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How Does Industry Structure Affect Upside Cost Stickiness? An Explanation for IT Industry

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Abstract

While prior literature on the asymmetric behavior of costs has predominantly focused on firms experiencing losses, a number of recent studies have shifted the focus to the opposite side, documenting that firms tend to hesitate to incur additional costs (i.e., make additional investments in resources) when faced with an unusually large increase in sales revenue. To extend the existing literature on this "upside cost stickiness," this study examines how the asymmetric cost behavior of firms with an unusually large sales increase is influenced by factors such as industry characteristics and a firm's position within the industry. Drawing on economic theory regarding the relationship between industry structure and corporate behavior, this research predicts that the degree of upside cost stickiness is weaker for industry leaders and diminishes as market concentration increases. As an application, this study further predicts that upside cost stickiness is weaker for firms in the concentrated IT industry. These predictions are strongly supported by empirical evidence based on 135,649 unique firm-year observations.

Keyword: cost stickiness, cost behavior, industry structure, market concentration, IT industry, resource investment.

I. INTRODUCTION

In both real-life investment decisions and academic research in accounting, earnings are often considered the most important factor affecting the real value of a firm and, by extension, the decisions of investors and creditors (Basu, 1977; Bao & Bao, 2001). This also means that understanding costs is critical since earnings are essentially revenues minus costs (or expenses). The prior literature shows that, however, corporate cost behavior is way more complicated than what traditional textbooks explain using the simple concept of variable and fixed costs (Noreen & Soderstrom, 1997; Cooper & Kaplan, 1999; and Anderson et al., 2003). As an attempt to better understand the complex behavior of costs, this study extends the prior literature on the asymmetric cost behavior called "cost stickiness." In specific, this study examines how the nonlinear cost behavior for firms facing an unusually large sales increase (i.e., "upside" cost stickiness) is affected by the industry structure and the firms' position within the industry. Drawn on the theories on industry structure and corporate investment behavior, this study predicts that the degree of upside cost stickiness 1) is weaker for firms leading/dominating the industry, and 2) decreases with market concentration. This study further applies these predictions to the IT industry, which is known for a high market concentration and an importance of human capital, expecting a weaker upside cost stickiness for IT firms. Empirical results based on 135,649 unique firm/year observations are consistent with the predictions.

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This study is expected to make several significant contributions to the extant literature on cost behavior and the impact of industry characteristics on managerial decision making. First, compared to the asymmetric cost behavior for firms facing a sales decline, such behavior for firms facing an unusually large sales increase has been relatively less studied in the cost accounting literature. Considering that rising cost aversion due to increased uncertainty in the economy (e.g., Covid-19) is likely to affect firms' decisions to change investment in both directions, understanding how costs behave in response to a "positive" sales shock has become more crucial than ever. To add to the recent studies on the upside cost stickiness (e.g., Jin & Cary, 2019), this study provides new evidence of factors affecting the upside cost stickiness. Second, the literature on the behavior of market leaders, dominant firms, and innovators relies significantly on theoretical models (e.g., Dasgupta & Stiglitz, 1980; Etro, 2004; and Novy-Marx, 2007). This study is expected to complement the theoretical arguments in the literature by providing empirical evidence on how firms' position or role in the industry affects their managerial decisions on resource investment. Third, the findings in this study also contribute to a better understanding of the IT industry, which is known for its complex nature (Rockart et al., 1996; Rai et al., 2015).

The remainder of this study is organized as follows. Second section provides a literature review and hypotheses development. Third section presents the research design including empirical models and data descriptions. Fourth section presents empirical results. The final section concludes with a short summary and implications for future research.

II. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Upside Cost Stickiness

Managerial cost decisions in response to a change in sales revenue are not linear, but rather nonlinear depending on the direction and the magnitude of the sales change. For instance, firms are likely to respond to an increase in sales by adding more resources (i.e., incurring more costs) because otherwise they will lose not only current sales but also future sales due to unhappy customers. When sales decrease, on the other hand, firms tend to hesitate to cut off slack resources such as idle machines and human resources because (1) there is usually an uncertainty regarding whether the sales decline is permanent, and (2) adding back the resources in the future when sales are back will be costly. Such asymmetric behavior of costs, first identified by Anderson et al. (2003), is often referred to as "cost stickiness." Anderson et al. (2003) and subsequent studies in the literature also find that cost stickiness is affected by macroeconomy (Anderson et al., 2003), employment protection (Banker et al., 2013), managerial incentives to avoid losses or to meet analysts' earnings forecast (Dierynck et al., 2012; Kama & Weiss, 2013), and managerial compensation structure (Jin & Banker, 2025).

To add to the cost stickiness literature, Jin and Cary (2019) and Jin (2021) show that costs change relatively less not only when sales decrease but also when the "increase" in sales is sufficiently large because of (1) firms' limit in adding resources (e.g., budgets, cash availability), and (2) managerial risk aversion. Such asymmetric behavior of costs at the higher-end in terms of sales change is referred to as "upside" cost stickiness (Jin, 2021) as opposed to the "downside" cost stickiness identified by Anderson et al. (2003). Jin (2021) also identifies a number of determinants of upside cost stickiness including firm size and free cash flows.

2.2. Industry Structure and Corporate Investment Behavior

A firm's managerial decisions regarding costs or investment are affected not only by sales change (as described above) but also by the nature of the industry as well as the firm's position within the industry and its peers (Link & Neufeld, 1986; Li & Yao, 2010; and Frésard & Valta, 2016). In particular, making constant or additional investment is especially important to industry leaders or dominators (e.g., monopolists) for a number of different reasons. When there are significant barriers to entry, the industry leaders can maximize their profit by making more investment to enhance the barriers to entry and preempt potential competitors (Dasgupta & Stiglitz, 1980). When the barriers to entry are low, first mover advantages (e.g., patents) provide incentives to make more investment to the industry leaders, who by definition can choose to invest before other firms (Etro, 2004). Consistent with these theoretical expectations, the prior literature in general also empirically finds a positive association between market power and innovation activity such as R&D (e.g., Blundell et al., 1999).

