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# A Study on Asymmetrical Cost Behavior of Distribution Industry: Evidence from Korea

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## Abstract

**Purpose:** This research investigates the cost behavior of the distribution industry. Specifically, we investigate if the ratio of the increase in costs with an increase in sales is consistent with the ratio of the decrease in costs when sales decrease. Traditionally, cost is assumed to be symmetrical. In the case of the distribution industry, it was expected that the downward rigidity of the cost would be shown because it would be very difficult to decide to adjust resources when sales temporarily decrease. Therefore, studies have looked at Korean capital markets based on manufacturing and steel industries. However, no research has been done on the distribution industry. **Research design, data, and methodology:** To verify the hypothesis of this study, the asymmetry of cost was measured by Anderson et al. (2003). The sample used 28,695 firm-year data from 2002 to 2019 for the KOSPI and KOSDAQ stock markets. **Results:** The empirical analysis results are as follows. First, asymmetry of cost was observed in the case of the distribution industry. We confirm cost rigidity when sales decreased. Conclusions. This is the first study to look at cost behavior in the distribution industry, and the downward rigidity of cost in the distribution industry is observed.

**Keywords:** Cost Behavior, Cost Stickiness, Cost Asymmetry, Managers' Internal Resource Decision, Distribution Industry

**JEL Classifications:** D40, D52, M41

## 1. Introduction

This study investigated the management's decision-making of internal resources as sales change in the distribution industry. There has been an effort to look at the financial characteristics of distribution industry and this study is to verify cost behavior as an extension of these studies (Shin, 2019). The distribution industry is one of the industries in which the cost structure is different from the manufacturing industry and decision-making based on the business environment is difficult to make flexible decisions(Cho & Song, 2010; Paek, 2010; Yoon, 2014; Yeom & Cho, 2014). But nothing is known about the cost behavior of this industry. Therefore, this study is to conduct an analysis to answer following three empirical questions. First, we investigate whether asymmetry cost behavior exists in distribution industry. In the traditional view, it is assumed that costs occur purely according to cost drivers, but according to the case study in Noreen (1991) suggested that the increase in costs as sales increase and the slope of reduction in costs as sales decrease are different. In subsequent studies, economic factors (Della Via & Pego, 2014) or differences between countries (Calleja et al., 2006; Yanwen & Yugang, 2009; Bugeja et al., 2015; Kitching et al. 2016), the manager's optimism about future performance (Yang, 2015; Kuang et al., 2015) has been reported to have an impact. However, the industry-specific research is relatively poor. Therefore, looking at the existence of asymmetry in costs in the distribution industry will be meaningful in that it will be able to grasp the cost behavior of the distribution industry and information on managers'

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internal resource decisions in the distribution industry. Second, we investigate to confirm that asymmetry in the costs of the distribution industry is differently observed compared to other industries. Third, the distribution industry is divided into wholesale, retail, warehouse and transportation to identify which industries have strong relevance.

For this purpose, a total of 28,695 companies listed on the KOSPI and KOSDAQ markets were analyzed from 2002 to 2019. The model presented in Anderson et al. (2003) was used to measure asymmetry in cost. The analysis results are summarized as follows. First, the downward rigidity of the cost could be confirmed by the analysis of the distribution industry. In other words, in the Korean distribution industry, the slope of the cost when sales fell was lower than the increase in costs when sales increased. This means that disposition of surplus assets is not well evident in the distribution industry when sales decline. Second, when the entire sample was divided into distribution and non-distribution industry, it was observed that the downward rigidity of the cost in the distribution industry was higher than that of other industries. Third, when the distribution business was divided into wholesale and retail and transportation businesses, the downward rigidity of the cost in the wholesale and retail business was greater.

This study is meaningful as it examines the cost behavior of the distribution industry in the Korean capital market. In the prior researches usually focused on the earnings quality and audit quality of the distribution industry in terms of finance, and the capital market. however, this study was expanded prior studies by examining the decisions of managers' internal resources.

The composition of this study is as follows. First, Chapter 2 introduced the study on the accounting aspects that examined the financial characteristics of the distribution industry and briefly summarized the research on asymmetry of cost. Based on this, research theories were derived. Chapter 3 describes the research model and sample selection process to verify cost asymmetry in the distribution industry, and Chapter 4 describes the result analysis along with the analysis results. Chapter 5 presents the conclusions and limitations of this study respectively.

