 2019, public institutions' bond issue balance is 324 trillion won (KFIA, 2019). Moreover, public institutions were established with taxpayers' money and their revenues mostly come from public utility charges on tap water, electricity and gas. Thus, a rise in bond interest rates for public institutions will cause a hike in public utility charges, ultimately increasing the burden on the people.

There has been a growing interest in studying the correlation between company's financial risks, such as high debt ratio and increased bond interest rates (Choe & Choi, 2018). Because bond investors invest in the consideration of the financial risk of the entity, differences in financial statement results for each company cause a difference in their bond interest rates (Kyeong, 2014). Also, because a company's credit rating evaluates its financial factors, the bond interest rate is lowered when a company's credit rating is raised (Kim, 2006). However, these studies were conducted on bonds of private companies, not public institutions. It means that when South Korean public institutions go bankrupt, the government can pay off their debts instead. Consequently, the effect of a public institution's financial risk may differ from that of a private company. For example, figure 1 shows the difference in interest rate between Korean Treasury and K-water bonds from 2010 to 2018. Although K-water's debt ratio has increased tenfold from about 20 percent to about 200 percent during this period (Alio, 2019), the difference between the interest rate of K-water and the interest rate of Korean treasury bonds has not changed.

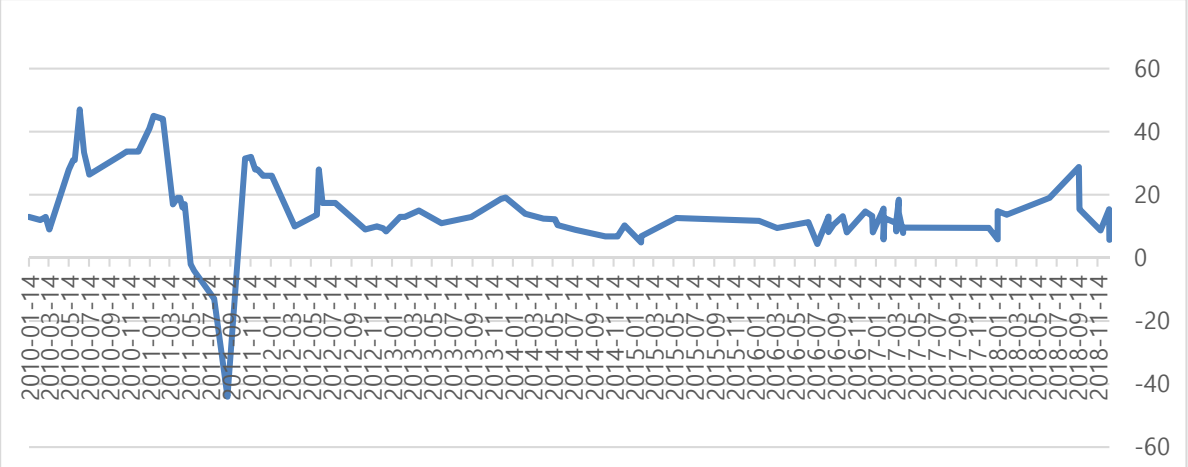

Figure 1 Interest rate difference between Korean Treasury bonds and K-water bonds of the same maturity.
Source. Korea Financial Investment Association. Bond Issue Statistics. (2019). Retrieved from http://freesis.kofia.or.kr/stat/FreeSIS.do?parentDivId=MSIS20000000000000

The purpose of this paper is to analyze the extent to which financial and nonfinancial factors affect the bond interest rate issued by South Korean public institutions', like K-water. In other words, the researcher will investigate whether there are factors that affect the bond issue rate of public institutions' differently from private companies. Thus, this paper will suggest policies on how to reduce financing costs for public institutions.

Ultimately, the following research questions will guide this research paper. First, is there a correlation between the financial risk of a public institution and the interest rate? Second, is there a difference in the issue rate due to financial risk, and if so how significant is this difference? Last, is there a specific factor that affects the bond issuing rate only for public institutions (such as Government policies and government budget support)?

This research paper is divided into four steps. First, I will analyze the current status of Korean bond market. Secondly, I will review previous research on determinants of private companies' bond issue rate. Thirdly, I will hypothesize the determinants of public institutions' bond interest rate and draw a statistical research model. Finally, I will summarize the study and suggest practical application methods. In order to conduct this research, I will run a regression of

various financial and nonfinancial dependent variables including debt ratio, interest compensation scale and credit ratings, etc. Also, I will examine the existing literature through the KDIS library and many companies' financial statements through audit reports.

