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Cost Stickiness and Investment Efficiency

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Abstract

Purpose: This study predicted cost asymmetry as a determinant of investment efficiency, and empirically analyzed the relationship between cost stickiness and investment efficiency. **Research design, data and methodology:** Using a sample of 4,382 Korean firm-year observations over 2011-2017 period, I examined the relationship between cost stickiness and investment efficiency. Asymmetrical cost behavior is measured as model of Homburg and Nasev (2008) and model of Park, Koo, and Pae (2012). Investment efficiency is measured as Chen, Hope, Li, and Wang (2011)'s model. **Results:** Firms with cost stickiness are less efficient in their investment than firms with non-cost stickiness. In other words, cost stickiness is an empirical result that supports the previous research on cost decision-making from perspective of managers pursuing private benefits due to information asymmetry. **Conclusions:** By showing that the manager's decision-making on the cost behavior affects the investment efficiency corresponding to capital management, the implications for the mechanism for efficient capital management are provided. Through the empirical results, it was shown that the cost stickiness is a product of opportunistic cost decision-making due to information asymmetry, and it is to present evidence that expands the meaning of the causes of asymmetric cost behavior.

Keywords : Cost Stickiness, Asymmetry Cost Behavior, Investment Efficiency, Overinvestment, Underinvestment

JEL Classification Code : M4, M41, M49

1. Introduction

The purpose of this study is to verify the relationship between cost stickiness and investment efficiency. Cost stickiness means that the rate of cost reduction when sales decrease by 1% is lower than the rate of cost increase when sales increase by 1% (Anderson, Banker, & Janakiraman, 2003). In the traditional cost model, it was assumed that volume and cost exhibit a symmetrical behavior, so the existence of cost stickiness has been confirmed, and studies have been actively conducted. In studies related to the causes of cost stickiness, the perspective that the manager makes a strategic decision in preparation for future demand and the perspective that the manager makes a decision in the process of pursuing personal utility are contradictory (Cheung, Jang, & Yang, 2013).

On the other hand, investment efficiency is defined as adopting an investment project with a positive net present value in the absence of market friction factors such as adverse selection or agency cost. In a perfect capital market, firms can make efficient investments, but in an imperfect capital market, inefficient investment decisions frequently occur. Such investment inefficiency is mainly caused by information asymmetry between managers and investors. Investment inefficiency is defined as over-investment, in which investment is made despite a negative (-) net present value, and under-investment, in which an investment opportunity with a positive (+) net present value is

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abandoned (Biddle, Hilary, & Verdi, 2009; Lee & Paek, 2015). Of these, overinvestment is caused by moral hazard, and underinvestment is caused by adverse selection.

In this study, according to the perspective that the cause of cost stickiness is the product of the discretionary judgment of managers, information asymmetry between firms and investors is predicted to increase and analysis is carried out. According to Biddle and Hilary (2006) examining the relationship between investment efficiency and accounting quality, high accounting quality appears to reduce information asymmetry between managers and external providers of capital. Accordingly, it is estimated that firms with cost stickiness will have inefficient investment compared to firms that are not.

Previous studies related to investment efficiency mainly focus on the effect of financial reporting quality and investment efficiency. Investment efficiency is directly related to the existence of a firm, not only in the quality of financial reporting, but also in making a decision on whether to use the limited resources of the firm efficiently. It is considered that manager's intentions related to cost input and cost decision making as well as financial reporting are important. Therefore, the purpose of this study is to examine how the manager's decision-making related to cost behavior affects investment efficiency.

The rest of this study is as follows. Section 2 presents the theoretical background and hypotheses, and section 3 explains the research design. And section 4 reports the empirical analysis results, and section 5, 6 present the discussion and conclusion.

2. Literature Review and Research Hypotheses

2.1. Cost Stickiness

Cost behavior refers to the behavior in which costs change as the volume of a company's activity changes. In general, when a company's activity level increases, its cost increases in response, and when the activity level decreases, its cost decreases (Cho, Kim, Gong, & Jeong, 2014).

As such, it is assumed in the traditional cost model that the pattern of cost change according to the decrease or increase in the activity level is symmetrical. However, a number of previous studies confirm the existence of asymmetric cost behavior that violates the traditional cost model, and present the results of the existence of asymmetric cost behavior, determinants, and implications of asymmetric cost behavior.

This study examines the prior research focusing on the determinants of asymmetric cost behavior to verify the relationship between cost stickiness and investment efficiency. Asymmetric cost behavior is divided into cost downward stickiness and cost downward elasticity. Cost downward stickiness means that the rate of cost reduction due to a decrease in sales appears to be smaller than the rate of cost increase due to an increase in sales. The main causes of asymmetric cost behavior are uncertainty about future demand, changes in sales, and decision-making on surplus resources (Koo, 2011).

The cause of cost downward stickiness is agency problems such as manager's pursuit of private interests and utility (Anderson, Banker, & Janakiraman, 2003). In addition, cost downward stickiness behavior is induced by managers' empire-building tendency and privileged consumption (Chen, Hope, Li, & Wang, 2011).