In addition to the "incentives" to make investment, industry leaders also have more "abilities" to make such investment. In specific, industry leaders, by nature, are likely to be large in size and have more resources (e.g., cash). As large firms, they also have an easier access to capital markets and bank financing when more financing is needed, while small companies tend to face more difficulties in financing and more financial restrictions (Whited, 1992; Fazzari & Petersen, 1993; and Petersen & Rajan, 1997). This suggests that financial restrictions are less likely to be an issue when firms decide whether to make additional investment in response to a large increase in sales if they are industry leaders. Industry leaders' such incentives and abilities to make investment suggest that industry leaders are relatively less likely to hesitate to add resources when facing a large increase in sales, resulting in a more symmetric (i.e., less asymmetric) relation between the change in sales and the change in costs. This leads to the first hypothesis of this study:

H_1: the magnitude of the upside cost stickiness is weaker for industry leaders or dominators.

The distinctive investment behavior of industry leaders described above suggests that investment behavior of the overall industry is expected to be different depending on the structure of the industry. As the industry becomes more concentrated, the upside cost stickiness of the overall industry is expected to become weaker mainly for two reasons. First, by nature, the industry's portion represented by the leaders gets larger when the industry becomes more concentrated on a small number of leaders or dominators. Second, non-leaders tend to follow the industry leaders' decision regarding investment (i.e., peer effects) (Chen & Ma, 2017; Bustamante & Frésard, 2021; and Rashid & Said, 2021). As a result, the cost behavior of the overall industry is expected to be more similar to that of the industry leader when the industry concentration is high. On the contrary, the overall industry is expected to show relatively more prominent upside cost stickiness when there is no significant industry leader i.e., when the market concentration is low. This leads to the second hypothesis of this study:

H_2: the magnitude of the upside cost stickiness decreases with market concentration.

2.3. Application - IT Industry

Next, to apply the above general predictions to a specific case, this study focuses on the IT industry, which is usually defined as firms that either manufacture or sell computer hardware, software, peripherals, and telecommunications services (e.g., Ramaseshan & Chong, 2000). While it can be further decomposed into many

subindustries, IT industry has a number of characteristics that are likely to affect firms' investment decisions. First, IT industry is an example of a concentrated market where a relatively small number of leader firms dominate the whole market. For instance, the PC (personal computer) market is an oligopoly where five companies (HP, Dell, Lenovo, Apple, and Acer) represent more than 85% of the market as of 2021 (Canalys, 2022). As a more extreme example, the desktop operating system market has been dominated by two products (Microsoft's Windows and Apples' Mac OS) which represent more than 90% of the whole market (Statcounter, 2021). Such a high market concentration is observed also in the internet search engine market (dominated by Google) and telecommunications (dominated by three firms—Verizon, AT&T, and T-Mobile). In fact, the IT industry has been the subject of antitrust scrutiny for a long time (e.g., Microsoft, AT&T); however, enforcement of antitrust laws has become more lenient recently while lobbying has increased, suggesting that dominant firms may have been able to erect barriers to entry and increase market power even further (Bessen, 2016; Grullon et al., 2019). Consistent with the general change in the environment, Stigler Committee on Stigler Center (2019) reports an increasing trend in the market concentration in the IT industry.

As another characteristic of IT industry, human capital is considered the key resource to maintain sustainable competitive advantage (Hatch & Dyer, 2004). In particular, quality of human resource is critical in IT industry because of the complexity of IT works which require mastery of difficult technical concepts such as data modeling and system design theory (Ang et al., 2002; Levina & Xin, 2007; Mithas & Krishnan, 2008; and Mithas & Lucas, 2010). This suggests that, when facing a large increase in demand, IT firms are more likely to be willing to spend more in hiring high-quality employees as well as training existing employees as the quality of human capital can be enhanced through education (Nelson & Phelps, 1966; Griliches, 2000).

Related to the importance of human capital, another characteristic of the IT industry is the high prevalence of the use of stock option grants as a form of managerial compensation. IT firms, especially smaller firms and start-up firms, tend to rely heavily on stock option grants as a way to lure high-quality executives (Ceccucci & Gius, 2008), which is expected to result in more managerial risk taking.

Taken together, the strong market concentration, importance of human capital, and more reliance on stock option grants suggest that, compared to firms in other industries, firms in the IT industry are expected to less hesitate to make additional investment in resources when facing an unusually large sales increase, resulting a weaker asymmetry in cost behavior at the upper-end of sales changes. This leads to the last hypothesis of this study:

H_3: the upside cost stickiness is less prominent in the IT industry.

III. RESEARCH METHODOLOGY

3.1. Empirical Models and Variables

To examine how the upside cost stickiness is affected by a firm's position within the industry (H_1), this study extends the upside cost stickiness model used by Jin (2021) as follows:

Insert model 1 here.