## 2. Literature Review and Research Question

In the traditional view of cost behavior in management accounting, it was observed that the occurrence of cost is proportional to the cost driver because cost is determined by cost driver such as sales. However, studies from the early 2000s suggested empirical evidence of asymmetry in costs, which had been suggested that the behavior of costs was not proportional to the cost drivers. Anderson et al. (2003)'s study presented a model for empirical analysis of cost behavior, which was validated using US capital market. As a result of the analysis, the downward rigidity of the cost was observed, in which less reduction of the cost occurred when the sales volume decreased. If sales decline, managers should consider which options will benefit by comparing whether to reduce or maintain unused resources at present and in the future (Anderson et al. 2003; Balakrishnan & Gruca 2008; Weiss, 2010). These choices result in asymmetry of cost. When sales decrease, if the cost decreases less, it is called cost stickiness, and if the cost decreases more, it is called cost elasticity. Subramaniam and Watson (2003) reported that the greater the change in sales, the greater the cost downward rigidity, and the difference in the downward rigidity depends on the characteristics of the industry to which it belongs.

As mentioned earlier, many studies focused on rigidity in cost behavior. Studies have explored why less cost is reduced when sales decrease. The causes can be largely divided into structural reasons, economic consequences and management incentives. Firstly, the structural reason is that the higher the proportion of facility assets due to the characteristics of the firm or industry is hard to determine rapid decision of asset disposal may not be made when decrease in sales. In addition, asymmetric cost behavior may occur when the cost allocation process is not based on a reasonable basis or is not properly distributed for macro-economic reasons (price, foreign exchange). The second economic incentive is the size of the adjustment cost. Adjustment cost means the cost of determining firm's production level, and maintenance cost is the cost of maintaining the current level of production. A typical example of adjustment costs is to reduce the resources spent during the sales slump and replace the resources needed as demand increases. These adjustment costs include severance pay for employees arising from layoffs, costs for hiring and training new employees when demand increases again, and costs for reducing morale among fellow employees. Disposing of available resources too quickly can create problems with high coordination costs if demand reduction is a temporary phenomenon. This increases the likelihood that managers will maintain resources instead of reducing them during the period when sales decline takes places. Therefore, if manager determines that it is better to cover maintenance costs after considering adjustment and maintenance costs, the downward rigidity of the cost will arise when the sales decrease and the costs will not decrease as much as the sales decrease. Finally, it is about management incentives. If managers do not reduce expenses for pursuing private interest despite a decrease in sales or make indiscriminate expansion for performance while a decrease in revenue, the downward rigidity of costs will be indicated (Yang, 2015; Zhong et al., 2020). In the

study by Chen et al. (2012), they noted that higher surplus cash flows and longer managers' service periods lead to greater influence within the organization, resulting in higher decision-making authority, which leads to cost rigidity.
This study is an analysis of the cost behavior in aspect of first incentives. Subramaniam and Watson (2003) that the downward rigidity varies in industry. In the aspect, we study to focus on the characteristics of the industry, especially the distribution industry.

The distribution industry generates more initial facility investment than other industries and it is very difficult to make flexible decisions in response to temporary sales reductions. In other words, the costs of adjustment are so high that the downward rigidity of the costs can be seen. Furthermore, it is an empirical question that is difficult to predict in advance whether the downward rigidity of the cost is stronger than that of other industries or the downward rigidity is lower than that of other industries. Therefore, identifying the cost behavior of the distribution industry provides information that is very useful in expanding the understanding of the asymmetry of costs. Previously, studies on asymmetry of costs by industrial characteristics were difficult to say that they had fully examined the distribution industry because they were case studies or did not take account of the distribution industry. However, this study will contribute to understanding the distribution industry in depth. In this respect, this study has academic implications. In sum, the following hypotheses were established:

**Hypothesis:** The distribution industry has a greater downward rigidity of cost than other industries.

## 3. Methodology

### 3.1. Cost Stickiness

In this study, the research model used to examine the asymmetry of costs in the distribution industry used Anderson et al. (2003) model. The model is as follows.