Koo (2011) examined earnings management incentives and cost downward stickiness, and Cheung, Jang, and Yang (2013) verified the relationship between tax audit and supervisory firms and cost downward stickiness from the perspective of agency costs. Kama and Weiss (2013) reported that managers promote costly downward stickiness in order to meet financial analysts' earnings forecasts (Ciftci & Salama, 2018). Banker and Byzalov (2014) find that the cost stickiness is due to management incentives and agency problems. Studies that have presented results in which earnings forecasting accuracy is lowered due to cost stickiness also suggest that cost stickiness is negative information that lowers the usefulness of earnings information. When costs exhibit cost stickiness, the distribution of reported earnings increases and the symmetry of earnings information decreases. As a result, the earnings forecasting of financial analysts and managers becomes less accurate and the error increases (Ciftci & Salama, 2018).

On the other hand, Lee (2012), and Park and Sonu (2016) stated that, based on the rational expectation theory perspective, the management expects future sales growth, so the cost stickiness is maintained. Kim and Ryu (2014) reported that managers who are overconfident about future earnings do not reduce surplus resources immediately but maintain related costs. This means that cost stickiness can be induced depending on the management characteristics. If managers are optimistic about future demand, they will decide to maintain idle resources by judging the decrease in current sales as a temporary phenomenon, which may lead to a cost stickiness in cost behavior (Banker, Byzalov, & Chen, 2013). As a company's financial risk level increases or operating risk increases, cost elasticity increases by flexibly adjusting resources according to sales changes (Holzhacker, Krishnan, & Mahlendorf, 2015a, 2015b).

In this study, from the perspective that cost stickiness is the result of managers' discretionary judgment, it is predicted and analyzed that cost stickiness increases information asymmetry and thus investment will be inefficient.

2.2. Investment Efficiency

Efficient investment means that a firm chooses an investment that brings positive net present value in the absence of market friction (Biddle, Hilary, & Verdi, 2009). Investment efficiency is caused by an incomplete capital market, and in the presence of information asymmetry, previous studies have focused on the causes of investment inefficiency and the effects of investment efficiency. In this section, we look at previous studies focusing on the causes of investment efficiency.

According to Biddle and Hilary (2006), which reviewed the relationship between investment efficiency and accounting quality, high-quality accounting information was found to reduce information asymmetry between managers and investors.

There are a number of previous studies (Bushman & Smith, 2001; Lambert, Leuz, & Verrecchia, 2007; Biddle, Hilary, & Verdi, 2009) that the investment efficiency increases when the quality of financial reporting is high. Cheng, Jang, and Yang (2013) analyzed companies that disclosed weaknesses in internal control systems to understand how the quality of financial reporting affects investment efficiency. Companies that disclose internal control weaknesses have a tendency to underinvest when there is a financial constraint, and a tendency to overinvest when there is no financial constraint.

Investments are determined by the company's internal growth preferences, financial stability and risk assessment (Ali & Asri, 2019). Chen, Hope, Li, and Wang (2011) suggested that firms can deviate from optimal investment. That is, overinvestment or underinvestment may occur. The reason is due to information asymmetry within the company. Excellent financial reporting quality can reduce information asymmetry and monitor manager's behavior.

Good quality of financial disclosure could assist investor to choose an optimum investment decision (Sadalia, Rahamani, & Muda, 2017). Financial reporting quality may improve investment efficiency by enabling managers to access reliable accounting information so as to produce more accurate investment decisions (Bushman & Smith, 2001; McNichols & Stubben, 2008; Gomariz & Bellestam, 2014). Good information quality may reduce the problem of overinvestment and underinvestment in the company (Hirshleifer, Hou, Teoh, & Zhang, 2004; Biddle, Hilary, & Verdi, 2009; Chen, Hope, Li, & Wang, 2011)

Shin and Oh (2017) analyzed the relationship between earnings transparency and investment efficiency. It is predicted that the more transparent the firm's profits are, the less information asymmetry problems will occur, and the lower manager control costs will improve investment efficiency. As a result of the analysis, the higher the earnings transparency, the higher the investment efficiency of the company.

Lee and Shin (2018) analyzed the effect of financial reporting quality on investment efficiency. As a result of the analysis, the company's financial reporting quality and investment efficiency showed a statistically significant positive (+) relationship. This means that investment efficiency increases as the quality of financial reporting increases.

Park and Shin (2019) analyzed the effect of earnings persistence on corporate investment efficiency. The higher the persistence of earnings, the more useful it is to predict future performance and future cash flows with current earnings, which means that the quality of earnings is high (Dichev, Graham, Harvey, & Rajgopal, 2013). As a result of the analysis, the higher the earnings persistence, the higher the company's investment efficiency.

Summarizing the above, it can be inferred that cost downward stickiness is a product of managers' discretionary decision-making on cost behavior due to information asymmetry, and at the same time can be a cause of investment inefficiency due to information asymmetry. Since the main cause of investment efficiency is distortion of efficient resource allocation by firms due to information asymmetry, in this study, it is predicted that the discretionary decision-making of managers on cost behavior will become a hindrance to investment efficiency. Therefore, the hypothesis is established as follows.

H1: There is a negative (-) relationship between cost stickiness and investment efficiency.

