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A Study on Asymmetric Volatility of Stock Returns: Focusing on the Effects of the Changes in the Capital Structure by Capital Financing Types

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Abstract: This study analyzes the effects of changes in the capital structure caused by raising capital on stock returns. Among the various factors influencing stock returns, this study focuses on three factors: capital financing types, capital structures and accrual-based earnings management. The signaling effects of raising capital by issuing bonds or equity affect stock returns, as do changes in the capital structure from different capital raising types. In addition, earnings management before financing affects stock returns. This study analyzes these three types of effects separately. In general, a firm's capital structure improves with issuing equity as its debt ratio declines, while issuing bonds deteriorates the capital structure since the firm's debt ratio increases. However, stock returns respond differently to changes of the same size in the capital structure due to asymmetrical volatility of stock returns, which can be explained by the leverage effect, volatility feedback effect and asymmetric information. According to the results of our analysis, change in the real debt ratio to the target debt ratio caused by issuing bonds have a greater impact on stock returns than the change in the real debt ratio to the target debt ratio due to issuing equity.

Key words: Asymmetric volatility, capital financing, capital structures, debt ratio, stock returns, earnings management, signaling effect

INTRODUCTION

This study analyzes the effects of changes in the capital structure due to capital raising via seasoned equity offerings and the issuance of bonds on stock returns. While the debt ratio of a company decreases with seasoned equity offerings, it increases with the issuance of bonds. Moreover, a lower debt ratio will increase stock returns while a higher debt ratio will decrease them. If the increase and decrease in the debt ratio are the same, will the rise and fall in stock returns be identical? It is difficult to answer this question partly because of the lack of a benchmark debt ratio. A rise or a fall of one point in a very low debt ratio has a different impact on stock returns than a change of one point in a very high debt ratio. To answer this question, this study conducts an analysis with the target debt ratio as the benchmark debt ratio. The target debt ratio was estimated using the Flannery and Rangan (2006) Model.

The findings indicate that the impact of change in the real debt ratio to the target ratio due to issuing bonds on stock returns exceeds that of change in the real debt ratio to the target ratio due to seasoned equity offerings. These results stem from the asymmetric volatility of stock returns which can be explained by the leverage effect, volatility feedback effect and asymmetric information as proposed by Black (1976) and Khil *et al*. (2009).

Literature review: Christie (1982) studied the relations between stock returns dispersion and a few explanatory variables and discovered that stock returns dispersion has strong positive relations with financial leverage and interest rates. In general, the market value of debt securities is less volatile that of equity securities. When a company faces financial hardship, the value of highly volatile equities falls more than the value of debt, increasing its debt ratio. The increased debt ratio reinforces the volatility of the returns on equity as part of the leverage effects. On the other hand, when a company is thriving, the volatility of the returns on equity reduces. Therefore, it can be said that in terms of leverage effects, positive relations exist between stock returns dispersion and the debt ratio and negative relations exist between stock returns dispersion and stock returns.

While many studies focused on the decline in the expected rate of return, Pindyck (1984) concentrated on the distribution of the expected rate of return. The relative importance of changes in the expected rate of return and its distribution differs in accordance with investor's risk

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aversion propensities. The market inherently dislikes uncertainty, volatility and risk. Unexpected market conditions drive volatility in the market.

Campbell and Hentschel (1992) viewed increased volatility in the equity market as a factor that raises the required rate of return and thus brings down the stock price; in addition, they developed a model that tests the volatility feedback effect. According to their results, while volatility feedback did not usually have a significant impact on the rate of return, they argued that effect was very important during highly volatile periods. This effect was explained as an asymmetric phenomenon where the market reacts to unfavorable market conditions by a greater margin compared to favorable market conditions.

Gorton and Pennacchi (1993) proposed that asymmetric information caused asymmetric volatility of stock returns. Positive feedback traders and noise traders exist on the market; they argued that the former buy rising stocks and sell falling stocks, whereas the latter, who are in the dark, undermine the efficiency of the market and cause asymmetric volatility that is more sensitive to falling stocks.