In the above equation, SGA refers to sales and administrative expenses, and SALES refers to sales. DEC is a dummy variable of 1 if sales for the current period have decreased compared to electricity, or 0 otherwise. In the expression $a_1 1$ is the increase in sales and administrative expenses as sales increase, and $a_3$ is the decrease in sales and administrative expenses when sales decrease. Therefore, showing a significant (+) correlation with $a_3$ indicates that sales and administrative costs are further reduced as sales decrease, which means that sales and administrative costs are downward elastic. However, having a significant negative (-) value indicates that a decrease in sales and administrative costs is less likely to occur when sales decrease, which means that it is downward rigid.

$$\ln\left(\frac{SGA_t}{SGA_{t-1}}\right) = \alpha_0 + \alpha_1 \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) + \alpha_2 DEC_t + \alpha_3 DECx \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) \quad (1)$$

### 3.2. Research Model

The following equation is to verify hypothesis by including indicator variable of the distribution industry and control variables, in the asymmetry model of Anderson et al. (2003).

$$\begin{aligned}\ln\left(\frac{SGA_t}{SGA_{t-1}}\right) = {} & \alpha_0 + \alpha_1 \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) + \alpha_2 DEC_t \\ & + \alpha_3 DECx \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) + \alpha_4 Distribution \\ & + \alpha_5 \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) xDistribution \\ & + \alpha_6 DistrivutionxDEC \\ & + \alpha_7 \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) xDistributionxDEC \\ & + \alpha_8 SIZE + \alpha_9 \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) xSIZE \\ & + \alpha_{10} SIZExDEC \\ & + \alpha_{11} \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) xSIZExDEC + \alpha_{12} CFO \\ & + \alpha_{13} \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) xCFO + \alpha_{14} CFOxDEC \\ & + \alpha_{15} \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) xCFOxDEC + \alpha_{16} PPE \\ & + \alpha_{17} \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) xPPE + \alpha_{18} PPExDEC \\ & + \alpha_{19} \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) xPPExDEC + \alpha_{20} FOR \\ & + \alpha_{21} \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) xFOR + \alpha_{22} FORxDEC \\ & + \alpha_{23} \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) xFORxDEC \\ & + \alpha_{24} LOSS + \alpha_{25} \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) xLOSS \\ & + \alpha_{26} LOSSxDEC \\ & + \alpha_{27} \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) xLOSSxDEC + \alpha_{28} DS \\ & + \alpha_{29} \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) xDS + \alpha_{30} DSxDEC \\ & + \alpha_{31} \ln\left(\frac{SALES_t}{SALES_{t-1}}\right) xDSxDEC + YEAR \end{aligned} \quad (2)$$

Distribution was measured as an indicator variable of 1, otherwise zero, if classified as wholesale and retail and transportation in the section of the Korean Standard Industrial Classification. We limited the distribution

business to wholesale and retail and transportation. The distribution industry does not appear separately in the Korean Standard Industrial Classification, but the wholesale and retail and transportation industries are presented separately. The interest variable in this study is $\alpha_7$. If $\alpha_7$ has a positive of value, the distribution industry shows higher cost elasticity than other industry, while negative values mean that costs in the distribution industry have showed cost stickiness.

The control variables selected, based on the relevant research, whether the size of the entity (SIZE), the cash flow (CFO), the proportion of property, plant and equipment (PPE), the proportion of foreign investors' equity (FOR), the loss of electricity (LOSS), and the reduction of electricity sales (DS). The size of the entity is the total asset divided by sales, and the cash flows are calculated by dividing the cash flows from the operating activities by sales. The proportion of property, plant and equipment is divided into asset totals and the loss of electricity is one indicator variable if it is a prior-term net loss or zero indicator. The decrease in electricity sales was calculated as 1 if the previous (t-1) sales were less than the previous (t-2) sales, otherwise as 0. Annual indicators are included for the purpose of controlling the impact of the fixed annual effects.

## 3.3. Sample Selection

The analysis window is from 2002 to 2019 to verify the hypothesis of this study. For this purpose, data were used from 2000 to 2019. This is due to the characteristics of the variables used in this study. Among the variables, DS should measure a decrease in revenue for the past two consecutive years, requiring data from 2000 and 2001 to generate a variable for 2002. Financial data extraction we used the KISVALUE database of NICE Evaluation Information Co., Ltd. Of the data extracted, (1) if the month of settlement is not December, (2) if the data available under the operational definition of this study is not available, (3) if the firm designated as a listing management item, (4) if classified as finance industry(K) in the Korean Standard Industrial Classification, was excluded from the sample. Finally, the number of samples used for analysis was 28,695 companies-year, and the annual distribution of each listed market was shown in Table 1 and Table 2, respectively. The annual distribution shows that the size of samples available increases over the years, but no results were biased in a specific year, with about 40 percent of the samples being securities market and 60 percent being KOSDAQ market. Therefore, the results of this study indicated that there were no specific year or market-specific effects, and that the distribution of samples by industry was not presented separately, but it was also confirmed that samples were not concentrated in certain industry.