Following the prior literature on cost stickiness (e.g., Anderson et al., 2003), ΔSG&A is defined as natural logarithm of current SG&A costs over prior SG&A costs; ΔREV is defined as natural logarithm of current sales revenue over prior sales revenue. Following Jin (2021), LARGE_INC, a dummy variable used to capture the upside cost

stickiness behavior, is defined in multiple ways using different criteria for sales increase, ranging from 15% increase to 50% increase. (See the empirical results section for further details). For a given criterion, LARGE_INC has a value of one if the sales increase is considered sufficiently large, and zero otherwise. As in Jin (2021), a negative coefficient on the two-way interaction term, LARGE_INC×ΔREV, would indicate that SG&A costs become sticky when the magnitude of the sales increase reaches a given level of sales increase. DOMINANT, the main variable of interest to test H_1, is defined as one if the firm has a market share larger than 50% in the four-digit SIC industry for the year, and zero otherwise. A positive β_3 would indicate that the degree of upside cost stickiness is weaker for firms dominating the industry. As an alternative measure to test the same hypothesis, MONOPOLIST is defined as one if the firm is the only player in the industry/year, and zero otherwise.

$$\begin{aligned}\Delta SG\&A = {} & \beta_0+\beta_1\Delta REV+\beta_2 LARGE\_INC\times\Delta REV \\ & +\beta_3 LARGE\_INC\times\Delta REV\times DOMINANT \\ & +\beta_4 LARGE\_INC\times\Delta REV\times FIRM\_SIZE \\ & +\beta_5 LARGE\_INC\times\Delta REV\times FCF \\ & +\beta_6 LARGE\_INC\times\Delta REV\times RECESSION \\ & +\beta_7 DEC\times\Delta REV \\ & +\beta_8 DEC\times\Delta REV\times SUCCESSIVE\_DEC \\ & +\beta_9 DEC\times\Delta REV\times ASSETINT \\ & +\beta_{10} DEC\times\Delta REV\times EMPINT \\ & +\text{Industry/Year Fixed Effects} \quad (1)\end{aligned}$$

The model also includes previously known determinants of upside cost stickiness as control variables; SIZE is defined as market capitalization (in million USD); FCF (free-cash-flow) is defined as cash flows from operating activities less capital expenditure scaled by total assets; RECESSION, a dummy variable for recession, has a value of one for the 2007−2009 period, and zero for other periods. Following Jin (2021), the model also includes downside cost stickiness variables as control variables; DEC is a dummy variable which takes the value of one if sales revenue of the firm decreases in the current period, and zero otherwise. A negative β_7 would indicate that costs decrease relatively less when sales decrease (i.e., downside cost stickiness). To also include determinants of downside cost stickiness, the two-way interaction term, DEC×ΔREV, is then interacted with a dummy variable for successive sales decrease (SUCCESSIVE_DEC= 1 if sales decreased for two consecutive years, = 0 otherwise), asset intensity (ASSETINT= log (total assets/sales revenue)), and employee intensity (EMPINT= log(number of employees/sales revenue)).

Next, to examine how the upside cost stickiness is affected by market concentration (H_2), Jin's (2021) model is extended in a way similar to described above:

$$\begin{aligned}\Delta SG\&A = {} & \gamma_0+\gamma_1\Delta REV+\gamma_2 LARGE\_INC\times\Delta REV \\ & +\gamma_3 LARGE\_INC\times\Delta REV\times HHI \\ & +\gamma_4 LARGE\_INC\times\Delta REV\times FIRM\_SIZE \\ & +\gamma_5 LARGE\_INC\times\Delta REV\times FCF \\ & +\gamma_6 LARGE\_INC\times\Delta REV\times RECESSION \\ & +\gamma_7 DEC\times\Delta REV \\ & +\gamma_8 DEC\times\Delta REV\times SUCCESSIVE\_DEC \\ & +\gamma_9 DEC\times\Delta REV\times ASSETINT \\ & +\gamma_{10} DEC\times\Delta REV\times EMPINT \\ & +\text{Industry/Year Fixed Effects} \quad (2)\end{aligned}$$

As a measure of market concentration, the Herfindahl–Hirschman index (HHI) is calculated as the sum of the squared market shares (in terms of revenue) of firms in the four-digit SIC industry and year.[1] The higher value of HHI would indicate a more concentrated market and thus H_2 predicts a positive coefficient on the three-way interaction term containing HHI (i.e., an inverse relation between HHI and upside cost stickiness).

Although the HHI is a commonly accepted and arguably the most popular measure of market concentration, it may not perfectly capture what firms actually perceive regarding the industry they are in, which is expected to significantly affect their strategic and operational decisions including investment on resources. Furthermore, calculating the HHI using the Compustat data (as described in the next subsection) comes with an inherent caveat that Compustat covers publicly traded companies only while private companies may describe or define a significant portion of a given industry. For instance, State Farm is the largest auto insurance provider with a 16% market share (Masterson, 2022), but is missing in Compustat because it is a private company.

The potential concerns regarding the use of HHI based on Compustat data can be mitigated by examining a specific industry which is generally considered highly concentrated—IT industry. To test the last hypothesis (H_3), the above models of upside cost stickiness is modified as follows:

$$\begin{aligned}\mathbf{\Delta SG\&A} = {} & \delta_0+\delta_1\mathbf{\Delta REV}+\delta_2\mathbf{LARGE\_INC}\times\mathbf{\Delta REV}\\ & +\delta_3\mathbf{LARGE\_INC}\times\mathbf{\Delta REV}\times\mathbf{IT\_FIRM}\\ & +\delta_4\mathbf{LARGE\_INC}\times\mathbf{\Delta REV}\times\mathbf{FIRM\_SIZE}\\ & +\delta_5\mathbf{LARGE\_INC}\times\mathbf{\Delta REV}\times\mathbf{FCF}\\ & +\delta_6\mathbf{LARGE\_INC}\times\mathbf{\Delta REV}\times\mathbf{RECESSION}\\ & +\delta_7\mathbf{DEC}\times\mathbf{\Delta REV}\\ & +\delta_8\,\mathbf{DEC}\times\mathbf{\Delta REV}\times\mathbf{SUCCESSIVE\_DEC}\\ & +\delta_9\mathbf{DEC}\times\mathbf{\Delta REV}\times\mathbf{ASSETINT}\\ & +\delta_{10}\mathbf{DEC}\times\mathbf{\Delta REV}\times\mathbf{EMPINT}\\ & +\mathbf{Industry/Year\ Fixed\ Effects}\ \ldots\ldots\ldots \qquad \mathbf{3}\end{aligned}$$

where IT_FIRM is a dummy variable which has a value of one if the two-digit SIC code of the firm is 35 (industrial and commercial machinery and computer equipment, e.g., HP), 36 (electronic and other electrical equipment and components, e.g., Apple), or 48 (communications, e.g., AT&T). Similarly to the other model specifications, a positive δ_3 would indicate a weaker upside cost stickiness for firms competing in an IT industry.