3. Research Design

3.1. Empirical Models

In this study, the regression model to verify the effect of cost stickiness on investment efficiency is shown in Equation (1). Cost stickiness, a variable of interest, was measured using the methodology of Homburg and Nasev (2008) and Park, Koo, and Pae (2012). The dependent variable was investment efficiency, which was measured using the model of Chen, Hope, Li, and Wang (2011).

$$INV\_EFF_{it+1} = \beta_0+\beta_1 CSDUM_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 LOSSDUM_{it} + \beta_5 TA_{it} + \beta_6 STD\_OCF_{it} + \beta_7 AGE_{it} + \beta_8 SLACK_{it} + \beta_9 BIG4_{it} + \sum YD + \sum ID + \varepsilon_{it+1} \quad (1)$$

Investment efficiency is defined as the value obtained by multiplying the absolute value of the residual estimated by the method of Chen, Hope, Li, and Wang (2011) by -1. The closer the residual is to 0, the more optimal investment is, and the farther the

residual is from 0, the more inefficient investment is. In this study, the absolute value of the residual multiplied by -1 is used to define and interpret the dependent variable as investment efficiency. That is, the larger the value, the more efficient the investment. In Equation (1), CSDUM is the variable of interest in this study as cost stickiness, and the predictive sign of β_1 is the negative (-) direction.

Control variables are SIZE, LEV, LOSSDUM, TA, STD_OCF, AGE, SLACK, and BIG4. SIZE is the firm size and is measured by taking the natural logarithm of total assets. LEV is a company's debt-to-equity ratio and represents leverage or capital structure. LOSSDUM is a loss dummy variable, which is 1 if net income is negative, and 0 otherwise. TA is the ratio of tangible assets divided by total assets. STD_OCF means the standard deviation of the operating cash flow in the cash flow statement for 5 years from period t-4 to period t divided by the lagged total assets. AGE is the natural logarithm of the listing year. SLACK is a cash ratio, which is a value obtained by dividing cash by total assets, and BIG4 is a dummy variable that is 1 if the auditor is a BIG4 accounting firm, and 0 otherwise.

Control variables were set by referring to previous studies (Biddle, Hilary, & Verdi, 2009; Chen, Hope, Li, & Wang, 2011; Cho & Kang, 2016). In order to control investment efficiency according to company size (SIZE) and debt ratio (LEV), additional control variables were considered. Additionally, the effect of loss (LOSSDUM), operating cash flow volatility (STD_OCF), and corporate age (AGE) on investment efficiency was considered and included as control variables (Biddle, Hilary, & Verdi, 2009). The level of cash holding (SLACK) was included in the control variable to control the ability to raise funds required for capital investment, and was additionally included in the tangible asset ratio (TA) control variable to control the impact of the past level of capital investment (Biddle , Hilary, & Verdi, 2009; Cho & Kang, 2016). In addition, year (YD) and industry dummy (ID) are included to control for year- and industry-specific characteristics.

Table 1: Variable Definitions

Variable	Definition
INV_EFF	investment efficiency, the absolute value of the residual measured as Chen et al. (2011) multiplied by (−1) for firm i in year t + 1
CS1DUM	cost stickiness measured as Homburg and Nasev (2008)
CS2DUM	cost stickiness measured as Park et al. (2012)
SIZE	firm size, the nature logarithm of total assets for the firm in year t
LEV	debt ratio for the firm in year t, (long-term debt/total assets)
LOSSDUM	loss dummy variable for the firm in year t, 1 if net income is negative, and 0 otherwise
TA	tangible asset ratio for the firm in year t, (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 number of years from the date of initial listing to the lagged period
SLACK	cash / total assets for firm i in year t
BIG4	1 if annual financial statement is audited by a BIG4 auditor, and 0 otherwise
YD	year dummy
ID	industry dummy
ε	residual

3.2. Measurement of Variables

3.2.1. Cost Stickiness (Homburg & Nasev, 2008)

Using the change in SG&A ratio defined in the model of Anderson, Banker, Huang, and Janakiraman (2007), the change in SG&A ratio is defined as the difference between the ratio of SG&A to sales in t year and SG&A to sales in t-1 year (Oh & Bae, 2021). Cost stickiness refers to a case in which the cost reduction when sales decrease is less than the cost increase when sales increase. Therefore, the ratio of SG&A expenses of a company that does not decrease SG&A when sales decrease is measured as in Equation (2) (Homburg & Nasev, 2008; Kim & Yang, 2012). If the value of CSFIRM(1) calculated in Equation (2) shows a positive value, it is defined as a company with cost stickiness. In this paper, firms for which CSFIRM(1) has a positive (+) value are set as 1, otherwise 0 as a dummy variable (Oh & Bae, 2021).

$$CSFIRM(1)_{it} = SG\_A\_Ratio_{it} * DSALES_{it} * DSG\_A_{it}$$
$$= (SG\_A_{it}/SALES_{it} - SG\_A_{it-1}/SALES_{it-1}) * DSALES_{it} * DSG\_A_{it} \quad (2)$$

Table 2: Variable Definitions

Variable	Definition
CSFIRM(1)	cost stickiness for firm i in year t measured as Homburg and Nasev (2008)
SG_A	sales, general, and administrative for firm i in year t
SALES	sales for firm i in year t
SG_A_Ratio	sales, general, and administrative for firm i in year t / sales for firm i in year t - sales, general, and administrative for firm i in year t-1 / sales for firm I in year t-1
DSALES	1 if (sales for firm i in year t / sales for firm I in year t-1) <1, and 0 otherwise
DSG_A	1 if SG_A_Ratio >0, and 0 otherwise