Companies with poor capital structures do not have high valuations. The debt ratio is one of the representative variables that affect the value of a company and as such, numerous studies support this notion. Issuing bonds increases the debt ratio, whereas issuing equity decreases it. Such a rise in the debt ratio has a negative impact on stock returns; however, a fall in the debt ratio impacts stock returns positively. Nevertheless, the effect of the rising debt ratio due to the issuance of bonds and that of the falling debt ratio resulting from seasoned equity offerings affect stock returns in opposite directions, creating a positive signaling effect from issuing bonds and a negative signaling effect from issuing equity. Therefore, more work is needed to separate the impacts resulting from changes in the capital structure on stock returns from the signaling effects.

The response of stock returns is likely to differ when the debt ratio rises with the issuance of bonds and when the debt ratio falls with seasoned equity offerings. Investor's risk aversion utility functions indicate that they react more sensitively to unfavorable market conditions in the equity market since a decline in the utility of not selling stocks that are falling with unfavorable market conditions is greater than a decline in the utility of not buying stocks that are rising with favorable market conditions.

As such, volatility of stock returns is asymmetric and is largely explained by three effects. First, Black (1976) discovered that stock returns are more volatile when they are in the negative, rather than positive, territory and he called this phenomenon the "leverage effect." Christle (1982) noted that volatility of stock returns is directly related to an increase in debt while Schwert (1989) empirically proved that a bigger standard deviation exists during periods with high debt ratios.

Second, Pindyck (1984), French *et al*. (1987), Campbell and Hentschel (1992) argued in favor of the volatility feedback effect. Basically, the market dislikes uncertainty and volatility. Irrespective of its nature (good or otherwise), news creates volatility in the market. Good news increases the stock price of a company, but even so, it creates volatility in the market. Hence, the market, which dislikes volatility, partially offsets a rise in the stock price. On the contrary, the stock price of a company decreases with bad news. Since bad news also creates volatility, the market instigates a fall in the stock price.

Third, Gammill and Perold (1989), Shiller *et al*. (1984), Subramanyam (1991), Gorton and Pennacchi (1993) proposed asymmetric information as a cause for the asymmetric volatility of stock returns. Rational investors buy rising stocks and sell falling stocks. On the other hand, irrational investors, who are in the dark are thought to undermine market efficiency and cause asymmetric volatility and thus react more sensitively to a fall in the stock price.

As such, the response of stock returns to a rising debt ratio resulting from the issuance of bonds can differ from the response of stock returns to a falling debt ratio caused by seasoned equity offerings. The following hypothesis tests the effects of such a change in the capital structure on stock returns.

Hypothesis: A change in the real debt ratio to the target debt ratio due to the issuance of bonds will have a greater impact on stock returns than a change in the real debt ratio to the target debt ratio resulting from seasoned equity offerings

MATERIALS AND METHODS

Two important factors must be considered in testing the aforementioned hypothesis. First, there is a signaling effect. In general, capital for a project with a high net present value is raised by issuing bonds. This is done to share the benefits of outstanding project performance among the existing shareholders. However, for projects with a small net present value or uncertainties, firms raise capital through seasoned equity offerings, the intention being to share the possible losses with new shareholders. Therefore, the market perceives news about the issuance of bonds as a signal of an investment in promising projects, resulting in a rise in the stock price while news about issuing equity is perceived by the market as a signal for investment in uncertain projects, resulting in a fall in the stock price. Second, earnings management also imposes an effect. Previous studies including those by Rangan (1998), Teoh *et al.* (1998a, b), Sloan (1996), Xie (2001) and Khan *et al.* (2016), focused on seasoned equity offerings and initial public offerings. When a company issues new stock, a high stock price is beneficial; there are incentives to raise the stock price before issuing equity. Therefore, a fall in the stock price after issuing equity is thought to reflect the earnings management effect along with the signaling effect. This study controls and analyzes such effects.