**Table 1:** Samples Distribution by Year

| year | Freq. | Percent | Cum. |
|---|---|---|---|
| 2002 | 1,210 | 4.22 | 4.22 |
| 2003 | 1,274 | 4.44 | 8.66 |
| 2004 | 1,328 | 4.63 | 13.28 |
| 2005 | 1,385 | 4.83 | 18.11 |
| 2006 | 1,432 | 4.99 | 23.10 |
| 2007 | 1,493 | 5.20 | 28.30 |
| 2008 | 1,530 | 5.33 | 33.64 |
| 2009 | 1,553 | 5.41 | 39.05 |
| 2010 | 1,584 | 5.52 | 44.57 |
| 2011 | 1,615 | 5.63 | 50.20 |
| 2012 | 1,651 | 5.75 | 55.95 |
| 2013 | 1,687 | 5.88 | 61.83 |
| 2014 | 1,711 | 5.96 | 67.79 |
| 2015 | 1,755 | 6.12 | 73.91 |
| 2016 | 1,814 | 6.32 | 80.23 |
| 2017 | 1,865 | 6.50 | 86.73 |
| 2018 | 1,900 | 6.62 | 93.35 |
| 2019 | 1,908 | 6.65 | 100.00 |
| Total | 28,695 | 100.00 | |

**Table 2:** Samples Distribution by Listed market

| market | Freq. | Percent | Cum. |
|---|---|---|---|
| KOSPI | 11,479 | 40.00 | 40.00 |
| KOSDAQ | 17,216 | 60.00 | 100.00 |
| Total | 28,695 | 100.00 | |

# 4. Result

## 4.1. Descriptive Statistics

<Table 3> presents descriptive statistics of variables. Changes in SG&A( $\ln\left(\frac{SGA_t}{SGA_{t-1}}\right)$ ) and changes in sales($\ln\left(\frac{SALES_t}{SALES_{t-1}}\right)$) were averaged 0.088 (median 0.072) and 0.086 (median 0.064), respectively. This was similarly to the research results in the Korean capital market. The decrease in sales (DEC) was 34.1%, and in the case of distribution industry (Distribution), it was observed that

0.096, about 9.6% of the sample was distribution. The result of the control variable is as follows.

**Table 3:** Descriptive Statistics

| Variable | n | Mean | S.D. | .25 | Mdn | .75 |
|---|---|---|---|---|---|---|
| $\ln\left(\frac{SGA_t}{SGA_{t-1}}\right)$ | 28,695 | 0.088 | 0.355 | -0.030 | 0.072 | 0.197 |
| $\ln\left(\frac{SALES_t}{SALES_{t-1}}\right)$ | 28,695 | 0.086 | 0.458 | -0.050 | 0.064 | 0.201 |
| DEC | 28,695 | 0.341 | 0.474 | 0.000 | 0.000 | 1.000 |
| Distribution | 28,695 | 0.096 | 0.295 | 0.000 | 0.000 | 0.000 |
| SIZE | 28,695 | 2.283 | 4.620 | 0.851 | 1.209 | 1.835 |
| CFO | 28,695 | 0.050 | 0.227 | 0.001 | 0.061 | 0.132 |
| PPE | 28,695 | 0.466 | 0.629 | 0.140 | 0.303 | 0.545 |
| DS | 28,695 | 0.380 | 0.485 | 0.000 | 0.000 | 1.000 |
| LOSS | 28,695 | 0.219 | 0.414 | 0.000 | 0.000 | 0.000 |
| FOR | 28,695 | 0.057 | 0.104 | 0.000 | 0.010 | 0.651 |

In the case of firm size (SIZE), the average was 2.283 (median 1.209). This means that the ratio of assets to the average sales of listed companies is 228%. The proportion of cash flows from operating activities (CFO) was 0.050, and the proportion of tangible assets (PPE) was 0.466 on average, indicating the proportion of tangible assets to assets of 46.6%. The decrease in previous sales (DS) means that the average of previous sales decreased by 0.380, 38% of the sample, and the net loss of previous year (LOSS) was confirmed at 21.9%. Foreign investors' ownership ratio was confirmed to be about 5.7%.

## 4.2. Correlation

The results of the correlation analysis of variables are presented in <Table 4>. Top side is Spearman correlation result, bottom is Pearson correlation result. The result describe was based on Pearson correlation.

First, the change in sales and administrative costs($\ln\left(\frac{SGA_t}{SGA_{t-1}}\right)$) and the change in sales ($\ln\left(\frac{SALES_t}{SALES_{t-1}}\right)$) are shown to have a significant positive relevance at the 1% level, which can be judged to be very proportional to the change in sales and administrative expenses. However, it can be inferred that the behavior of costs is asymmetric because the sales decrease (DEC) and the change in the selling and administrative costs ($\ln\left(\frac{SGA_t}{SGA_{t-1}}\right)$) have significant negative values at the 1% level.

