Open Journal of Accounting, 2022, 11, 243-282
https://www.scirp.org/journal/ojacct
ISSN Online: 2169-3412
ISSN Print: 2169-3404

Cost Management and Strings of Increasing Earnings

Chih-Yang Tseng[1], Lei Zhou[2], Lawrence A. Gordon[2], Martin P. Loeb[2*]

[1]College of Management, National Taiwan University, Taiwan
[2]Robert H. Smith School of Business, University of Maryland, Washington DC
Email: chihyangtseng@ntu.edu.tw, lzhou@umd.edu, lagordon@umd.edu, *mploeb@umd.edu

How to cite this paper: Tseng, C.-Y., Zhou, L., Gordon, L. A., & Loeb, M. P. (2022). Cost Management and Strings of Increasing Earnings. *Open Journal of Accounting, 11,* 243-282.
https://doi.org/10.4236/ojacct.2022.114013

Received: May 17, 2022
Accepted: September 17, 2022
Published: September 20, 2022

Abstract

Barth et al. (1999) document that firms sustaining a string of increasing earnings have higher price-earnings ratios and Myers et al. (2007) find such firms receive higher abnormal stock market returns during the string periods compared to firms not exhibiting this earnings pattern. The primary objective of the current study is to improve our understanding of how firms can maintain a consecutive string of increasing earnings. Most firms that have a string on increasing earnings do so by increasing revenues (Ghosh et al., 2005). Firms that maintain a string of earnings during periods of decreasing revenues must effectively manage costs to decrease their expenses sufficiently to increase earnings during those periods. Prior literature does not provide insights into the characteristics of firms and their market environments that allow them to maintain a string of consecutive earnings over periods that include both increasing and decreasing revenues. This paper contributes to filling that gap in the literature using large data and shows that cost flexibility is an important factor associated with a firm that can maintain a string of increasing earnings and finds that demand uncertainty for a firm's products is inversely related to a firm's ability to maintain a string of increasing earnings. In addition, an examination of the asymmetric cost behavior of the firms that experience at least one sales decrease during a consecutive string of increasing earnings indicates that these firms are associated with anti-sticky cost behavior during the string periods and exhibit sticky costs when the string ends.

Keywords

Cost Management, Strings of Increasing Earnings, Cost Flexibility, Asymmetric Cost Behavior, Demand Uncertainty

1. Introduction

Barth et al. (1999) document that firms sustaining a string of consecutive increasing earnings over five years or longer (hereafter often referred to as a "string") have higher price-earnings multiples (i.e. P/E ratios) during the string than the firms not exhibiting this earnings pattern. Furthermore, the P/E ratios of firms experiencing a string have been found to increase with the number of years the firms have been able to sustain the string, with the largest increases occurring when the string gets to the fifth year. However, the P/E ratios of firms with strings decline significantly once the string breaks. Consistent with Barth et al.'s (1999) findings, Myers et al. (2007) find that firms sustaining a string of adjusted consecutive non-decreasing quarterly earnings per share (EPS) over at least twenty quarters (i.e. five years) have significantly higher abnormal stock market returns during the string periods than firms not exhibiting this earnings pattern[1]. The increases in P/E ratios and abnormal stock market returns provide managers with a strong incentive to report a string of increasing earnings or EPS, preferably for five years or longer.

Striving to maintain a string of consecutive increasing earnings or EPS over multiple periods is, of course, a subset of a larger body of literature that addresses issues related to meeting or beating an earnings-related target. The literature addressing issues related to meeting or beating earnings-related targets points out that there are many factors that enable and/or motivate firms to achieve such targets. These factors include revenue growth, management's ability to manage costs, discretionary accounting choices, earnings management, firm size, slowing the growth of labor costs, and the pressure from investors or senior executives to meet or beat a specific target (e.g. see Beatty et al., 2002; Chu et al., 2019; Cohen & Zarowin, 2010; Ghosh et al., 2005; Dierynck et al., 2012; Kama & Weiss, 2013; Kao & Na, 2013). Due to a large number of these factors, as well as the interactions among them, it is impossible to develop a neatly defined model specifying the conditional expectations when earnings-related targets will or will not be achieved. This latter fact notwithstanding, one way or the other meeting or beating earnings-related targets is the result of meeting or beating targets with respect to revenues and/or costs (i.e. earnings equal the difference between revenues and costs)[2].