2. Literature Review

Before proceeding further, it is necessary to define clearly the two terminologies referred to in this research paper. In particular, it is imperative to clarify what we mean when we talk about "corporate bond spread" and "bond credit rating." According to Kim (2014), corporate bonds have higher interest rates because of their high credit risk compared to treasury bonds. This difference between corporate bond interest rates and Treasury bond interest rates is called "corporate bond spread." In other words, investors demand higher interest rates than Treasury bonds because they think corporate bonds are riskier assets than treasury bonds. Regarding the second terminologies, "bond credit rating, it is useful to refer to the definition made by Kim (2009). Kim defines credit rating as a function of determining the ability of a corporate bond issuer to repay principal and interest and providing it to investors. Therefore, to evaluate credit ratings, credit rating agencies conduct quantitative assessments such as financial ratios and qualitative assessments such as the growth potential of the industry.

Recently, there have been growing concerns about the increase of public institutions' debt and bond issuance, but few related studies are conducted (Jun, 2015). Like developed countries, Korea's bond market size is growing, and bonds issued by public institutions are also exposed to the risk of price fluctuations due to interest rate fluctuations. However, there are not enough research papers about bonds compared to stocks in Korea (Choe & Choi, 2018).

Many research papers have been made to determine the cause of corporate bond spreads. In this section, I provide an account of the development of scholarship in the field of studies on the determinants of corporate bond spread. Foreign countries developed bond markets earlier

than Korea; thus, there are various research papers about determinants of corporate bond.

Papers about the correlation between credit ratings and bond spreads revealed that credit ratings alone cannot explain bond spreads (Collin et al., 2001; Elton et al., 2004; Chen et al., 2009). It was revealed that liquidity of corporate bonds is an important factor in determining the spread of corporate bonds (Houweling et al., 2005; Chen et al., 2007; Lin et al., 2011). There is a negative correlation between stock market returns and bond spreads (Lamdin, 2004). As explained above, many studies have been conducted in foreign countries to identify the correlation between external or macroeconomic indicators and bond spreads. In Korea, however, many studies have attempted to reveal the correlation between individual factors of corporate and bond spread.

In Korea, studies on the determinants of corporate bond spread have largely been divided into three parts. The first part is the financial factors and size of the enterprise. According to Byeon (2004), the debt ratio shows a positive relationship with the bond interest rate. However, there is no correlation between enterprise size and bond interest rates. The second is the study on the impact of credit ratings and the financial characteristics of companies on bond interest rates. (Kim, 2001). According to this research, there is a 51% correlation between the credit rating and corporate bond spread. In addition, financial factors like a debt ratio, also have additional causal factors. The third is a study that tries to find a correlation between corporate governance, managerial transparency, and bond interest rates. For governance items, the composition of the board of directors and the operation status of the board of directors were assessed. For managerial transparency items, financial information disclosure and IR activities were considered. According to the analysis, governance and managerial transparency represent a negative correlation between bond interest rates (Park, 2002).

The various studies quoted above helped explain the causes of bond spreads in the entire bond market. However, these studies were conducted on bonds of private companies, not public

institutions. Therefore, the above papers may not explain the cause of public institutions' bond spread. In other words, according to Kim (2001) and Byeon (2004), the company's credit ratings and financial ratios have an impact on the bond spread, but public institutions' credit ratings do not downgrade even if their debt increases more than ten times. In addition, according to Park (2002), financial information disclosure and IR activities affect bond spread but public institutions are passive in these activities compared to private companies. Nevertheless, bond spreads are much smaller than those of private companies.

The purpose of this study is not to focus on the analysis of the whole Korean corporate bond market. Instead, this research is primarily focused on the bond of Korean public institutions only for the last decade because I want to focus on recent, unique factors that affect the corporate bond interest rate of public institutions, unlike many previous research papers. To find the correlation between the financial ratio and bond interest rate, I will compare the cases of K-water and Korea Highway Corporation. Because these two companies have similar financial ratios and business areas from the past, the bond interest rate has been similar. I will also compare the case of K-water and LH. Over the past decade, the financial ratios of these two companies have changed in the opposite direction. In other words, K-water's debt ratio has increased tenfold from 2008 to 2018 but during this period, LH's debt-to-equity ratio dropped by about half.

It seems appropriate to limit the scope of this study to the most recent 10-year period and to public institutions. If an investigation is conducted for a period of more than ten years, it may become difficult to obtain accurate bond data, and the results may be distorted by various variable such as regulation changes in the financing market and changes in investor's demand. Instead, the results could present accurate factors affecting the bond interest rate.

3. Data

The bond data for the analysis of this research will be used from the Korea Financial Investment Association and Yonhap Infomax, a financial information provider. Unlike standardized and highly liquid treasury bonds, corporate bond transactions are conducted intermittently, making it difficult to measure the transaction rate of individual corporate bonds and the corresponding spread. Therefore, the transaction rate of individual corporate bonds will be excluded from the analysis list, and only the difference between the corporate bond interest on the day of issue and the interest rate with the same maturity of treasury bonds will be analyzed. Detailed definition of corporate bond for the analysis is bonds is as follows.