**Table 4:** Correlation

| | $\ln\left(\frac{SGA_t}{SGA_{t-1}}\right)$ | $\ln\left(\frac{SALES_t}{SALES_{t-1}}\right)$ | DEC | Distribution | SIZE | CFO | PPE | DS | LOSS | FOR |
|---|---|---|---|---|---|---|---|---|---|---|
| $\ln\left(\frac{SGA_t}{SGA_{t-1}}\right)$ | 1.00 | 0.452*** | -0.341*** | -0.032*** | -0.109*** | 0.023*** | -0.078*** | -0.100*** | -0.152*** | -0.105*** |
| $\ln\left(\frac{SALES_t}{SALES_{t-1}}\right)$ | 0.535*** | 1.00 | -0.821*** | -0.029*** | -0.204*** | 0.084*** | -0.129*** | -0.054*** | -0.023*** | -0.116*** |
| DEC | -0.265*** | -0.503*** | 1.00 | 0.022*** | 0.188*** | -0.093*** | 0.089*** | 0.103*** | 0.074*** | 0.051*** |
| Distribution | -0.020*** | -0.018*** | 0.022*** | 1.00 | -0.036*** | -0.089*** | -0.091*** | 0.018*** | 0.050*** | 0.010* |
| SIZE | -0.093*** | -0.179*** | 0.106*** | 0.00 | 1.00 | 0.093*** | 0.483*** | 0.124*** | 0.175*** | 0.133*** |
| CFO | -0.036*** | 0.038*** | -0.084*** | -0.045*** | -0.184*** | 1.00 | 0.071*** | -0.079*** | -0.255*** | 0.106*** |
| PPE | -0.093*** | -0.158*** | 0.103*** | -0.013** | 0.411*** | -0.188*** | 1.00 | 0.053*** | 0.073*** | 0.015** |
| DS | -0.042*** | 0.019*** | 0.103*** | 0.018*** | 0.085*** | -0.084*** | 0.074*** | 1.00 | 0.225*** | -0.044*** |
| LOSS | -0.116*** | 0.037*** | 0.074*** | 0.050*** | 0.106*** | -0.280*** | 0.141*** | 0.225*** | 1.00 | -0.080*** |
| FOR | -0.040*** | -0.044*** | -0.022*** | -0.01 | 0.018*** | 0.123*** | -0.035*** | -0.057*** | -0.120*** | 1.00 |

Variables definition is as same as 3.2 Research Model
*, **, *** are indicates 10%, 5%, 1%, respectively

In general, the relationship between the changes in the selling and administrative costs ($\ln\left(\frac{SGA_t}{SGA_{t-1}}\right)$) and the control variables represented a significant negative relationship. However, because these results mean simple correlation, it is necessary to examine the cost asymmetry of the distribution industry through multiple regression analyses, including control. On the other hand, it was determined that the high correlation between independent variables identified through correlation analysis could involve quantitative economic estimation errors called multicollinearity, which was observed through the VIF index to be less than 10. Thus, we assumed that there was no concern on multicollinearity.

<Table 5> is the result of an analysis to see if asymmetry in cost is observed in a sample of the distribution industry prior to the hypothesis verification, as in Anderson et al. (2003). For the model (1), Anderson et al. (2003) is the result of the basic model, and the model (2) is the result after controlling a certain variable. The analysis showed that the value of ln(SALESt/SALESt-1)×DEC was significantly negative. These results indicate that asymmetry in cost is observed in firms belonging to the distribution industry listed on Korea capital market. The traditional view previously assumed that the behavior of cost is symmetrical according to the cost driver, but the result of measuring the cost driver as sales and the cost as sales and administrative costs showed cost rigidity, which showed less reduction in sales and administrative costs when sales decreased.

<Table 6> is the result of analysis of all samples including distribution. It can be interpreted that if the value of $ln(SALES_t/SALES_{t-1})\times DEC$ has a significant negative value, it means that the our samples has showed cost rigidity.

The empirical analysis results are as follows. First, the suitability of the model in the study was shown at 371.737 and the explanatory power of the model was 0.383. The analysis results are the result of annual control of fixed effects, but they are not reported separately for concise reporting. A negative value with a significant value for the parameter $ln(SALES_t/SALES_{t-1})\times Distribution\times DEC$ appeared (the -0.106, t value: -3.03). It indicates that the retail industry has a greater downward rigidity of cost than the non-distribution industry.