A declining capital structure has a negative impact on stock returns, while an improving capital structure has a positive impact on the same. However, the worsening and improving effects on the capital structure resulting from the issuance of bonds and seasoned equity offerings respectively affect the stock returns in opposite directions, with positive signaling effects from issuing bonds and negative ones from issuing equity. Therefore, the impact of signaling effects on the stock returns can be separated from the impact of the changes in the capital structure. To test the assumption that stock returns movements in response to a worsening capital structure resulting from the issuance of bonds differ from that to an improving capital structure resulting from seasoned equity offerings, we use Eq. 1 and conduct a regression analysis.

Research model:

$$SAR_t = \beta_0+\beta_1 SEO_t+\beta_2\Delta GAP_t+\beta_3 SEO_t\times \Delta GAP_t+\beta_4 DA_{t-1}+\beta_5 DA_{t-1}\times SEO_t+\beta_6 MV_{t-1}^{dec}+\beta_7 EP_{t-1}^{dec}+\beta_8 MTB_{t-1}^{dec}+\beta_9 BETA_{t-1}^{dec}+\beta_{10} SAR_{t-1}^{dec}+e_t$$

Where:

- SAR_t = Size adjusted returns
- SEO_t = 1 if financed by seasoned equity offerings, 0 if financed by issuing bonds
- GAP_t = The difference between the real and target debt ratio (real debt ratio-target debt ratio)
- ΔGAP_t = GAP_t -GAP_{t-1}
- Da_{t-1} = Discretionary accruals measured by Kothari *et al.* (2005)
- Mv^{dec}_{t-1} = Natural logarithm of market value of net common equity, transformed to a scaled-decile variable with values ranging 0 to 1
- Ep^{dec}_{t-1} = EPS divided by stock price, transformed to a scaled-decile variable with values ranging 0 to 1
- MTB^{dec}_{t-1} = market value of net asset divided by book value of net asset, transformed to a scaled-decile variable with values ranging 0-1
- $BETA^{dec}_{t-1}$ = Systematic risk, transformed to a scaled-decile variable with values ranging 0 to 1
- SAR^{dec}_{t-1} = size adjusted returns, transformed to a scaled-decile variable with values ranging 0 to 1

Equation 1 tests the assumption that changes in the capital structure resulting from different capital financing types affect stock returns differently. $SEO_t\times\Delta GAP_t$ is the interaction variable for the explanatory variables SEO_t and ΔGAP_t. It is expected that β_3 which is the coefficient of $SEO_t\times\Delta GAP_t$ will have a positive value. After classifying companies into 10 groups according to their market values, SAR is calculated by deducting the median rate of return of the group to which a company belongs from the company's rate of return (Ko, 2008; Cho, 2015). The control variables are variables that affect stock returns, including common variables used in a number of the previous studies. DA_{t-1} and $DA_{t-1}\times SEO_t$ control earnings management effects. As reported in previous studies, companies try to support their stock price by raising their earnings from discretionary accruals before issuing equity. Thus, variables such as DA_{t-1} and $DA_{t-1}\times SEO_t$ have been added to control such effects.

As a proxy for earnings management, we use a performance-matched model (Kothari *et al.*, 2005) to estimate discretionary accruals.

Performance matched model (Kothari *et al.*, 2005):

$$\frac{TA_t}{TA_{t-1}} = \beta_0 + \beta_1\left(\frac{1}{A_{t-1}}\right) + \beta_2\left(\frac{\Delta REV_t - \Delta AR_t}{A_{t-1}}\right) + \beta_3\left(\frac{PPE_t}{A_{t-1}}\right) + \beta_4 ROA_t + e_t$$

Where:

- Ta_t = Total accruals
- A_{t-1} = Beginning total assets
- ΔREV_t = Δrevenue = ΔREV_t-ΔREV_{t-1}
- ΔAR_t = Account receivable ΔAR_t-ΔAR_{t-1}
- PPE_t = Property, plant and equipment
- ROA_t = Return on assets = net income/total assets

Previous studies typically used average past debt ratio or industry average debt ratio as a proxy for the target debt ratio; however, this study uses values generated from the model developed by Flannery and Rangan (2006) for a more accurate estimation (Na *et al.*, 2015).