3.2.2. Cost Stickiness (Park, Koo, & Pae, 2012)

Park, Koo, and Pae (2012) measured cost stickiness by additionally considering the number of employees and tangible assets to the methodology of Homburg and Nasev (2008). The cost stickiness arises in relation to fixed resources, and the number of employees or the assets owned by the company incurs adjustment costs. Therefore, managers do not intentionally dispose of them (Anderson, Banker, & Janakiraman, 2003; Oh & Bae, 2021). When sales decrease, restructuring costs such as employee layoffs, and when sales increase, new hiring costs become a burden on the company, while tangible assets are accompanied by asset sales costs and customization costs (Park, Koo, & Pae, 2012). If the value of CSFIRM(2) calculated in Equation (3) shows a positive

(+) value, it is defined as a company with cost downward rigidity. In this paper, companies for which CSFIRM(2) shows a positive (+) value are set as 1, otherwise 0 as a dummy variable.

$$CSFIRM(2)_{it} = SG\_A\_Ratio_{it} * DSALES_{it} * DSG\_A_{it} * DEM_{it} * DTA_{it} \quad (3)$$

Table 3: Variable Definitions

Variable	Definition
CSFIRM(2)	cost stickiness for firm i in year t measured as Park et al. (2012)
SG_A	sales, general, and administrative for firm i in year t
SALES	Sales for firm i in year t
SG_A_Ratio	sales, general, and administrative for firm i in year t / sales for firm i in year t - sales, general, and administrative for firm i in year t-1 / sales for firm I in year t-1
DSALES	1 if (sales for firm i in year t / sales for firm I in year t-1) <1, and 0 otherwise
DSG_A	1 if SG_A_Ratio >0, and 0 otherwise
DEM	1 if (the number of employees for firm i in year t / sales for firm i in year t - the number of employees for firm i in year t-1 / sales for firm I in year t-1) >0, and 0 otherwise
DTA	1 if (tangible assets for firm i in year t / sales for firm i in year t – tangible assets for firm i in year t-1 / sales for firm I in year t-1) >0, and 0 otherwise

3.2.3. Investment Efficiency (Chen, Hope, Li, & Wang, 2011)

Investment efficiency was measured using the methodology of Chen, Hope, Li, and Wang (2011). When the residual estimated by Equation (4) is 0, it means optimal investment. If the residual is greater than 0, it means overinvestment, and if the residual is less than 0, it means underinvestment. In this study, the absolute value of the residual measured by the method of Chen, Hope, Li, and Wang (2011) multiplied by -1 is used. The larger the absolute value of the residual, the lower the investment efficiency. Therefore, the value multiplied by -1 means that the higher the value, the higher the investment efficiency.

$$INVEST_{it+1} = \beta_0+\beta_1 NEG\_GRWDUM_{it} + \beta_2 GRW_{it} + \beta_3 NEG\_GRWDUM*GRW_{it} +\varepsilon_{it+1} \quad (4)$$

Table 4: Variable Definitions

Variable	Definition
INVEST	Investment, (tangible assets for firm i in year t - (tangible assets for firm i in year t-1 + depriciation + loss on disposition of tangible assets - gain on disposition of tangible assets + research and development cost) / total assets for firm i in year t-1
NEG_GRWDUM	growth rate dummy, 1 if growth rate is negative, and 0 otherwise
GRW	growth rate, (sales for firm i in year t-1 - sales for firm i in year t-2) / sales for firm i in year t-2
NEG_GRWDUM*GRW	Interaction variable between NEG_GRWDUM and GRW
ε	residual

3.3. Samples and Data

In this study, companies listed on KOSPI from 2011 to 2017 were selected as a sample to analyze the effect of cost stickiness on investment efficiency. The detailed sampling process is presented in Table 5. Information on financial data was collected from the FN Data-Guide database. In order to secure the homogeneity of the sample with other companies, the financial industry is excluded from the sample. This is because the financial industry has different components of financial statements, and even the same account subject has different meanings from other industries. In order to exclude the effect of the settlement date, companies that are not corporations with a settlement of accounts at the end of December are excluded. Since companies with different settlement dates are focused on specific industries, industry characteristics according to settlement dates may affect the analysis results. Finally, in order to remove the effect of the extreme value on the empirical results, observations with values less than or equal to the lower 1% and higher than the upper 99% of each variable used in this analysis were winsorized to 1% and 99% as outliers. The final sample through the above process is 4,382 firm-year observations.

Table 5: Sample Selection

Sample Selection Criteria	Firm-Year Observations
Firms listed in the Korea Stock Exchange, 2011 to 2017	5,572
(less) Firms that aren't closing at the end of December	98
(less) Firms with financial industry	313
(less) Financial data could not be collected from the FN Data Guide	779
Final sample	4,382

Table 6 shows the distribution by year and industry for the sample. Panel A of Table 6 is the distribution of the sample by year. Although the number of companies is increasing year by year, there is not much variation by period. Panel B of Table 6 shows the distribution of the sample by industry. The coke and chemicals (10.86%) and professional service industries (8.85%) had a large share, while the non-metals (2.94%) and rubber and plastics (3.38%) industries accounted for a small proportion.