- When comparing the spread between KTBs and corporate bonds, only the Straight Bonds are analyzed. This is because structured bonds with options can distort interest rate differences.

- Compound bonds and discount bonds can also distort interest rate information, so only coupon bonds are analyzed.

- Land compensation bonds are excluded from analysis because interest rates are fixed based on the 3-year or 5-year periodic deposit interest rate announced by the Financial Association under the Land Compensation Act, regardless of individual company's financial risks.

- I will analyze bonds issued from 2009. Because kwater has issued a number of bonds for the four-river and Ara-waterway business since 2009, while LH was established in 2009 by merging two different companies.

According to the above definition, there are a total of 381 bond data to be analyzed, 115 for Kwater and 266 for LH and bond issue amount by year are shown in figure 2&3 below.

Unit : Number

Company	Sum	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Kwater	115	3	15	30	10	7	8	3	9	13	9	8
LH	266	3	10	30	69	72	39	14	14	5	6	4

Figure 2 Number of bond issues by year
Source. Korea Financial Investment Association. Bond Issue Statistics. (2019). Retrieved from http://freesis.kofia.or.kr/stat/FreeSIS.do?parentDivId=MSIS20000000000000

Unit : KRW 100 million

Company	Sum	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Kwater	125,000	6,000	20,700	36,600	10,400	7,000	8,900	2,600	9,200	10,400	7,900	5,300
LH	375,670	6,000	18,500	47,000	90,800	88,500	63,600	21,700	22,900	6,800	5,570	4,300

Figure 3 Bond issue amount by year
Source. Korea Financial Investment Association. Bond Issue Statistics. (2019). Retrieved from http://freesis.kofia.or.kr/stat/FreeSIS.do?parentDivId=MSIS20000000000000

Although the two institutions were selected to analyze changes in bond interest rates caused by changes in debt ratio, the problem found in the table above is that the number of bonds issued and the amount of bonds issued are different. Different timing of bond issuance is that the Bank of Korea's benchmark interest rate applied at the time the two institutions issued bonds was different, and financial market conditions, including demand for investment in bonds, were different due to changes in the real economy. The different size of bond issuance means that the two institutions' ability to negotiate interest rates with bond investors was also different when issuing bonds. Therefore, it is impossible to analyze the impact of interest rates on newly issued bonds due to changes in financial ratios, such as debt ratios, if the interest rates of the two institutions are simply compared.

Therefore, in this study, we want to analyze the correlation of bond interest rates by debt

ratio using bond valuation yield. The estimated interest rate when each individual entity issues a bond is called the bond valuation yield, which is calculated using data such as the interest rate of each individual entity's new issued bond and the transaction price of the existing bond. Bond valuation yields are accepted as market interest rates in the bond market. This bond valuation yield is announced daily, so if this is compared, the interest rate issued by each company can be compared.

4. Empirical Analysis

4.1. Bond Valuation Yield Analysis

To further explain bond valuation yield, there are four bond valuation companies in Korea, and these four companies analyze data such as changes in the interest rate of Korea treasury bonds, interest rates on newly issued bonds of each individual company, and the transaction price of existing bonds through their own bond interest rate estimation model, and disclose the estimated interest rate if each individual company issues new bonds. The average interest rate of estimated interest rates announced by the four companies may differ slightly from the actual bond issuance rate, but it is accepted as a market rate in the bond market. Therefore, when comparing daily bond valuation yield, changes in the bond issue interest rate of each agency can be compared.

In this section of bond valuation yield analysis, I will compare the examples of highway corporation and K-water. The reason for comparing the bond valuation yield between Korea Expressway Corporation and K-water is that in the past, when the bond valuation yield notice was first started, the interest rate on the newly issued bonds of the two companies was considered the same and announced at the same interest rate. The reason why the two companies were publicly announced at the same interest rate in the past was that they were the

only SOC public institutions with a lower debt ratio than the average debt ratio of 180% of other public corporations. Thus, comparing the bond valuation yield from the change in the debt ratio of these two companies, we find the effect of changes in the debt ratio of public institutions on the bond issue interest rate.

The table figure4 shows changes in the annual debt ratio of the two agencies. K-water was the lowest among South Korea's public companies with a debt ratio of 16% in 2007, but its debt ratio increased to about 180% in 2018 as it began large-scale state projects such as the four-river project and the Ara Waterway project in 2009. In comparison, the Korea Expressway Corporation had a debt-to-equity ratio of 87.6% in 2007, but the debt-to-equity ratio fell to 80.8% at present in 2018.