3.2. Data and Descriptive Statistics

To examine how upside cost stickiness is influenced by the industry structure and the firm's position within the industry, this study uses financial statement data obtained from the Compustat fundamental annual files. From the initial sample consists of 381,146 firm-year observations for fiscal years 1987−2017, observations with missing variables needed in the estimation models and duplicate observations are discarded. The top and bottom one percent of the observations with extreme values in the change of SG&A costs and the change of sales revenue are then truncated.[2] The final sample consists of 135,649 observations for 16,211 firms for fiscal years 1988-2017.

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[1] See Rhoades (1993) for details. While a whole number is often used to express the market share in HHI, this study uses a fraction for a clearer interpretation of regression results.

[2] All empirical findings are robust when winsorization is used instead of truncation.

Table 1
Summary Statistics

A. Descriptive Statistics		
	Mean	**Median**
Sales revenue ($ million)	2,434.6	162.5
SG&A costs ($ million)	435.2	35.8
Market capitalization ($ million)	2,992.2	154.1
Total assets ($ million)	3,237.5	175.8
Free cash flows ($ million)	113.3	0.8
Number of employees	8,894.6	802.0
Sample period	1988−2017	
Number of firm/year observations	135,649	

B. Sample Distribution		
	No. Obs.	**% of Total**
Firms with sales decline	41,900	30.9%
Firms with sales increase over …		
15%	48,002	35.4%
20%	37,717	27.8%
25%	30,108	22.2%
30%	24,186	17.8%
40%	16,183	11.9%
"Dominant" firm	7,328	5.4%
Monopolist	1,318	0.9%
Firms in IT industry	26,101	19.2%

C. Market Concentration				
	Mean	**Median**	**25th Percentile**	**75th Percentile**
Herfindahl–Hirschman index	4,916.5	4,208.5	2,604.4	6,930.1
Number of industry/year observ.	12,216			

Notes: market capitalization= Price per share×Number of outstanding shares; Free cash flows= Cash flows from operating activities–Capital expenditures; Dominant firm= firm with a market share larger than 50% in the four-digit SIC industry each year; Monopolist= firm which is the only player in the industry/year; IT industry= Industry with two-digit SIC code of 35 (industrial and commercial machinery and computer equipment), 36 (electronic and other electrical equipment and components), or 48 (communications); Herfindahl–Hirschman index= Sum of squared market shares in whole numbers (in terms of revenue) of firms in four-digit SIC industry/year.

Panel A of Table 1 provides descriptive statistics for the sample data. On average, the sample firms have $2,434.6 million of annual sales revenue, $435.2 million of SG&A costs, $2,992.2 million of market capitalization, and $3,237.5 million of total assets. Overall, these statistics are comparable to those reported by Anderson et al. (2003) and subsequent studies using Compustat data.

The sample distribution in panel B of Table 1 shows that 30.9% of the sample observations are experiencing a sales decline and that a similar number of observations (27.8% of all observations) are experiencing a sales increase larger than 20%, which are both comparable to what prior studies document. As Jin (2021) pointed out, the considerable number of firms with a relatively large sales increase suggests that the "upside" cost stickiness observed in these firms should not be treated as outliers. "Dominant" firms, defined as those with a market share larger than 50% in the industry/year (to test H_1), represent 5.4% of the sample; Monopolists (to be used as an alternative measure to test H_1) represent 0.9% of the sample. Firms in IT industry, which are expected to show weaker upside cost stickiness (H_3), represent 19.2% of the sample.

Panel C of Table 1 presents data on the (unscaled) Herfindahl–Hirschman Index. For the 12,216 unique industry/year observations, the average value of the index is 4,916.5 (i.e., 0.49165 in HHI for this study). The (untabulated) detailed distribution by year shows that the least concentrated industry is pharmaceutical preparation (SIC code 2834) with the unscaled average index value of 635.7 (i.e., 0.06357 in HHI) during the sample period while 19 different four-digit SIC industries are identified as monopoly (i.e., index value of 10,000 or HHI of 1) during the entire sample period.

IV. RESULTS AND DISCUSSIONS

4.1. Relationship between Firm's Position within the Industry and Upside Cost Stickiness

Table 2 presents the estimation results of model (1). Consist with the findings of Jin (2021), the coefficient on LARGE_INC×ΔREV is not significantly negative when a "sufficiently large sales increase" is defined as a sales increase of 15%, suggesting that a 15% increase in sales is not large enough to trigger the upside cost stickiness. The coefficient becomes significantly negative when a 20% sales increase is used to define LARGE_INC and the magnitude of the negative value increases as the percentage used to define LARGE_INC increases. The results suggest that, on average, a 20% sales increase is considered large enough to slow down additional investments.[3]

As described in the previous section, how a firm's position within the industry affects the upside cost stickiness (H_1) is tested using the three-way interaction term containing DOMINANT. In all columns, the coefficient β_3 (on the interaction term containing DOMINANT) is significant and positive, suggesting that the degree of upside cost stickiness (indicated by a negative β_2 on LARGE_INC×ΔREV) is mitigated when a firm is dominating the market (with a market share of 50% or more.) Further, the sum of β_2 and β_3 is positive in Columns (1) – (5), which suggests that dominant firms do not slow down their investments even when the sales increase reaches 40% i.e., for market dominators, even a 40% sales increase is not large enough to trigger upside cost stickiness. The sum finally becomes negative (-0.003 = -0.164 + 0.161) in Column (6) when a 50% sales increase is used to define a "large increase."[4] Overall, the estimation results regarding the DOMINANT interaction term are highly consistent with H_1.