Table 6: Sample Distribution by Year and Industry

Panel A Sample Distribution by Year			
Year	Number	(%)	Cumulative (%)
2011	592	13.51	13.51
2012	600	13.69	27.20
2013	610	13.92	41.12
2014	618	14.10	55.23
2015	636	14.51	69.74
2016	652	14.88	84.62
2017	674	15.38	100

Total	4,382	100	100
Panel B Sample Distribution by Industry			
Industry	**Number**	**(%)**	**Cumulative (%)**
Food and Beverage	230	5.25	5.25
Fiber, Clothes and Leathers	166	3.79	9.04
Timber, Pulp and Furniture	178	4.06	13.10
Cokes and Chemical	476	10.86	23.96
Medical Manufacturing	234	5.34	29.30
Rubber and Plastic	148	3.38	32.68
Non-Metallic	129	2.94	35.62
Metallic	369	8.42	44.04
PC and Medical	284	6.48	50.52
Machine and Electronic	297	6.78	57.30
Other Transportation	331	7.55	64.86
Construction	199	4.54	69.40
Retail and Whole Sales	378	8.63	78.02
Transportation Services	149	3.40	81.42
Professional Services	388	8.85	90.28
Other	426	9.72	100
Total	4,382	100	100

4. Empirical Results

4.1. Descriptive Statistics

Table 7 is the descriptive statistics of the main variables. INV_EFF, which indicates investment efficiency, is -0.039 on average and -0.024 on median. The average of cost stickiness (CS1DUM, CS2DUM) was 0.296 and 0.209, respectively. The average (median) of the firm size (SIZE) is 26.843 (26.616), and the average (median) of the debt ratio (LEV) is 0.428 (0.420). The average loss dummy (LOSSDUM) is 0.231, which accounts for approximately 23% of the total sample. The ratio of tangible assets (TA) was average (median) 0.295 (0.283), and volatility of operating cash flow (STD_OCF) was average (median) 0.126 (0.110). Corporate age (AGE) was average (median) 2.826 (3.135), and cash weight (SLACK) was average (median) 0.058 (0.036). The BIG4 average was 0.674, and an average of 67% of the companies in the total sample were audited by a large accounting firm.

Table 7: Descriptive Statistics

Variable	Mean	Std.	Min	Median	Max
INV_EFF	-0.039	0.048	-0.330	-0.024	0.000
CS1DUM	0.296	0.457	0.000	0.000	1.000
CS2DUM	0.209	0.407	0.000	0.000	1.000
SIZE	26.843	1.464	23.649	26.618	30.783
LEV	0.428	0.241	0.001	0.420	2.140
LOSSDUM	0.231	0.421	0.000	0.000	1.000
TA	0.295	0.218	0.000	0.283	3.365
STD_OCF	0.126	0.073	0.030	0.110	0.525
AGE	2.826	0.878	0.000	3.135	4.111
SLACK	0.058	0.067	0.000	0.036	0.850
BIG4	0.674	0.469	0.000	1.000	1.000

Note: Please see Table 1 for variable definitions.

4.2. Correlations

Table 8 shows the results of pearson correlation analysis of major variables. Cost stickiness (CS1DUM, CS2DUM), debt ratio (LEV), loss dummy (LOSSDUM), tangible asset ratio (TA), cash flow volatility (STD_OCF) and investment efficiency (INV_EFF) were a significantly negative relationship. The more sticky the company is, the greater the debt ratio, the greater the proportion of tangible assets, and the greater the volatility of cash flow, the more inefficient the investment is. Cash holding ratio (SLACK) and investment efficiency (INV_EFF) show a significantly positive (+) relationship. The higher the proportion of cash holdings, the more efficient the company's investment is. Cost stickiness, a variable of interest in this study, and investment efficiency, a dependent variable, show a negative direction, and thus coincide with the prediction direction of the hypothesis. These results are the result of not controlling the influence of other variables on investment efficiency. Accordingly, a regression analysis was performed by including several control variables affecting the investment efficiency reported in previous studies in the model.

Table 8: Pearson Correlation

Variable	2	3	4	5	6	7	8	9	10	11
1. INV_EFF	-0.026	-0.040	0.017	-0.051	-0.030	-0.088	-0.031	0.020	0.025	-0.012
	(0.045)	(0.008)	(0.258)	(0.001)	(0.044)	(<.0001)	(0.038)	(0.190)	(0.096)	(0.419)
2. CS1DUM		0.801	-0.047	-0.076	0.184	-0.028	0.023	0.023	0.005	-0.038
		(<.0001)	(0.002)	(<.0001)	(<.0001)	(0.066)	(0.129)	(0.133)	(0.744)	(0.013)
3.CS2DUM			-0.014	-0.049	0.132	0.001	0.022	0.021	-0.001	-0.025
			(0.359)	(0.001)	(<.0001)	(0.940)	(0.152)	(0.178)	(0.938)	(0.098)