Table 1: Sample criteria

Samples	Values
KOSPI companies listed in the KRX between 1992 and 2014	12,446
(-) Companies with fiscal year not ending in December and financial companies	(1,196)
(-) Companies for which financial data are not available	(1,390)
(-) Companies that issued bonds and equity at the same time	(6,934)
Final samples	2,926

Flannery and Rangan (2006) Model:

$$TDEBT_t = \beta_0 + \beta_1 DEBT_{t-1} + \beta_2 EBIT_{t-1} + \beta_3 MTB_{t-1} + \beta_4 DEP_{t-1} + \beta_5 SIZE_{t-1} + 6PPEt\text{-}1 + 7RNDt\text{-}1 + \beta_8 RND\_D_{t-1} + \beta_9 RATED_{t-1} + \beta_{10} ID\_MED_{t-1} + e_t$$

Where:

- $TDEBT_t$ = Target debt ratio measured by Flannery and Rangan (2006)
- $DEBT_{t-1}$ = Real debt ratio = book value of debt/(book value of debt+market value of net asset)
- $EBIT_{t-1}$ = Earnings before interest and tax scaled by total asset
- MTB_{t-1} = Market to book ratio
- DEP_{t-1} = Depreciation expense scaled by total asset
- $SIZE_{t-1}$ = Natural logarithm of beginning total asset
- PPE_{t-1} = Property, plant and equipment scaled by total asset
- RND_{t-1} = Research and development expense scaled by total asset
- RND_D_{t-1} = 1 if there is no R&D expense, otherwise 0
- $RATED_{t-1}$ = 1 if there is a credit rating of corporate bonds, otherwise 0
- ID_MED_{t-1} = Industry median debt ratio

Many researchers such as Rajan and Zingales (1995), Hovakimian *et al.* (2001), Fama and French (2002) and Hovakimian (2006), used company characteristics that affect the target debt ratio.

The samples analyzed in this study were taken from the KOSPI companies listed on the Korea Exchange, covering the period between 1992 and 2014. The sample excludes financial companies that use different accounting methods and have different corporate characteristics, as well as companies with fiscal years not ending in December. In addition, the sample excludes companies that issued bonds and equity at the same time. The sample data were winsorized at the extreme end of 1% which yielded a final sample of 2,926 companies (Table 1).

RESULTS AND DISCUSSION

Table 2 shows the descriptive statistics of the main variables. Average SAR_t is 0.031, slightly >0, calculated after deducting the median, not the average, value. Previous researchers using the same measurement method such as Cho (2015), showed similar results. Average $DEBT_{t-1}$ and $TDEBT_{t-1}$ are almost similar (0.618 and 0.612, respectively). In addition, as these two debt ratios are similar in value to the general debt ratio reported in previous studies, they are likely to have been estimated appropriately. Average DA_{t-1} is 0.007 which is closer to but slightly greater than, 0 owing to the corporate characteristics of sample companies that raised capital through bonds or equity. The other control variables have values similar to those reported in previous studies and lie within the respective normal ranges.

Table 2: Descriptive statistics

Variables	N	Mean	SD	Median	Min	Max
SAR_t	2.926	0.031	0.331	-0.332	-0.379	0.691
SEO_t	2.926	0.365	0.481	0.000	0.000	1.000
$DEBT_{t-1}$	2.926	0.618	0.223	0.648	0.037	0.979
$TDEBT_{t-1}$	2.926	0.612	0.194	0.636	0.098	0.956
DA_{t-1}	2.926	0.007	0.065	0.001	-0.321	0.393
MV^{dec}_{t-1}	2.926	0.646	0.306	0.778	0.000	1.000
EP^{dec}_{t-1}	2.926	0.448	0.316	0.444	0.000	1.000
MTB^{dec}_{t-1}	2.926	0.527	0.329	0.556	0.000	1.000
$BETA^{dec}_{t-1}$	2.926	0.577	0.320	0.667	0.000	1.000
SAR^{dec}_{t-1}	2.926	0.465	0.326	0.444	0.000	1.000

Table 3 shows the Pearson correlations of the main variables. SAR_t and SEO_t have a significant negative correlation. This result is in line with the signaling hypothesis in which stock returns increase with the issuance of bonds and decrease when issuing equity. SAR_t and DA_{t-1} also have a significant negative correlation since earnings management before capital raising has a negative impact on the stock returns. DA_{t-1} and SEO_t have a significant positive correlation, indicating that there should be more earnings management before issuing equity rather than before issuing bonds. All the correlations between the main variables have significant values in the expected directions.