Regarding other determinants of upside cost stickiness, the coefficients on the three-way interaction terms containing FIRM_SIZE or FCF are significant and positive in all columns, suggesting that the degree of upside cost stickiness decreases with firm size and free cash flows. The coefficient on the interaction term containing RECESSION is significant and negative in all columns, suggesting that the degree of upside cost stickiness is stronger when the economy experiences a large-scale recession. Overall, the results are highly consistent with Jin (2021). Regarding control variables related to "downside" cost stickiness, the negative coefficient on DEC×ΔREV is consistent with what the prior literature finds in general (e.g., Anderson et al., 2003). The positive coefficients on SUCCESSIVE_DEC interaction term and the negative coefficients on

[3] Using a pinpoint analysis, Jin (2021) reports that the negative coefficient on LARGE_INC ×ΔREV becomes significant and negative when the criterion for being "sufficiently large" reaches +18.6%.

[4] In order to pinpoint where the upside cost stickiness starts for dominant firms, the 40%−50% interval is broken down into smaller subintervals. The (untabulated) results show that the sum of β_2 and β_3 becomes negative (i.e., the upside cost stickiness for dominant firms is triggered) when the criterion for being "sufficiently large" reaches +49.6%.

the ASSETINT interaction term are also consistent with the prior findings. The coefficient on EMPINT interaction term is not statistically significant at the conventional level of significance.[5] Overall, estimation results regarding control variables are highly consistent with the prior findings in the literature.

Table 2

Firm's Position within Industry and Upside Cost Stickiness

	Criteria for "Sufficiently Large Sales Increase"					
	+15%	+20%	+25%	+30%	+40%	+50%
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ΔSG&A	ΔSG&A	ΔSG&A	ΔSG&A	ΔSG&A	ΔSG&A
ΔREV	0.461***	0.543***	0.589***	0.625***	0.648***	0.653***
	(30.48)	(48.11)	(64.45)	(80.94)	(107.38)	(129.31)
LARGE_INC×ΔREV	0.046***	-0.032***	-0.077***	-0.114***	-0.145***	-0.164***
	(3.21)	(-3.07)	(-9.11)	(-15.86)	(-25.20)	(-32.78)
LARGE_INC×ΔREV ×DOMINANT	0.136***	0.141***	0.143***	0.145***	0.156***	0.161***
	(10.32)	(10.38)	(10.16)	(9.92)	(9.84)	(9.38)
LARGE_INC×ΔREV ×FIRM_SIZE	0.002***	0.002***	0.003***	0.003***	0.003***	0.004***
	(10.69)	(11.07)	(11.72)	(11.95)	(12.19)	(11.78)
LARGE_INC×ΔREV ×FCF	0.053***	0.053***	0.053***	0.052***	0.050***	0.048***
	(29.91)	(29.84)	(29.72)	(29.24)	(27.82)	(26.01)
LARGE_INC×ΔREV ×RECESSION	-0.080***	-0.080***	-0.081***	-0.084***	-0.087***	-0.084***
	(-9.98)	(-10.13)	(-10.19)	(-10.47)	(-10.66)	(-9.83)
DEC×ΔREV	-0.120***	-0.209***	-0.264***	-0.309***	-0.342***	-0.354***
	(-6.60)	(-14.18)	(-20.34)	(-26.13)	(-32.58)	(-36.29)
DEC×ΔREV×SUCC ESSIVE_DEC	0.210***	0.210***	0.210***	0.211***	0.211***	0.211***
	(29.92)	(29.93)	(29.96)	(29.99)	(30.07)	(30.14)
DEC×ΔREV×ASSET INT	-0.134***	-0.133***	-0.132***	-0.130***	-0.129***	-0.129***
	(-45.83)	(-45.47)	(-45.11)	(-44.74)	(-44.44)	(-44.29)
DEC×ΔREV×EMPI NT	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-0.43)	(-0.41)	(-0.38)	(-0.37)	(-0.29)	(-0.23)
Constant	0.032***	0.028**	0.025**	0.021*	0.016	0.013
	(2.76)	(2.44)	(2.13)	(1.84)	(1.40)	(1.15)
Industry/Year Fixed Effects	Included	Included	Included	Included	Included	Included
Observations	135,649	135,649	135,649	135,649	135,649	135,649
Adjusted R-squared	0.360	0.360	0.360	0.361	0.363	0.365

Notes: ΔSG&A= Log(Current SG&A costs/Prior SG&A costs); ΔREV= Log(Current sales revenue/Prior sales revenue); LARGE_INC= 1 if ΔREV > given criterion, = 0 otherwise; DOMINANT= 1 if market share is larger than 50% in four-digit SIC industry/year, = 0 otherwise; FIRM_SIZE= Price per share×Number of outstanding shares (i.e., market capitalization); FCF= Cash flows from operating activities–Capital expenditures (scaled by total assets); RECESSION= 1 for the period of 2007−2009, = 0 for other periods; DEC= 1 if current sales revenue < prior sales revenue; SUCCESSIVE_DEC= 1 if sales declined for two consecutive years, = 0 otherwise; ASSETINT= Log(Total assets/Sales revenue); EMPINT= Log(Number of employees/Sales revenue). *, **, and *** denote significance at levels of 0.1, 0.05, and 0.01, respectively. T-statistics are in parentheses.

To reconfirm the findings based on model (1), Table 3 presents the estimation results based on an alternative measure of market dominance. Consistent with H_1 and the results in Table 2, the coefficient on the interaction term containing MONOPOLY

[5] The prior literature finds mixed results regarding the relationship between employee intensity and downside cost stickiness (e.g., Anderson et al., 2003; Chen et al., 2012).

is significant and positive in all columns, suggesting that the degree of upside cost stickiness is weaker when there is no other firm in the industry. The sum of β_2 and β_3 is positive (+0.042= -0.028+0.070) in Column (2), meaning a 20% sales increase (which usually triggers upside cost stickiness) is not considered large enough for monopolists. The sum becomes negative (-0.006= -0.074+0.068) in Column (3) when a 25% sales increase is used to define a "large increase." Overall, the results in Table 3 are consistent with H_1 and those in Table 2.