4.SIZE				0.169	-0.116	0.067	-0.054	.0.001	-0.118	0.452
				(<.0001)	(<.0001)	(<.0001)	(0.000)	(0.984)	(<.0001)	(<.0001)
5.LEV					0.211	0.289	-0.002	-0.010	-0.129	0.036
					(<.0001)	(<.0001)	(0.907)	(0.518)	(<.0001)	(0.019)
6.LOSSDUM						-0.011	0.061	0.085	-0.069	-0.114
						(0.480)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
7.TA							-0.029	0.013	-0.124	-0.003
							(0.051)	(0.405)	(<.0001)	(0.823)
8.STD_OCF								-0.120	0.089	-0.021
								(<.0001)	(<.0001)	(0.166)
9.AGE									-0.069	-0.084
									(<.0001)	(<.0001)
10.SLACK										-0.032
										(0.033)
11.BIG4										

Note: Please see Table 1 for variable definitions.

4.3. Multivariate Results

Table 9 shows the results of regression analysis of cost asymmetry and investment efficiency for the entire sample. The F value of the analysis result is statistically significant, so the research model is appropriate. The variance inflation index (VIF) of the independent variable used in the regression analysis of this study was 2 or less and did not exceed 10, indicating that the problem of multicollinearity is not significant. The regression coefficients of CS1DUM of Model 1 and CS2DUM of Model 2, indicating the relationship between cost stickiness and investment efficiency, were -0.004 and -0.005, which were significant in the negative (-) direction at the 5% and 1% levels, respectively. This is interpreted as cost decision-making based on manager's discretionary judgment impairing the investment efficiency of the company, and it is an empirical result supporting the agency cost perspective among the research results related to the cause of cost downward stickiness. In other words, it can be inferred that the information asymmetry between investors and companies increases due to the discretionary judgment of managers, which may lead to inefficient investment.

Table 9: Cost Stickiness and Investment Efficiency (Full Sample)

Variable	Model 1		Model 2	
Dependent	Coefficient	t-Stat	Coefficient	t-Stat
INTERCEPT	-0.065	-4.330***	-0.066	-4.390***
CS1DUM	-0.004	-2.230**		
CS2DUM			-0.005	-2.760***
SIZE	0.001	2.600***	0.001	2.650***
LEV	-0.008	-2.160**	-0.008	-2.160**
LOSSDUM	-0.002	-1.320	-0.002	-1.380
TA	-0.047	-11.580***	-0.047	-11.490***
STD_OCF	-0.013	-1.270	-0.013	-1.260
AGE	0.001	1.550	0.001	1.570
SLACK	-0.006	-0.530	-0.006	-0.520
BIG4	-0.003	-1.540	-0.003	-1.550
YDUM	Included		Included	
IDUM	Included		Included	
F-value	12.65***		12.75***	
Adj R-Sq	7.61%		7.67%	

Note: ***, **, and * represent significance at the 0.01, 0.05, and 0.1 level, respectively. Please see Table 1 for variable definitions.

Table 10 shows the results of regression analysis of cost stickiness and investment efficiency for the over-investment sample. The F value of the analysis result is statistically significant, so the research model is appropriate. The regression coefficients of CS1DUM of Model 1 and CS2DUM of Model 2, indicating the relationship between cost stickiness and investment efficiency, were 0.001 and -0.002, and showed no statistical significance.

Table 10: Cost Stickiness and Investment Efficiency (Overinvestment Sample)

Variable	Model 1		Model 2	
Dependent	Coefficient	t-Stat	Coefficient	t-Stat
INTERCEPT	-0.149	-5.800***	-0.148	-5.790***
CS1DUM	0.001	0.100		
CS2DUM			-0.002	-0.470
SIZE	0.004	4.130***	0.004	4..130***
LEV	-0.004	-0.670	-0.005	-0.710
LOSSDUM	0.001	0.430	0.002	0.510
TA	-0.048	-6.670***	-0.048	-6.680***
STD_OCF	-0.015	-0.820	-0.015	-0.810
AGE	0.003	2.160**	0.003	2.180**
SLACK	0.015	0.730	0.015	0.740
BIG4	-0.005	-1.480	-0.004	-1.480
YDUM	Included		Included	
IDUM	Included		Included	
F-value	9.29***		9.30***	

Adj R-Sq	10.84%	10.85%

Note: ***, **, and * represent significance at the 0.01, 0.05, and 0.1 level, respectively. Please see Table 1 for variable definitions.

Table 11 shows the results of a regression analysis of cost stickiness and investment efficiency for the underinvestment sample. The F value of the analysis result is statistically significant, indicating that the research model is appropriate. The regression coefficients of CS1DUM of Model 1 and CS2DUM of Model 2, indicating the relationship between cost stickiness and investment efficiency, were -0.005 and -0.005, which were significant in the negative (-) direction at 1% and 1% levels, respectively. The empirical results for the underinvested sample were similar to those for the full sample. This suggests that the negative relationship between cost stickiness and investment efficiency is the result of underinvestment sample. It should be noted that the investment inefficiency caused by the discretionary judgment of the management is mainly due to underinvestment, so stakeholders will be able to use it as a basis for decision making.