Unit : %

Company	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Kwater (A)	16.0	19.6	29.1	76.6	116.0	122.6	120.6	112.4	211.4	204.8	188.5	179.9
KE(B)	87.6	96.6	98.1	97.8	99.6	97.1	94.2	91.6	88.0	85.8	81.8	80.8
Difference (A-B)	(71.6)	(77.0)	(69.0)	(21.2)	16.4	25.5	26.4	20.8	123.4	119.0	106.7	99.1

Figure 4 K-water & Korea Expressway Corp.'s Debt-to-equity ratio
Source. All Public Information In-One. Retrieved from http://www.alio.go.kr/home.do

In terms of total borrowings and bonds payable to total assets, as shown in figure 5 below, K-water also saw a 57.0% increase in 2018 from 8.7% in 2007, while the Korea Expressway Corp. saw a drop from 43.1% in 2007 to 41.1% in 2018.

Unit : %

Company	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Kwater (A)	8.7	11.7	17.8	37.9	48.2	47.4	45.3	46.4	59.5	58.0	58.1	57.0
KE (B)	43.1	46.5	46.7	45.3	45.9	45.3	44.9	44.8	44.0	42.7	41.6	41.1
Difference (A-B)	(34.4)	(34.8)	(28.9)	(7.4)	2.3	2.1	0.4	1.6	15.5	15.3	16.5	15.9

Figure 5 K-water & Korea Expressway Corp.'s Total borrowings and bonds payable to total assets Source. All Public Information In-One. Retrieved from http://www.alio.go.kr/home.do

In other words, in the past, the two companies had similar financial ratios and were disclosed at the same bond valuation yield, but over the past decade, K-water saw its debt equity ratio more than 10-fold, while the Korea Highway Corp. saw its debt equity ratio fall slightly. Thus, comparing the bond valuation yield of the two companies, we will find a correlation between the change in the debt equity ratio and the bond issue interest rate.

The below figure6 is an average of bond valuation yield by year with a maturity of 5 years. According to this table, K-water, which has a low debt ratio than Korea Expressway Corp., had a 0.01% lower interest rate than the Korea Expressway Corp. until 2010, while the two companies had the same interest rate from 2011 to 2016, when K-water's debt equity ratio was higher than that of the Korea Expressway Corp. But in 2017, when K-water's debt equity ratio was still higher than that of Korea Expressway Corp., K-water's interest rate was again 0.01 % lower than that of Korea Expressway Corp. From 2017, K-water has a debt equity ratio of 100 % higher than Korea Expressway Corp., but interest rates are the same.

Therefore, the analysis of bond valuation yield of these two companies shows no clear correlation between the debt-to-equity ratio of public institutions and the issuing interest rate of bonds.

Unit : %

Company	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Kwater (A)	6.23	5.78	4.67	4.24	3.48	3.23	3.00	2.12	1.67	2.19	2.49	1.71
KE (B)	6.24	5.79	4.68	4.24	3.48	3.23	3.00	2.12	1.67	2.20	2.49	1.71
Difference **(A-B)**	(0.01)	(0.01)	(0.01)	-	-	-	-	-	-	(0.01)	-	-

Figure 6 K-water & Korea Expressway Corp.'s Average of bond valuation yield by year with a maturity of 5 years.
Source. Korea Financial Investment Association. Bond Issue Statistics. (2019). Retrieved from http://freesis.kofia.or.kr/stat/FreeSIS.do?parentDivId=MSIS20000000000000

4.2. Correlation Analysis

In the previous paragraph, through comparison of K-water and Korea Expressway bond valuation yield, it was found that there is no clear correlation between the debt equity ratio of public institutions and the interest rate of bond issuance. In this section, we will examine which factors affect the interest rate of bond issuance by analyzing the correlation between various financial ratios, bond maturity, etc. of LH and K-water, and bond issuance interest rates.

Over the past decade, the K-water and LH have shown opposite changes in their financial ratios. In other words, as shown in the table figure7&8&9, K-water's financial ratio worsened, with its debt rising and its net profit ratio falling. On the other hand, LH recorded a lot of profits through the construction of large-scale new cities such as Sejong City, Dongtan and Wirye, which allowed it to improve its debt equity ratio by about half in 2018 compared to 2008.