Table 3
Robustness Check – Upside Cost Stickiness for Monopolists

	Criteria for "Sufficiently Large Sales Increase"					
	+15%	+20%	+25%	+30%	+40%	+50%
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ΔSG&A	ΔSG&A	ΔSG&A	ΔSG&A	ΔSG&A	ΔSG&A
ΔREV	0.458***	0.541***	0.588***	0.625***	0.648***	0.653***
	(30.24)	(47.93)	(64.30)	(80.83)	(107.30)	(129.25)
LARGE_INC×ΔREV	0.052***	-0.028***	-0.074***	-0.111***	-0.142***	-0.162***
	(3.60)	(-2.67)	(-8.71)	(-15.47)	(-24.78)	(-32.36)
LARGE_INC×ΔREV ×MONOPOLY	0.069***	0.070***	0.068***	0.075***	0.088***	0.095***
	(2.87)	(2.89)	(2.71)	(2.92)	(3.27)	(3.36)
LARGE_INC×ΔREV ×FIRM_SIZE	0.002***	0.002***	0.003***	0.003***	0.004***	0.004***
	(11.43)	(11.82)	(12.40)	(12.57)	(12.75)	(12.26)
LARGE_INC×ΔREV ×FCF	0.054***	0.054***	0.053***	0.053***	0.050***	0.048***
	(30.02)	(29.95)	(29.82)	(29.34)	(27.91)	(26.09)
LARGE_INC×ΔREV ×RECESSION	-0.080***	-0.080***	-0.081***	-0.084***	-0.088***	-0.084***
	(-9.99)	(-10.14)	(-10.21)	(-10.50)	(-10.70)	(-9.88)
DEC×ΔREV	-0.115***	-0.207***	-0.262***	-0.308***	-0.342***	-0.354***
	(-6.37)	(-14.01)	(-20.22)	(-26.05)	(-32.54)	(-36.26)
DEC×ΔREV×SUCC ESSIVE_DEC	0.210***	0.210***	0.211***	0.211***	0.211***	0.211***
	(29.92)	(29.93)	(29.95)	(29.99)	(30.06)	(30.13)
DEC×ΔREV×ASSET INT	-0.134***	-0.133***	-0.132***	-0.131***	-0.129***	-0.129***
	(-45.89)	(-45.50)	(-45.14)	(-44.76)	(-44.44)	(-44.30)
DEC×ΔREV×EMPI NT	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-0.43)	(-0.40)	(-0.38)	(-0.37)	(-0.29)	(-0.23)
Constant	0.033***	0.029**	0.025**	0.022*	0.016	0.013
	(2.80)	(2.47)	(2.15)	(1.85)	(1.40)	(1.16)
Industry/Year Fixed Effects	Included	Included	Included	Included	Included	Included
Observations	135,649	135,649	135,649	135,649	135,649	135,649
Adjusted R-squared	0.359	0.359	0.360	0.361	0.362	0.364

Notes: ΔSG&A= Log(Current SG&A costs/Prior SG&A costs); ΔREV= Log(Current sales revenue/Prior sales revenue); LARGE_INC= 1 if ΔREV > given criterion, = 0 otherwise; MONOPOLY= 1 if there is no other firm in the four-digit SIC industry/year, = 0 otherwise; FIRM_SIZE= Price per share×Number of outstanding shares (i.e., market capitalization); FCF= Cash flows from operating activities–Capital expenditures (scaled by total assets); RECESSION= 1 for the period of 2007−2009, = 0 for other periods; DEC= 1 if current sales revenue < prior sales revenue; SUCCESSIVE_DEC= 1 if sales declined for two consecutive years, = 0 otherwise; ASSETINT = Log(Total assets/Sales revenue); EMPINT= Log(Number of employees/Sales revenue). *, **, and *** denote significance at levels of 0.1, 0.05, and 0.01, respectively. T-statistics are in parentheses.

4.2. Impact of Market Concentration on Upside Cost Stickiness

Table 4 presents the estimation results of model (2) which uses the Herfindahl–Hirschman index (HHI) to test the relation between market concentration and upside cost stickiness (H_2). As in the previous tables, the coefficient on LARGE_INC×ΔREV is significantly negative in Column (2) and after, suggesting that a 20% increase in sales is large enough to trigger the upside cost stickiness for the sample firms. Coefficients on all control variables also remain consistent with the previous tables and prior findings in the literature. More importantly, the coefficient on the interaction term containing HHI (γ_3) is significant and positive in all columns. As a higher value of HHI indicates a more concentrated market, the positive sign of γ_3 suggests that the degree of upside cost stickiness decreases with market concentration, consistent with H_2. In theory, the coefficients in Column (2) suggest that the degree of upside cost stickiness is 86.1% lower in a monopolistic market (i.e., HHI= 1) compared to a perfectly competitive market with an infinite number of firms (i.e., HHI= 0) (-0.861= 0.031/(-0.036)). As a further analysis, the magnitude (i.e., absolute value) of γ_2 increases substantially from Column (2) through Column (6) while the increase in the value of γ_3 is relatively small. This suggests that the impact of market concentration becomes weaker as the increase in sales becomes more extreme. For instance, an industry is expected to show strong upside cost stickiness regardless of market concentration when experiencing a highly extreme 50% increase in sales, which can be intuitively expected. Overall, the empirical results shown in Table 3 are highly consistent with H_2.