Table 11: Cost Stickiness and Investment Efficiency (Underinvestment Sample)

Variable	Model 1		Model 2	
Dependent	Coefficient	t-Stat	Coefficient	t-Stat
INTERCEPT	-0.302	-19.460***	-0.303	-19.500***
CS1DUM	-0.005	-2.670***		
CS2DUM			-0.005	-2.730***
SIZE	0.001	1.990**	0.001	2.010**
LEV	-0.004	-1.250	-0.004	-1.200
LOSSDUM	-0.005	-2.820***	-0.005	-2.980***
TA	-0.041	-10.100***	-0.041	-10.000***
STD_OCF	-0.009	-0.840	-0.009	-0.870
AGE	-0.001	-1.490	-0.001	-1.460
SLACK	-0.004	-0.330	-0.004	-0.370
BIG4	0.001	0.710	0.001	0.740
YDUM	Included		Included	
IDUM	Included		Included	
F-value	639.51***		639.59***	
Adj R-Sq	85.98%		85.98%	

Note: ***, **, and * represent significance at the 0.01, 0.05, and 0.1 level, respectively. Please see Table 1 for variable definitions.

4.4. Additional Analysis

Table 12 shows the results of additional analysis applying the methodology of Biddle, Hilary, and Verdi (2009) to the measurement of investment efficiency. The analysis results were generally similar to Table 9, showing that the hypothesis was supported even when other investment efficiency measures were applied, demonstrating the robustness of the study.

Table 12: Cost Stickiness and Investment Efficiency (Biddle, Hilary, & Verdi, 2009 : Full Sample)

Variable	Model 1		Model 2	
Dependent	Coefficient	t-Stat	Coefficient	t-Stat
INTERCEPT	-0.064	-4.090***	-0.065	-4.160***
CS1DUM	-0.004	-2.510**		
CS2DUM			-0.006	-3.040***
SIZE	0.002	2.560**	0.002	2.610***
LEV	-0.008	-2.250**	-0.008	-2.240**
LOSSDUM	-0.003	-1.470	-0.003	-1.550
TA	-0.051	-12.060***	-0.051	-11.960***
STD_OCF	-0.016	-1.570	-0.016	-1.550
AGE	0.001	1.650*	0.001	1.670*
SLACK	-0.009	-0.800	-0.009	-0.800
BIG4	-0.002	-0.880	-0.002	-0.890
YDUM	Included		Included	
IDUM	Included		Included	
F-value	12.78***		12.88***	
Adj R-Sq	7.69%		7.75%	

Note: ***, **, and * represent significance at the 0.01, 0.05, and 0.1 level, respectively. Please see Table 1 for variable definitions.

In Table 13, Hypothesis 1 was re-verified by classifying samples according to the cash holding ratio. The classification criterion was based on the median. As a result of the analysis, the group with a higher cash holding ratio than the median showed statistical significance in a negative direction. Thus, it can be seen that the negative relationship between cost stickiness and investment efficiency is prominent in the group with a higher cash holding ratio than the median. It can be inferred that excessive cash holdings of a company can become an impediment to investment efficiency when managers make discretionary cost decisions.

Table 13: Cost Stickiness and Investment Efficiency (According to Cash Holding Ratio : Full Sample)

Panel A Cash Holding Ratio > Median				
Variable	Model 1		Model 2	
Dependent	Coefficient	t-Stat	Coefficient	t-Stat
INTERCEPT	-0.102	-3.350***	-0.101	-3.330***
CS1DUM	-0.006	-2.130**		
CS2DUM			-0.010	-2.990***
Controls	Included		Included	
YDUM	Included		Included	
IDUM	Included		Included	
F-value	4.45***		4.61***	
Adj R-Sq	7.19%		7.51%	
Panel A Cash Holding Ratio > Median				
Variable	Model 1		Model 2	
Dependent	Coefficient	t-Stat	Coefficient	t-Stat
INTERCEPT	-0.056	-2.790***	-0.057	-2.840***
CS1DUM	-0.003	-1.540		

CS2DUM			-0.003	-1.230
Controls	Included		Included	
YDUM	Included		Included	
IDUM	Included		Included	
F-value	8.76***		8.73***	
Adj R-Sq	8.62%		8.59%	

Note: ***, **, and * represent significance at the 0.01, 0.05, and 0.1 level, respectively. Please see Table 1 for variable definitions.

In Table 14, Hypothesis 1 was re-verified by classifying samples according to the proportion of tangible assets. Samples were classified based on the median. As a result of the analysis, there was a statistical significance in the negative direction in the group where the proportion of tangible assets was greater than the median. Thus, it can be seen that the negative relationship between cost stickiness and investment efficiency is prominent in the group where the proportion of tangible assets is larger than the median. It can be inferred that a company with a high concentration of tangible assets can become an impediment to investment efficiency when managers make discretionary cost decisions.