Table 4 shows the results of the regression analysis that tests the hypothesis (The results of the analyses using average debt ratios and median debt ratios by industry instead of the target debt ratio, based on Flannery and Rangan (2006)'s Model are not qualitatively different. The result of the analysis using a discretionary accrual measured by the modified Jones Model of Dechow *et al.* (1995) instead of the performance-matched model of Kothari *et al.* (2005) is also qualitatively similar. Every variance inflation factor has values <10 indicating no multicollinearity issue.). First, as shown in the partial model in Panel B, the regression analysis was conducted with SEO_t and ΔGAP_t as the explanatory variables and SAR_t as the dependent variable after controlling the earnings management effects. The results show that the coefficient of SEO_t is -0.089, a negative value indicating a negative impact on stock returns after issuing equity. In other words, the signaling hypothesis could be valid. The

Table 3: Pearson correlation matrix

Variables	SAR_t	SEO_t	DA_{t-1}	MV^{dec}_{t-1}	EP^{dec}_{t-1}	MTB^{dec}_{t-1}	$BETA^{dec}_{t-1}$	SAR^{dec}_{t-1}
SAR_t	1.000	-	-	-	-	-	-	-
SEO_t	-0.119^{***}	1.000	-	-	-	-	-	-
DA_{t-1}	-0.059^{***}	0.063^{***}	1.000	-	-	-	-	-
MV^{dec}_{t-1}	-0.014	-0.279^{***}	-0.081^{***}	1.000	-	-	-	-
EP^{dec}_{t-1}	0.091^{***}	-0.132^{***}	-0.029	0.065^{***}	1.000	-	-	-
MTB^{dec}_{t-1}	-0.134^{***}	0.107^{***}	-0.004	0.235^{***}	-0.202^{***}	1.000	-	-
$BETA^{dec}_{t-1}$	-0.017	-0.042^{**}	-0.043^{**}	0.215^{***}	-0.024	-0.106^{***}	1.000	-
SAR^{dec}_{t-1}	0.008	-0.076^{***}	-0.024	0.064^{***}	0.183^{***}	-0.010	-0.052^{***}	1.000

Refer to model for the definition of variables; ***,**,*Significant at the 1, 5 and 10% levels, respectively

Table 4: Regression analysis; $SAR_t = \beta_0+\beta_1 SEO_t+\beta_2\Delta GAP_t+\beta_3 SEO_t\times\Delta GAP_t+\beta_4 DA_{t-1}+\beta_5 DA_{t-1}\times SEO_t+\beta_6 MV^{dec}_{t-1}+_{77}EP^{dec}_{t-1}\beta_8 MTB^{dec}_{t-1}+\beta_9 BETA^{dec}_{t-1}+\beta_{10} SAR^{dec}_{t-1}+e_t$

	Panel A		Panel B		Panel C	
Variables	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Intercept	0.127	5.37^{***}	0.083	3.68^{***}	0.094	4.24^{***}
SEO	-0.069	-5.14^{***}	-0.089	-6.98^{***}	-0.089	-7.12^{***}
ΔGAP			-0.584	-18.03^{***}	-0.911	-19.00^{***}
SEO$\times\Delta$GAP					0.572	9.15^{***}
DA	-0.113	-0.90	-0.044	-0.37	-0.021	-0.18
DA$\times$SEO	-0.335	-1.82^{*}	-0.349	-2.00^{**}	-0.400	-2.32^{**}
MV^{dec}	-0.019	-0.85	0.015	0.70	0.007	0.31
EP^{dec}	0.059	2.95^{***}	0.054	2.83^{***}	0.050	2.70^{***}
MTB^{dec}	-0.110	-5.54^{***}	-0.053	-2.79^{***}	-0.048	-2.54^{**}
$BETA^{dec}$	-0.033	-1.66^{*}	-0.055	-2.93^{***}	-0.057	-3.10^{***}
SAR^{dec}	-0.012	-0.73	0.019	1.05	0.017	0.95
F-value	14.07	-	50.03	-	54.67	-