Unit : %

Company	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Kwater (A)	16.0	19.6	29.1	76.6	116.0	122.6	120.6	112.4	211.4	204.8	188.5	179.9
LH (B)	-	-	524.5	461.2	468.0	466.0	457.8	408.7	375.9	342.1	306.3	282.9
Difference (A-B)	16.0	19.6	-495.4	-384.6	-352.0	-343.4	-337.2	-296.3	-164.5	-137.3	-117.8	-103.0

Figure 7 K-water & LH's Debt Equity Ratio.
Source. All Public Information In-One. Retrieved from http://www.alio.go.kr/home.do

Unit : %

Company	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Kwater (A)	8.7	11.7	17.8	37.9	48.2	47.4	45.3	46.4	59.5	58.0	58.1	57.0
LH (B)	-	-	57.7	57.1	56.6	57.3	56.5	57.5	53.0	48.3	44.1	40.2
Difference (A-B)	8.7	11.7	-39.9	-19.2	-8.4	-9.9	-11.2	-11.1	6.6	9.7	14.0	16.8

Figure 8 K-water & LH's total borrowings and bonds payable to total assets.
Source. All Public Information In-One. Retrieved from http://www.alio.go.kr/home.do

Unit : %

Company	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Kwater (A)	8.2	6.8	4.0	2.3	4.6	8.4	9.5	8.1	-153.4	-3.2	5.5	7.1
LH (B)	-	-	7.6	3.9	5.2	6.6	3.9	4.0	4.1	9.7	11.8	11.5
Difference (A-B)	8.2	6.8	-3.6	-1.6	-0.5	1.8	5.6	4.1	-157.5	-12.9	-6.3	-4.4

Figure 9 K-water & LH's Ratio of net income to net sales.
Source. All Public Information In-One. Retrieved from http://www.alio.go.kr/home.do

Below are the multi-regulation analysis results (Stepwise) to detect factors that affect K-water's bond issue interest rate. Analysis of various independent variables, including the financial ratio, annual total bond issuance amount and base rate, found that only the net issuance amount and maturity of the bond affect the bond issuance interest rate.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Net issue amount	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	Maturity	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a. Dependent Variable: KwaterSpread

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.639[a]	.409	.403	8.99025
2	.667[b]	.445	.435	8.75065

a. Predictors: (Constant), Net issue amount

b. Predictors: (Constant), Net issue amount, Maturity

ANOVA*

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6258.063	1	6258.063	77.428	.000[b]
	Residual	9052.357	112	80.825		
	Total	15310.420	113			
2	Regression	6810.722	2	3405.361	44.472	.000[c]
	Residual	8499.698	111	76.574		
	Total	15310.420	113			

a. Dependent Variable: KwaterSpread

b. Predictors: (Constant), Net issue amount

c. Predictors: (Constant), Net issue amount, Maturity

Coefficients*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	12.279	1.122		10.949	.000
	Net issue amount	.000	.000	.639	8.799	.000
2	(Constant)	16.859	2.024		8.329	.000
	Net issue amount	.000	.000	.561	7.324	.000
	Maturity	-.319	.119	-.206	-2.687	.008

a. Dependent Variable: Kwater Spread

Excluded Variables*

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	Debt equity ratio	-.166[b]	-1.321	.189	-.124	.331
	Total borrowings and bonds payable to total assets	-.075[b]	-.629	.531	-.060	.370
	Current ratio	.070[b]	.964	.337	.091	.994
	Stockholders' equity to total assets	.101[b]	.814	.417	.077	.345
	Interest coverage ratio	.007[b]	.072	.942	.007	.518
	Profit volume ratio	.051[b]	.660	.511	.063	.877
	Return on assets	.054[b]	.697	.487	.066	.870
	Maturity	-.206[b]	-2.687	.008	-.247	.854
	Issue amount	-.719[b]	-1.614	.109	-.151	.026
	Base rate	.177[b]	2.040	.044	.190	.678
	Percentage of the total amount of bonds issued by state-owned enterprises and issued by Kwater	-.147[b]	-.660	.511	-.062	.108
	Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by Kwater	-.061[b]	-.830	.409	-.078	.978
2	Debt equity ratio	-.086[c]	-.670	.504	-.064	.308
	Total borrowings and bonds payable to total assets	-.006[c]	-.048	.962	-.005	.352
	Current ratio	.093[c]	1.306	.194	.124	.981
	Stockholders' equity to total assets	.031[c]	.250	.803	.024	.329
	Interest coverage ratio	-.029[c]	-.289	.773	-.028	.509
	Profit volume ratio	.023[c]	.305	.761	.029	.859
	Return on assets	.027[c]	.347	.729	.033	.853
	Issue amount	-.550[c]	-1.247	.215	-.118	.026
	Base rate	.154[c]	1.799	.075	.169	.670
	Percentage of the total amount of bonds issued by state-owned enterprises and issued by Kwater	-.053[c]	-.240	.811	-.023	.105
	Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by Kwater	-.050[c]	-.699	.486	-.067	.974