Table 14: Cost Stickiness and Investment Efficiency (According to Tangible Asset Ratio : Full Sample)

Panel A Tangible Asset Ratio > Median				
Variable	**Model 1**		**Model 2**	
Dependent	**Coefficient**	**t-Stat**	**Coefficient**	**t-Stat**
INTERCEPT	-0.054	-1.890*	-0.055	-1.930**
CS1DUM	-0.006	-2.010**		
CS2DUM			-0.006	-1.970**
Controls	Included		Included	
YDUM	Included		Included	
IDUM	Included		Included	
F-value	5.85***		5.82***	
Adj R-Sq	7.47%		7.43%	
Panel A Tangible Asset Ratio > Median				
Variable	**Model 1**		**Model 2**	
Dependent	**Coefficient**	**t-Stat**	**Coefficient**	**t-Stat**
INTERCEPT	-0.090	-4.670***	-0.090	-4.680***
CS1DUM	-0.001	-0.540		
CS2DUM			-0.003	-1.220
Controls	Included		Included	
YDUM	Included		Included	
IDUM	Included		Included	
F-value	5.75***		5.80***	
Adj R-Sq	6.65%		6.70%	

Note: ***, **, and * represent significance at the 0.01, 0.05, and 0.1 level, respectively. Please see Table 1 for variable definitions.

5. Discussion

After the empirical study of Anderson, Banker, and Janakiraman (2003), cost stickiness has been actively studied. Anderson, Banker, and Janakiraman (2003) argued that the incentives and decision-making of cost stickiness are related to the pursuit of private interests of managers, which is a decision-making for maximizing their own utility and is the main cause of agency costs. On the other hand, there is also the argument that the cost stickiness is the rational judgment of the management. While follow-up studies on the incentives and motives of cost stickiness are actively in progress, managers' cost decision-making is an important factor influencing the firm's sustainability. In addition to cost decision-making, investment efficiency also has a significant impact on the sustainability of a firm. The main cause of cost stickiness and investment inefficiency is information asymmetry between managers and investors. Therefore, through the relationship between cost stickiness and investment efficiency, the effect of managers' hidden actions on investment efficiency can be examined.

The cause of investment efficiency is information asymmetry due to the imperfection of the capital market, and managers make investment decisions of overinvestment or underinvestment due to moral hazard or adverse selection. Even if the probability of generating a profit is low, overinvestment occurs due to the act of choosing an investment that can bring a high return. On the other hand, the problem of underinvestment of the company arises ex post because the capital supplier limits the supply of capital in advance.

A number of efforts have been made in previous studies to identify the causes of such investment efficiency and devices for alleviating investment inefficiency. Improving the quality of accounting information through proxies such as earnings transparency and earnings persistence (Biddle & Hilary, 2006; Shin & Oh, 2017; Lee & Shin, 2018; Park & Shin, 2019), improving important weaknesses of internal control systems (Kim, 2015) and establishment of sound corporate governance (Ban, 2011) can improve investment efficiency.

On the other hand, cost stickiness can be the result of the manager's rational judgment on cost behavior or the purpose of pursuing private benefits due to the imperfection of the capital market.

Therefore, this study tried to examine how cost stickiness affects investment efficiency according to the view that cost decision-making is caused by information asymmetry.

6. Conclusion

This study investigated the effect of cost stickiness on investment efficiency using a sample 4,382 firm-year observations from 2011 to 2017 for companies listed on KOSPI.

The model of Homburg and Nasev (2008), and Park, Koo, and Pae (2012) was selected to measure the cost stickiness, and the

model of Chen, Hope, Li, and Wang (2011) was applied to the measurement of investment efficiency.

The analysis results of this study are as follows. First, as a result of analyzing the full sample, the cost stickiness and investment efficiency were significant in the negative (-) direction. This means that companies with cost stickiness are less efficient in their investment than those without.

In other words, cost stickiness is an empirical result that supports the previous research on cost decision making from the perspective of managers pursuing private benefits due to information asymmetry.

As a result of analyzing the sample by dividing it into an over-investment sample and an under-investment sample, the negative relationship between cost stickiness and investment efficiency was significant only in the under-invested sample. It can be inferred that the empirical result that investment efficiency and cost stickiness have a negative relationship is due to underinvestment sample.

Even when investment efficiency was measured with the methodology of Biddle, Hilary, and Verdi (2009), the empirical results were maintained, showing the robustness of the study. In addition, as a result of analyzing the sample by dividing it into cash holdings ratio and tangible asset ratio, statistical significance was found only in the sample group with large cash holding ratio and tangible asset ratio.

This is an empirical result that shows that the relationship between cost stickiness and investment efficiency can be different depending on the characteristics of each firm.

This study is meaningful in that it directly revealed that cost stickiness can be a determinant of investment efficiency in the period after the introduction of K-IFRS. By showing that the decision-making on the cost behavior of managers affects the investment efficiency corresponding to capital management, this study provides implications for the mechanism for efficient capital management. In addition, it was found that investment in firms with cost stickiness is inefficient compared to firms without cost stickiness. This is a circumstance that shows that cost stickiness is a product of opportunistic cost decision-making due to information asymmetry, and provides evidence to expand the meaning of the causes of asymmetric cost behavior.

Academically, there is a contribution point in suggesting a direction for follow-up research through the relationship between cost stickiness and investment efficiency. In practice, the auditor can use the empirical results of this study to establish an audit plan according to cost behavior when applying the audit process, and investors can refer to the cost asymmetry and efficiency of investment performance when making investment decisions.

The limitations of this study are that there may exist a problem of omitted variables that affect investment efficiency, and measurement errors in cost stickiness and investment efficiency. We look forward to a study that considers the relationship between investment efficiency according to the implication of cost stickiness and future research according to the characteristics of each firm and industry.

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