## 4.3. Regression

<Table 5> is the result of an analysis to see if asymmetry in cost is observed in a sample of the distribution industry prior to the hypothesis verification, as in Anderson et al. (2003). For the model (1), Anderson et al. (2003) is the result of the basic model, and the model (2) is the result after controlling a certain variable. The analysis showed that the value of ln(SALESt/SALESt-1)×DEC was significantly negative. These results indicate that asymmetry in cost is observed in firms belonging to the distribution industry listed on Korea capital market. The traditional view previously assumed that the behavior of cost is symmetrical according to the cost driver, but the result of measuring the cost driver as sales and the cost as sales and administrative costs showed cost rigidity, which showed less reduction in sales and administrative costs when sales decreased.

**Table 5:** Regression Result of Distribution Industry

| | (1) | (2) |
|---|---|---|
| | Dependent Variable: ln ($SGA_t/SGA_{t-1}$) | |
| Constant | 0.019*(1.93) | 0.164***(4.90) |
| $\ln(SALES_t/SALES_{t-1})$ | 0.480***(20.08) | 0.597***(11.84) |
| DEC | 0.015(0.92) | -0.010(-0.38) |
| $\ln(SALES_t/SALES_{t-1})\times DEC$ | -0.151***(-3.87) | -0.543***(-6.40) |
| SIZE | | -0.002(-0.74) |
| $\ln(SALES_t/SALES_{t-1})\times SIZE$ | | -0.008(-1.09) |
| DEC×SIZE | | 0.007(1.58) |
| $\ln(SALES_t/SALES_{t-1})\times DEC\times SIZE$ | | 0.013* (1.70) |
| CFO | | -0.433***(-6.56) |
| $\ln(SALES_t/SALES_{t-1})\times CFO$ | | 0.784***(6.84) |
| DEC×CFO | | 0.315***(3.59) |
| $\ln(SALES_t/SALES_{t-1})\times DEC\times CFO$ | | -0.589***(-4.45) |
| PPE | | 0.004(0.25) |
| $\ln(SALES_t/SALES_{t-1})\times PPE$ | | 0.100** (2.06) |
| DEC×PPE | | -0.009(-0.36) |
| $\ln(SALES_t/SALES_{t-1})\times DEC\times PPE$ | | -0.069(-1.09) |
| FOR | | -0.010(-0.11) |
| $\ln(SALES_t/SALES_{t-1})\times FOR$ | | 0.645** (2.07) |
| DEC×FOR | | 0.024(0.16) |
| $\ln(SALES_t/SALES_{t-1})\times DEC\times FOR$ | | 0.332(0.76) |
| LOSS | | -0.074***(-3.06) |
| $\ln(SALES_t/SALES_{t-1})\times LOSS$ | | -0.328***(-6.61) |
| DEC×LOSS | | -0.008(-0.21) |
| $\ln(SALES_t/SALES_{t-1})\times DEC\times LOSS$ | | 0.453***(5.57) |
| DS | | -0.058***(-2.74) |
| $\ln(SALES_t/SALES_{t-1})\times DS$ | | 0.085* (1.65) |
| DEC×DS | | 0.049(1.51) |
| $\ln(SALES_t/SALES_{t-1})\times DEC\times DS$ | | 0.131(1.55) |
| F-value | 232.887 | 25.862 |
| Adj. $R^2$ | 0.202 | 0.284 |
| N | 2,757 | 2,757 |