Table 4
Relation between Market Concentration and Upside Cost Stickiness

	Criteria for "Sufficiently Large Sales Increase"					
	+15%	+20%	+25%	+30%	+40%	+50%
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ΔSG&A	ΔSG&A	ΔSG&A	ΔSG&A	ΔSG&A	ΔSG&A
ΔREV	0.458***	0.541***	0.588***	0.625***	0.648***	0.653***
	(30.26)	(47.93)	(64.30)	(80.82)	(107.28)	(129.23)
LARGE_INC×ΔREV	0.044***	-0.036***	-0.083***	-0.121***	-0.152***	-0.173***
	(2.99)	(-3.32)	(-9.30)	(-15.68)	(-23.74)	(-29.67)
LARGE_INC×ΔREV ×HHI	0.031***	0.031***	0.035***	0.037***	0.039***	0.044***
	(3.08)	(3.12)	(3.45)	(3.60)	(3.64)	(3.91)
LARGE_INC×ΔREV ×FIRM_SIZE	0.002***	0.002***	0.003***	0.003***	0.004***	0.004***
	(11.48)	(11.87)	(12.47)	(12.64)	(12.81)	(12.33)
LARGE_INC×ΔREV ×FCF	0.054***	0.054***	0.053***	0.053***	0.050***	0.048***
	(30.02)	(29.95)	(29.83)	(29.34)	(27.90)	(26.09)
LARGE_INC×ΔREV ×RECESSION	-0.080***	-0.080***	-0.081***	-0.084***	-0.087***	-0.084***
	(-9.97)	(-10.11)	(-10.18)	(-10.46)	(-10.66)	(-9.84)
DEC×ΔREV	-0.115***	-0.206***	-0.262***	-0.308***	-0.342***	-0.354***
	(-6.37)	(-13.99)	(-20.19)	(-26.01)	(-32.49)	(-36.21)
DEC×ΔREV×SUCC ESSIVE_DEC	0.210***	0.210***	0.211***	0.211***	0.211***	0.211***
	(29.92)	(29.93)	(29.95)	(29.99)	(30.06)	(30.14)
DEC×ΔREV×ASSET INT	-0.134***	-0.133***	-0.132***	-0.130***	-0.129***	-0.129***
	(-45.81)	(-45.43)	(-45.07)	(-44.69)	(-44.39)	(-44.24)
DEC×ΔREV×EMPI NT	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-0.48)	(-0.46)	(-0.44)	(-0.42)	(-0.34)	(-0.28)
Constant	0.032***	0.028**	0.024**	0.021*	0.016	0.013
	(2.75)	(2.43)	(2.10)	(1.80)	(1.36)	(1.12)
Industry/Year Fixed Effects	Included	Included	Included	Included	Included	Included

To be continued Table 4.

	Criteria for "Sufficiently Large Sales Increase"					
	+15%	+20%	+25%	+30%	+40%	+50%
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ΔSG&A	ΔSG&A	ΔSG&A	ΔSG&A	ΔSG&A	ΔSG&A
Observations	135,649	135,649	135,649	135,649	135,649	135,649
Adjusted R-squared	0.359	0.359	0.360	0.361	0.363	0.364

Notes: ΔSG&A= Log(Current SG&A costs/Prior SG&A costs); ΔREV= Log(Current sales revenue/Prior sales revenue); LARGE_INC= 1 if ΔREV > given criterion, = 0 otherwise; HHI= Sum of squared market shares in fractions (in terms of revenue) of firms in four-digit SIC industry/year; FIRM_SIZE= Price per share×Number of outstanding shares (i.e., market capitalization); FCF= Cash flows from operating activities–Capital expenditures (scaled by total assets); RECESSION= 1 for the period of 2007−2009, = 0 for other periods; DEC= 1 if current sales revenue < prior sales revenue; SUCCESSIVE_DEC= 1 if sales declined for two consecutive years, = 0 otherwise; ASSETINT= Log(Total assets/Sales revenue); EMPINT= Log(Number of employees /Sales revenue). *, **, and *** denote significance at levels of 0.1, 0.05, and 0.01, respectively. T-statistics are in parentheses.

As a robustness check, model (2) is revised using the number of firms in the four-digit SIC industry and year as an alternative measure of market concentration. The (untabulated) results are highly consistent with those in Table 4 and H_2.

4.3. Upside Cost Stickiness for IT Firms

Table 5 presents the estimation results of model (3), showing whether the degree of upside cost stickiness is statistically different between IT firms and non-IT firms (H_3). As in Tables 2 – 4, the coefficient on LARGE_INC×ΔREV is significantly negative in Column (2) and after, suggesting that a 20% increase in sales is large enough to trigger the upside cost stickiness for the sample firms. Coefficients on all control variables also remain consistent with the previous tables and prior findings in the literature. In all model specifications, the three-way interaction term containing IT_FIRM has a positive coefficient (δ_3) as opposed to the negative coefficient on the two-way upside cost stickiness interaction term (δ_2). This suggests that the degree of upside cost stickiness is significantly weaker for firms in IT industries compared to those in non-IT industries. In more specific, the estimation result in Column (2) suggests that the degree of upside cost stickiness is 75% weaker in IT firms (-0.750= 0.024/(-0.032)) when the increase in sales is 20%. Similarly to the previous tables, the magnitude of the positive δ_3 remains relatively constant while the negative δ_2 becomes stronger in magnitude as a higher sales increase is used as a benchmark in defining LARGE_INC. When sales increase by 50% or more (Column (6)), for instance, the degree of upside cost stickiness is 22% weaker in IT firms (-0.220= 0.037/(-0.168)). This can be interpreted as a relatively small difference in upside cost stickiness between IT firms and non-IT firms when the sales increase is extreme i.e., an extreme sales increase is likely to induce upside cost stickiness regardless of industry.