a. Dependent Variable: KwaterSpread

b. Predictors in the Model: (Constant), Net issue amount

c. Predictors in the Model: (Constant), Net issue amount, Maturity

Below are the multi-regulation analysis results (Stepwise) to detect factors affecting LH's bond issue interest rate, and the same independent variables as K-water were used. According to the analysis, LH's bond issue rate was affected by more diverse independent variables than K-water. In other words, LH's bond issue rate was found to be affected by the net issuance amount, the ratio of LH's net issuance amount among the total issued bonds of public corporations, maturity, interest coverage ratio and the benchmark interest rate.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.706[a]	.498	.494	5.27496
2	.747[b]	.558	.551	4.96869
3	.766[c]	.587	.577	4.82080
4	.780[d]	.608	.596	4.71351
5	.775[e]	.600	.591	4.74143
6	.786[f]	.618	.607	4.65157
7	.801[g]	.642	.627	4.52603

a. Predictors: (Constant), Issue amount

b. Predictors: (Constant), Issue amount, Net issue amount

c. Predictors: (Constant), Issue amount, Net issue amount, Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH

d. Predictors: (Constant), Issue amount, Net issue amount, Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH, Maturity

e. Predictors: (Constant), Net issue amount, Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH, Maturity

f. Predictors: (Constant), Net issue amount, Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH, Maturity, Interest coverage ratio

g. Predictors: (Constant), Net issue amount, Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH, Maturity, Interest coverage ratio, Base rate

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Issue amount	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	Net issue amount	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
3	Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
4	Maturity	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
5	.	Issue amount	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
6	Interest coverage ratio	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
7	Base rate	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a. Dependent Variable: LHSpread

ANOVA*

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3613.247	1	3613.247	129.855	.000[b]
	Residual	3645.097	131	27.825		
	Total	7258.344	132			
2	Regression	4048.924	2	2024.462	82.002	.000[c]
	Residual	3209.420	130	24.688		
	Total	7258.344	132			
3	Regression	4260.366	3	1420.122	61.106	.000[d]
	Residual	2997.977	129	23.240		
	Total	7258.344	132			
4	Regression	4414.541	4	1103.635	49.675	.000[e]
	Residual	2843.803	128	22.217		
	Total	7258.344	132			
5	Regression	4358.271	3	1452.757	64.621	.000[f]
	Residual	2900.073	129	22.481		
	Total	7258.344	132			
6	Regression	4488.797	4	1122.199	51.865	.000[g]
	Residual	2769.547	128	21.637		
	Total	7258.344	132			
7	Regression	4656.757	5	931.351	45.465	.000[h]
	Residual	2601.587	127	20.485		
	Total	7258.344	132			

a. Dependent Variable: LHSpread

b. Predictors: (Constant), Issue amount

c. Predictors: (Constant), Issue amount, Net issue amount

d. Predictors: (Constant), Issue amount, Net issue amount, Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH

e. Predictors: (Constant), Issue amount, Net issue amount, Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH, Maturity

f. Predictors: (Constant), Net issue amount, Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH, Maturity

g. Predictors: (Constant), Net issue amount, Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH, Maturity, Interest coverage ratio

h. Predictors: (Constant), Net issue amount, Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH, Maturity, Interest coverage ratio, Base rate

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.278	1.049		6.941	.000
	Issue amount	.000	.000	.706	11.395	.000
2	(Constant)	9.448	1.115		8.476	.000
	Issue amount	9.751E-005	.000	.419	4.671	.000
	Net issue amount	.001	.000	.377	4.201	.000
3	(Constant)	10.777	1.168		9.229	.000
	Issue amount	7.712E-005	.000	.331	3.612	.000
	Net issue amount	.001	.000	.419	4.752	.000
	Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH	-.247	.082	-.182	-3.016	.003
4	(Constant)	14.730	1.885		7.812	.000
	Issue amount	4.006E-005	.000	.172	1.591	.114
	Net issue amount	.001	.000	.466	5.292	.000
	Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH	-.244	.080	-.179	-3.042	.003
	Maturity	-.156	.059	-.194	-2.634	.009
5	(Constant)	17.396	.870		20.003	.000
	Net issue amount	.001	.000	.568	9.411	.000
	Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH	-.276	.078	-.203	-3.540	.001
	Maturity	-.209	.050	-.260	-4.224	.000
6	(Constant)	16.981	.870		19.522	.000
	Net issue amount	.001	.000	.541	8.982	.000
	Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH	-.296	.077	-.218	-3.849	.000
	Maturity	-.275	.056	-.342	-4.956	.000
	Interest coverage ratio	.296	.121	.156	2.456	.015
7	(Constant)	9.952	2.597		3.833	.000
	Net issue amount	.001	.000	.434	6.231	.000
	Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH	-.294	.075	-.216	-3.927	.000
	Maturity	-.208	.059	-.258	-3.519	.001
	Interest coverage ratio	.365	.120	.193	3.048	.003
	Base rate	2.867	1.001	.231	2.863	.005