**Table 6:** Regression result of full samples

| | **Dependent Variable $\ln(SGA_t/SGA_{t-1})$** |
|---|---|
| Constant | 0.120***(12.46) |
| $\ln(SALES_t/SALES_{t-1})$ | 0.590***(48.91) |
| DEC | 0.022***(3.03) |
| $\ln(SALES_t/SALES_{t-1})$×DEC | -0.268***(-13.38) |
| Distribution | -0.022** (-2.52) |
| $\ln(SALES_t/SALES_{t-1})$×Distribution | 0.033(1.58) |
| Distribution × DEC | 0.004(0.30) |
| $\ln(SALES_t/SALES_{t-1})$×Distribution×DEC | -0.106***(-3.03) |
| SIZE | 0.004***(5.68) |
| $\ln(SALES_t/SALES_{t-1})$×SIZE | -0.012***(-13.55) |
| DEC×SIZE | 0.002*(1.72) |
| $\ln(SALES_t/SALES_{t-1})$×SIZExDEC | 0.012***(10.56) |
| CFO | -0.143***(-11.30) |
| $\ln(SALES_t/SALES_{t-1})$×CFO | 0.121***(8.67) |
| DEC×CFO | -0.027(-1.40) |
| $\ln(SALES_t/SALES_{t-1})$× DEC ×CFO | 0.026(1.42) |
| PPE | 0.005(1.11) |
| $\ln(SALES_t/SALES_{t-1})$×PPE | 0.020***(3.13) |
| DEC×PPE | -0.007(-1.05) |
| $\ln(SALES_t/SALES_{t-1})$× DEC ×PPE | -0.017**(-2.02) |
| FOR | -0.054**(-2.22) |
| $\ln(SALES_t/SALES_{t-1})$×FOR | 0.299***(3.74) |
| DEC×FOR | 0.068*(1.69) |
| $\ln(SALES_t/SALES_{t-1})$× DEC ×FOR | 0.657***(6.33) |
| LOSS | -0.076***(-11.36) |
| $\ln(SALES_t/SALES_{t-1})$×LOSS | -0.298***(-24.57) |
| DEC×LOSS | -0.031***(-2.99) |
| $\ln(SALES_t/SALES_{t-1})$× DEC ×LOSS | 0.257***(12.20) |
| DS | -0.044***(-7.95) |
| $\ln(SALES_t/SALES_{t-1})$×DS | 0.072***(6.01) |
| DEC×DS | 0.035***(4.03) |
| $\ln(SALES_t/SALES_{t-1})$× DEC ×DS | 0.100***(5.35) |
| Year Fixed Effect | Yes |
| F-value | 371.737 |
| Adj. $R^2$ | 0.383 |

Variables definition is as same as 3.2 Research Model
*, **, *** are indicates 10%, 5%, 1%, respectively

<Table 6> is the result of analysis of all samples including distribution. It can be interpreted that if the value of *ln(SALES$_t$/SALES$_{t-1}$)× DEC* has a significant negative value, it means that the our samples has showed cost rigidity.

**Table 7:** Additional Test: Dividing Distribution Industry into Two Categories

| | **(1)** | **(2)** |
|---|---|---|
| | Dependent Variable: $\ln(SGA_t/SGA_{t-1})$ | |
| Constant | 0.119***(12.42) | 0.118***(12.30) |
| $\ln(SALES_t/SALES_{t-1})$ | 0.589***(48.98) | 0.594***(49.59) |
| DEC | -0.269***(-13.42) | -0.280***(-14.17) |
| $\ln(SALES_t/SALES_{t-1})$×DEC | 0.023***(3.06) | 0.023***(3.12) |
| Wholesales&Retails | -0.025***(-2.61) | |
| $\ln(SALES_t/SALES_{t-1})$×Wholesales&Retails | 0.057**(2.47) | |
| Wholesales&Retails × DEC | 0.006(0.37) | |
| $\ln(SALES_t/SALES_{t-1})$×Wholesales&Retails×DEC | -0.127***(-3.45) | |
| Transportation | | -0.008(-0.43) |
| $\ln(SALES_t/SALES_{t-1})$×Transportation | | -0.073(-1.57) |
| Transportation × DEC | | -0.004(-0.10) |
| $\ln(SALES_t/SALES_{t-1})$×Transportation×DEC | | -0.086(-0.63) |
| Control Variable | YES | YES |
| Year Fixed Effect | YES | YES |
| F-value | 371.773 | 371.506 |
| Adj. $R^2$ | 0.383 | 0.383 |
| N | 28,695 | 28,695 |

Variables definition is as same as 3.2 Research Model
*, **, *** are indicates 10%, 5%, 1%, respectively

The empirical analysis results are as follows. First, the suitability of the model in the study was shown at 371.737 and the explanatory power of the model was 0.383. The analysis results are the result of annual control of fixed

effects, but they are not reported separately for concise reporting. A negative value with a significant value for the parameter $ln(SALES_t/SALES_{t-1})\times Distribution\times DEC$ appeared (the -0.106, t value: -3.03). It indicates that the retail industry has a greater downward rigidity of cost than the non-distribution industry.

<Table 7> is the result of dividing the distribution industry into wholesale and retail and transportation. The distribution industry defined in this study is divided into wholesale and retail and transportation. Therefore, it is intended to examine whether the downward rigidity of the cost varies by the detailed industry to another. The report of the analysis results is the same as the previous method. However, for concise reporting, the reporting was omitted for control variables. In other words, the analysis result of <Table 8> is the result after considering the control variables. In the analysis results, the model (1) is the result of the wholesale and retail sector, and the model (2) is the result of the transportation industry.