Adj. R^2 = 0.035, 0.131, 0.155; N = 2,926; 2,926; 2,926; Refer to Model for the definition of variables; ***, **, *Significant at the 1, 5 and 10% levels, respectively

coefficient of ΔGAP_t is -0.584. This means that changes in the capital structure have a negative relation with stock returns, resulting in a fall in stock returns when the real debt ratio to the target debt ratio rises after issuing bonds. On the other hand, stock returns increases when the capital structure improves after issuing equity.

Panel C in Table 4 reports the results of the regression analysis with the complete model where SEO_t, ΔGAP_t and $SEO_t\times\Delta GAP_t$ (the latter being an interaction variable between SEO_t and ΔGAP_t) are set as explanatory variables, while SAR_t is the dependent variable. The results show that SEO_t adversely affects stock returns as β_1, the coefficient of SEO_t, has a significant negative value while ΔGAP_t also negatively influences stock returns because β_2, the coefficient of ΔGAP_t has a significant negative value as well. However, β_3, the coefficient of the interaction variable $SEO_t\times\Delta GAP_t$ has a significant positive value. The finding for β_1 being negative is in line with the signaling hypothesis. When β_2, the coefficient of ΔGAP_t is in the negative territory, the real debt ratio to the target debt ratio increases which in turn indicates a fall in the stock returns due to a declining capital structure. The result fort β_3, the coefficient of $SEO_t\times\Delta GAP_t$ which is one of the main variables, being positive means that SAR_t, the dependent variable, reacts more sensitively to a unit change in ΔGAP_t resulting from the issuance of bonds than from the issuance of equity. In other words, the market reacts more sensitively to a declining capital structure than an improving one indicating that the result confirms the research hypothesis of this study.

Panel A in Table 4 shows the results of the partial model for the analysis of the signaling hypothesis. Supporting the argument that the market perceives seasoned equity offerings as an unfavorable condition resulting in a fall in stock returns, the coefficient of SEO_t is significantly negative. In addition, in line with the argument that earnings management before financing, causes a steeper fall in stock returns after issuing equity, the coefficient of $DA_{t-1}\times SEO_t$ returns a significant negative value. The coefficient of SEO_t resulting from the signaling effect is -0.069 which possibly reflects the effects of an improved capital structure. To analyze the research hypothesis, we focus on the coefficient of SEO_t in the complete model (-0.089) where the effects of an improved capital structure ($\Delta GAP_t+SEO_t\times\Delta GAP_t$) are controlled. Therefore, as there is a difference of only 0.020 between -0.069 and -0.089, we confirm the effects of an improved capital structure.

CONCLUSION

Volatility of stock returns is known to be asymmetric. Therefore, various studies aimed to explain the symmetric volatility of stock returns. Investors have risk-aversion utility functions owing to which they react more sensitively to unfavorable market conditions, because a decline in the utility of not selling stocks that are falling with unfavorable market conditions is greater than a decline in utility of not buying stocks that are rising with favorable market conditions. The volatility of stock returns is largely explained by three effects: the leverage effect, volatility feedback effect and asymmetric information. This study investigates how stock returns react to a declining capital structure due to the issuance of bonds and an improving capital structure from issuing equity in terms of asymmetric volatility of stock returns. The results of the analysis show that a change in the real debt ratio to the target debt ratio due to the issuance of bonds will have a greater impact on stock returns than such a change resulting from seasoned equity offerings. Such results can be interpreted to mean that the market reacts more sensitively to a declining capital structure than to an improving one. This study contributes to the literature by producing positive results with regard to the asymmetric volatility of stock returns by analyzing stock's responses when the real debt ratio rises or falls with the target debt ratio as a reference point. In addition, when firms raise capital, stock price responds to a mix of various factors. The present study is significant because it separates and analyzes the signaling effect, effect of the changes in the capital structure with different types of capital financing and the effect of accrual-based earnings management on stock returns during capital raising.

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