Table 5
Upside Cost Stickiness of IT Firms

	Criteria for "Sufficiently Large Sales Increase"					
	+15%	+20%	+25%	+30%	+40%	+50%
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ΔSG&A	ΔSG&A	ΔSG&A	ΔSG&A	ΔSG&A	ΔSG&A
ΔREV	0.458***	0.541***	0.588***	0.625***	0.648***	0.653***
	(30.23)	(47.93)	(64.32)	(80.86)	(107.33)	(129.29)
LARGE_INC×ΔREV	0.048***	-0.032***	-0.078***	-0.116***	-0.148***	-0.168***
	(3.33)	(-3.04)	(-9.15)	(-15.95)	(-25.38)	(-32.83)
LARGE_INC×ΔREV ×IT_FIRM	0.023***	0.024***	0.025***	0.027***	0.034***	0.037***
	(4.00)	(4.19)	(4.40)	(4.70)	(5.91)	(6.17)
LARGE_INC×ΔREV ×FIRM_SIZE	0.002***	0.002***	0.003***	0.003***	0.004***	0.004***
	(11.34)	(11.71)	(12.29)	(12.43)	(12.55)	(12.07)
LARGE_INC×ΔREV ×FCF	0.054***	0.053***	0.053***	0.053***	0.050***	0.048***
	(29.97)	(29.90)	(29.77)	(29.28)	(27.85)	(26.04)
LARGE_INC×ΔREV ×RECESSION	-0.080***	-0.080***	-0.081***	-0.083***	-0.087***	-0.084***
	(-9.95)	(-10.10)	(-10.16)	(-10.44)	(-10.62)	(-9.80)
DEC×ΔREV	-0.115***	-0.207***	-0.262***	-0.308***	-0.342***	-0.354***
	(-6.35)	(-14.01)	(-20.22)	(-26.06)	(-32.54)	(-36.26)
DEC×ΔREV× SUCCESSIVE_DEC	0.210***	0.210***	0.210***	0.211***	0.211***	0.211***
	(29.91)	(29.92)	(29.95)	(29.98)	(30.06)	(30.13)
DEC×ΔREV× ASSETINT	-0.134***	-0.133***	-0.131***	-0.130***	-0.129***	-0.128***
	(-45.75)	(-45.37)	(-45.01)	(-44.64)	(-44.32)	(-44.19)
DEC×ΔREV× EMPINT	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001
	(-0.52)	(-0.49)	(-0.46)	(-0.45)	(-0.38)	(-0.31)
Constant	0.033***	0.029**	0.025**	0.022*	0.017	0.014
	(2.84)	(2.51)	(2.19)	(1.88)	(1.43)	(1.18)
Industry/Year Fixed Effects	Included	Included	Included	Included	Included	Included
Observations	135,649	135,649	135,649	135,649	135,649	135,649
Adjusted R-squared	0.359	0.359	0.360	0.361	0.363	0.365

Notes: ΔSG&A= Log(Current SG&A costs/Prior SG&A costs); ΔREV= Log(Current sales revenue/Prior sales revenue); LARGE_INC= 1 if ΔREV > given criterion, = 0 otherwise; IT_FIRM= 1 if two-digit SIC code is 35 (industrial and commercial machinery and computer equipment), 36 (electronic and other electrical equipment and components), or 48 (communications), = 0 otherwise; FIRM_SIZE= Price per share×Number of outstanding shares (i.e., market capitalization); FCF= Cash flows from operating activities –Capital expenditures (scaled by total assets); RECESSION= 1 for the period of 2007−2009, = 0 for other periods; DEC= 1 if current sales revenue < prior sales revenue; SUCCESSIVE_DEC= 1 if sales declined for two consecutive years, = 0 otherwise; ASSETINT = Log(Total assets/Sales revenue); EMPINT= Log(Number of employees /Sales revenue). *, **, and *** denote significance at levels of 0.1, 0.05, and 0.01, respectively. T-statistics are in parentheses.

V. CONCLUSION

Using 135,649 firm/year observations, this study predicts and finds that the magnitude of upside cost stickiness is weaker for firms leading or dominating the industry and is inversely related with market concentration. This study also finds that firms in the highly concentrated IT industries show weaker upside cost stickiness than those in non-IT industries. In both academic research and practice, understanding such cost behavior is crucial to fully comprehend how earnings are generated and, further, to anticipate

future operations of the firm. As the cost accounting literature suggests (e.g., Anderson et al., 2003), however, such behavior of cost is substantially more complicated than what most textbooks explain using variable and fixed costs. As an attempt to obtain a better understanding of complex cost behavior, this study extends Jin (2021) and examines how industry structure affects the upside cost stickiness, a unique cost behavior triggered when a firm faces an unusually large increase in sales.

This study contributes to several streams of research by providing important implications. First, this study extends the prior literature on cost stickiness (e.g., Anderson et al., 2003). In specific, this study adds to the literature on asymmetric cost behavior for firms facing an unusual increase in sales by providing industry structure and firms' role within the industry as additional determinants of upside cost stickiness. Second, this study also adds to prior literatures on corporate investment decisions and industry structure. In specific, the main findings of this study show that, when facing an unusually large sales increase, industry leaders tend to be less hesitant in making additional investment in resources than followers (i.e., non-leaders) are. This provides the literature with new examples of how firms' position within the industry affects their decision making and how it is reflected in the cost and investment behavior.

The findings in this study further offer multiple venues for future research. First, while this study tests the impact of industry structure on upside cost stickiness mainly using empirical methods, the economics literature often provides theoretical models regarding the relation between corporate behavior and market characteristics (e.g., Blundell et al., 1999; Covarrubias et al., 2020; and Etro, 2004). Future studies incorporating similar theoretical approaches are expected to complement the empirical findings in this study. Second, this study particularly selects the IT industry for the additional analyses based on the industry's unique characteristics which enable a reasonable prediction regarding cost behavior. Future studies are expected to complement and extend this study by predicting and examining the cost behavior of firms in other industries with different unique characteristics.

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