**Table 8:** Additional Test: Pre and Post IFRS adoption

| | (1) | (2) |
|---|---|---|
| | Dependent Variable: $\ln(SGA_t/SGA_{t-1})$ | |
| Constant | 0.124*** (10.77) | 0.042*** (4.92) |
| $\ln(SALES_t/SALES_{t-1})$ | 0.587*** (34.94) | 0.590*** (33.20) |
| DEC | 0.025** (2.10) | 0.022** (2.36) |
| $\ln(SALES_t/SALES_{t-1})\times DEC$ | -0.236*** (-7.23) | -0.297*** (-11.11) |
| Distribution | -0.025** (-1.96) | -0.016 (-1.32) |
| $\ln(SALES_t/SALES_{t-1})\times$ Distribution | 0.047 (1.62) | 0.009 (0.30) |
| Distribution × DEC | -0.002 (-0.09) | 0.006 (0.34) |
| $\ln(SALES_t/SALES_{t-1})\times$ Distribution ×DEC | -0.191*** (-3.85) | -0.025** (-2.51) |
| Control Variable | YES | YES |
| Year Fixed Effect | YES | YES |
| F-value | 221.455 | 235.759 |
| Adj. $R^2$ | 0.402 | 0.365 |
| N | 12,789 | 15,906 |

The interest variable ln (SALESt / SALESt-1)x Wholesales & Retailsx DEC showed a significant negative (-) value at the 1% level, but no significant value was derived for ln (SALESt / SALESt-1)xTransportationx DEC. In other words, the downward rigidity in the distribution industry could be found to be greater in the wholesale and retail industries.

The above results showed that the lower cost rigidity of the distribution industry was observed in the Korean capital market, and when the sales decreased, the lower rigidity was shown through sales and administrative costs.

As part of the further analysis, samples from this study were analyzed separately before and after the introduction of IFRS. It is intended to examine the impact of the introduction of International Accounting Standards on the cost structure of the distribution sector.

Although the results of the control variable were not reported for a concise report, the analysis results of <Table 8> are the results after controlling the constant variable.

Model (1) is samples before the introduction of IFRS, and model (2) is a samples after the introduction of IFRS. If the same direction and significance levels are observed in both samples, this can be interpreted as having no effect by IFRS. As a result of empirical analysis, negative values with significant of *ln (SALESt / SALESt-1)x Wholesales & Distributionx DEC* were observed. This means that the retail industry is more downward cost stickiness than other industries.

## 5. Conclusion and Remarks

This study sheds light on the asymmetry of costs in the distribution industry. Prior studies were that identified the asymmetry of costs in consideration of existing industrial characteristics through product market competition in the industry as a proxy, rather than presenting actual industry-specific results (Li & Zheng, 2017; Cha & Park, 2020). In particular, the results of studies reviewed by industry show that the share of property, plant and equipment, such as the steel industry and hospitals, is high, but the cost behavior of the distribution industry has yet to be reported. With the recent steady consideration of the usefulness of accounting aspects of the distribution industry, it was seen that looking at management's resource decisions would provide implications (Shin, 2019; Cha & Kim, 2020). To that end, we looked at the data using 28,695 enterprise-year data over 18 years from 2002 to 2019. The empirical analysis of the distribution industry in the sample showed the downward rigidity of the cost in general. In other words, the decrease in costs resulting from a decrease in sales did not appear proportionately. Second, comparing to non-distribution sector, greater cost rigidity had been shown in distribution industry.

Third, in cases where the distribution business was divided into wholesale and retail and transportation, it was

observed more strongly in the wholesale and retail industry.

This study contributes in the following respects. First, due to the lack of research related to the quality of accounting information about the distribution industry and the management's decision-making, the results of this study were expanded in that it examined the management's resource decision.

Second, research on asymmetry of cost was expanded. Anderson et al. (2003) Research models used to identify cost asymmetry in the domestic capital market were generally focused on manufacturing, but extended research results were presented in terms of very limited research that looked at the distribution industry.

Notwithstanding the above contributions, this study has the following limitations. At a time when the boundaries of the industry are becoming increasingly blurred, a very careful interpretation is required to regard it as a characteristic of the whole distribution industry, even though the Korean Standard Industrial Classification only targets the distribution industry. It is also expected that the results of this study will be expanded by developing into a study on the causes of asymmetry in the costs of the distribution industry, as there are limitations to measurement errors that occur in empirical analysis as well as the asymmetry model of cost.

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