a. Dependent Variable: LHSpread

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	Debt equity ratio	-.193[b]	-1.516	.132	-.132	.234
	Total borrowings and bonds payable to total assets	-.005[b]	-.062	.951	-.005	.561
	Current ratio	-.044[b]	-.522	.602	-.046	.540
	Stockholders´ equity to total assets	.145[b]	1.289	.200	.112	.302
	Interest coverage ratio	.230[b]	3.581	.000	.300	.854
	Profit volume ratio	.160[b]	2.613	.010	.223	.974
	Return on assets	.212[b]	3.326	.001	.280	.874
	Maturity	-.124[b]	-1.538	.126	-.134	.589
	Net issue amount	.377[b]	4.201	.000	.346	.422
	Base rate	-.230[b]	-1.341	.182	-.117	.130
	Percentage of the total amount of bonds issued by state-owned enterprises and issued by LH	-.439[b]	-3.753	.000	-.313	.255
	Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH	-.136[b]	-2.124	.036	-.183	.906
2	Debt equity ratio	.165[c]	1.100	.273	.096	.152
	Total borrowings and bonds payable to total assets	.122[c]	1.477	.142	.129	.495
	Current ratio	.107[c]	1.238	.218	.108	.453
	Stockholders´ equity to total assets	-.148[c]	-1.161	.248	-.102	.209
	Interest coverage ratio	.145[c]	2.122	.036	.184	.709
	Profit volume ratio	.035[c]	.487	.627	.043	.681
	Return on assets	.091[c]	1.197	.233	.105	.582
	Maturity	-.198[c]	-2.602	.010	-.223	.563
	Base rate	.061[c]	.341	.734	.030	.108
	Percentage of the total amount of bonds issued by state-owned enterprises and issued by LH	.148[c]	.437	.663	.038	.030
	Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH	-.182[c]	-3.016	.003	-.257	.883
3	Debt equity ratio	-.114[d]	-.651	.516	-.057	.105

	Total borrowings and bonds payable to total assets	-.031[d]	-.310	.757	-.027	.325
	Current ratio	.023[d]	.257	.797	.023	.400
	Stockholders´ equity to total assets	.141[d]	.891	.375	.078	.127
	Interest coverage ratio	.150[d]	2.265	.025	.196	.708
	Profit volume ratio	.129[d]	1.759	.081	.154	.588
	Return on assets	.128[d]	1.713	.089	.150	.569
	Maturity	-.194[d]	-2.634	.009	-.227	.563
	Base rate	.321[d]	1.719	.088	.150	.091
	Percentage of the total amount of bonds issued by state-owned enterprises and issued by LH	.380[d]	1.132	.260	.100	.028
	Debt equity ratio	-.302[e]	-1.675	.096	-.147	.093
	Total borrowings and bonds payable to total assets	-.124[e]	-1.210	.229	-.107	.293
	Current ratio	-.074[e]	-.783	.435	-.069	.343
	Stockholders´ equity to total assets	.317[e]	1.943	.054	.170	.112
	Interest coverage ratio	.215[e]	3.253	.001	.277	.653
4	Profit volume ratio	.194[e]	2.653	.009	.229	.545
	Return on assets	.203[e]	2.711	.008	.234	.518
	Base rate	.322[e]	1.764	.080	.155	.091
	Percentage of the total amount of bonds issued by state-owned enterprises and issued by LH	.597[e]	1.787	.076	.157	.027
	Debt equity ratio	.047[f]	.490	.625	.043	.343
	Total borrowings and bonds payable to total assets	-.030[f]	-.325	.746	-.029	.374
	Current ratio	.008[f]	.098	.922	.009	.452
	Stockholders´ equity to total assets	-.016[f]	-.168	.867	-.015	.330
	Interest coverage ratio	.156[f]	2.456	.015	.212	.736
5	Profit volume ratio	.148[f]	2.072	.040	.180	.589
	Return on assets	.117[f]	1.690	.094	.148	.640
	Base rate	.182[f]	2.227	.028	.193	.451
	Percentage of the total amount of bonds issued by state-owned enterprises and issued by LH	.138[f]	1.941	.054	.169	.597
	Issue amount	.172[f]	1.591	.114	.139	.261
	Debt equity ratio	.309[g]	2.653	.009	.229	.210
	Total borrowings and bonds payable to total assets	.350[g]	2.533	.013	.219	.150
6	Current ratio	.184[g]	1.871	.064	.164	.302
	Stockholders´ equity to total assets	-.349[g]	-2.694	.008	-.233	.169

	Profit volume ratio	.022[g]	.187	.852	.017	.209
	Return on assets	-.082[g]	-.649	.517	-.058	.188
	Base rate	.231[g]	2.863	.005	.246	.433
	Percentage of the total amount of bonds issued by state-owned enterprises and issued by LH	.194[g]	2.723	.007	.235	.560
	Issue amount	.293[g]	2.644	.009	.228	.232
	Debt equity ratio	.096[h]	.435	.664	.039	.058
	Total borrowings and bonds payable to total assets	.256[h]	1.794	.075	.158	.136
	Current ratio	.098[h]	.949	.345	.084	.264
	Stockholders' equity to total assets	-.139[h]	-.614	.541	-.055	.055
7	Profit volume ratio	-.029[h]	-.247	.806	-.022	.204
	Return on assets	-.029[h]	-.232	.817	-.021	.184
	Percentage of the total amount of bonds issued by state-owned enterprises and issued by LH	.066[h]	.436	.663	.039	.125
	Issue amount	.051[h]	.203	.839	.018	.046

a. Dependent Variable: LHSpread

b. Predictors in the Model: (Constant), Issue amount

c. Predictors in the Model: (Constant), Issue amount, Net issue amount

d. Predictors in the Model: (Constant), Issue amount, Net issue amount, Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH

e. Predictors in the Model: (Constant), Issue amount, Net issue amount, Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH, Maturity

f. Predictors in the Model: (Constant), Net issue amount, Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH, Maturity

g. Predictors in the Model: (Constant), Net issue amount, Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH, Maturity, Interest coverage ratio

h. Predictors in the Model: (Constant), Net issue amount, Percentage of the total net issue amount of bonds issued by state-owned enterprises and issued by LH, Maturity, Interest coverage ratio, Base rate

Therefore, a correlation analysis that affects the bond issuance rates of K-water and LH above showed that LH is affected by a variety of independent variables than K-water, but both companies are affected by the same net issuance amount and maturity. In other words, financial ratios, such as debt-to-equity ratios, were found not to affect the bond issuance rates of the two companies.

Analyzing the reason why net issuance amount and maturity affected the bond issuance rate, it is estimated that if the company has a large amount of bond issuance, company will be forced to issue the bond at the high interest rate without considering the high and low interest rates. In addition, if the maturity of the bond is prolonged, it seems to be because the investors take higher risks and demand higher interest rates.

5. Conclusion

In the past, the South Korean government ordered a large budget execution for Korean public institutions to revitalize the economy, which led to a rise in the debt equity ratio of many Korean public institutions. Among them, K-water, in particular, has seen a 10-fold increase in its debt equity ratio over the past decade. According to the theory of financial management, an increase in a company's debt equity ratio also increases the risk of bankruptcy, thus increasing the cost of financing the company.

The following questions were studied in this study. Does the bond issue rate rise when the debt ratio of public institutions increases? What are the other factors that affect the bond's issuance rate?

In the first analysis, the bond valuation yield was analyzed. The bond valuation yield is announced daily in consideration of market conditions, such as the benchmark interest rate and the change in the interest rate of Korean treasury, thus it is the estimated interest rate when

each company issues bonds. K-water and Korea Expressway Corp. have been publicly notified of the same bond valuation yield as they have had similar financial ratios in the past, but over the past decade, K-water has seen its debt equity ratio increase 10-fold, and the Korea Expressway Corp. has maintained the same debt equity ratio for 10 years. According to the analysis of the bond valuation yield of the two companies, the two companies are still publicly notified of the same bond valuation yield as in the past, even though K-water's debt ratio is 100%p higher than that of the Korea Expressway Corp. Therefore, it is hard to say that there is a correlation between the debt equity ratio and the bond interest rate.

In the second analysis, the K-watr and LH cases analyzed the correlation of factors affecting bond interest rates among various independent variables, such as market conditions and issuance amount, including the benchmark interest rate, in addition to the financial ratio. The analysis showed that the independent varibles that affect the two companies were net issuance amount and maturity. The reason is estimated that if the company has a large amount of bond issuance, company will be forced to issue the bond at the high interest rate without considering the high and low interest rates. In addition, if the maturity of the bond is prolonged, it seems to be because the investors take higher risks and demand higher interest rates.

According to the above two analyses, the bond issue rate of public corporations is not related to the increase in financial risks such as debt-to-equity ratio. This means that even if the debt ratio of public corporations increases and the financial risk increases, the investor does not believe that the risk of bankruptcy of public corporations increases, in other words, the investor is seen as putting more importance on the government's supportability when investing in bonds of public.

However, this report did not study which policies of the government could prove more firmly the possibility of support for public enterprises. If further research in this field is developed in the future, it will be a great help to improve save interest cost for Korean public enterprises.

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