Since a firm cannot have earnings without revenues, a prima facie argument can be made that revenue growth (i.e. a revenue target) is an important driver of sustained strings of increasing earnings over multiple consecutive periods. The importance of revenue growth in sustaining a firm's earnings growth is clearly discussed in the business strategy literature (e.g. Porter, 1985). Based on a large sample of firms covering the period from 1980 to 2000, Ghosh et al. (2005) provide direct evidence supporting this argument. They find that roughly "…two-thirds of the firms with sustained increases in earnings

[1]Myers et al. (2007: p. 250) define consecutive increases in EPS as "…consecutive non-decreases in seasonally adjusted, split-adjusted EPS."

[2]The above discussion assumes that meeting or beating earnings-related targets are being accomplished within the framework of generally accepted accounting principles (GAAP). However, as Chu et al. (2019: p. 1966) point out, firms may manipulate earnings to meet or beat earnings-related targets (more will be said about this point in the next section of this paper).

also have concurrent sustained increases in revenues" (Ghosh et al., 2005: p. 34). The remaining one-third of firms in their study are considered to follow a "…cost-cutting strategy…to maintain sustained increases in earnings" (Ghosh et al., 2005: p. 34). The study by Ghosh et al. (2005) focuses on the subset of firms that generate a string of earnings via revenue growth. Their focus on revenue growth is premised, at least in part, on the argument that "…cost reductions are often 'reactive' while revenue growth strategies are typically 'proactive' (Ghosh et al., 2005: p. 36)".

Of course, firms can and often do, take a proactive approach to cost reductions. In fact, a strong motivation for a proactive approach to cost reductions exists when a firm is striving to maintain a string of increasing earnings during periods in which revenues are forecasted to decrease. This fact notwithstanding, understanding a firm's ability to maintain a consecutive string of increasing earnings via cost management has not been the focus of prior studies. The primary objective of the current study is to fill this gap by addressing the following basic research question: How can firms manage their costs to facilitate maintaining a string of increasing earnings, even during periods that include decreasing revenues (i.e. periods when revenue growth is clearly not the only important driver of a string of increasing earnings).

Based on a large contemporary data set covering the period from 1973 to 2018, the findings from the current study confirm the fact that revenue growth is an important driver facilitating a firm's ability to maintain a string of consecutive increasing earnings. However, the current study also finds that firms with strings of consecutive increasing earnings, including strings that include at least one period of decreasing revenues, are associated with higher cost flexibility than firms without strings. In other words, cost flexibility places firms in a position to proactively manage their costs in a manner that allows them to facilitate maintaining a string of increasing earnings. In addition, an examination of the asymmetric cost behavior of the firms that experience at least one sales decrease during a consecutive string of increasing earnings shows that these firms are associated with anti-sticky costs during string years but exhibit sticky cost behavior in the year the string ends[3]. Furthermore, the current study finds that demand uncertainty for a firm's products is inversely related to a firm's ability to maintain a string of increasing earnings. The finding regarding demand uncertainty suggests that revenue predictability contributes to a firm's ability to maintain a string of increasing earnings as more predictable revenues enable firms to maintain strings via the proactive application of cost management (e.g. by increasing the firm's cost flexibility and applying anti-sticky cost behavior).

The current study contributes to the literature in the following ways. First, the current study confirms the prima facie argument, as well as previous empirical

[3]Asymmetric cost behavior refers to the difference in a firm's cost changes responding to positive versus negative changes in sales. Sticky cost behavior refers to the situation where costs increase more rapidly when sales increase than they decrease when sales decrease. Anti-sticky cost behavior refers to the situation where costs decrease more rapidly when sales decrease than they increase when sales increase.

evidence (e.g. see Ghosh et al., 2005), that revenue growth is an important driver for maintaining a string of increasing earnings. Second, the current study provides new evidence regarding the way demand uncertainty impacts management's decisions on cost flexibility. More specifically, whereas Banker et al. (2014b) find a negative association between demand uncertainty and cost flexibility, Holzhacker et al. (2015) find a positive association between demand uncertainty and cost flexibility. Our findings, in a different setting (i.e. firms striving to maintain a string of increasing earnings), are consistent with those of Banker et al. (2014b)[4]. Third, the current study extends the sticky cost literature by identifying a group of firms with asymmetric cost behavior that experienced at least one sales decrease during a consecutive string of increasing earnings, indicating that these firms are associated with anti-sticky cost behavior during the string periods and exhibit sticky costs when the string ends. Fourth, the current study provides insight into the role that being able to predict the demand for a firm's products plays in facilitating a firm's ability to maintain a string of increasing earnings via cost management.

The remainder of the paper will proceed as follows. Section II reviews prior literature and develops our hypotheses. We describe our research design and methodology in Section III. Section IV summarizes our sample selection and main empirical results. As a check on the robustness of our empirical results, Section V discusses several additional robustness tests. Section VI provides a discussion of the implications of the findings from our study. The last section, Section VII, provides concluding comments.

2. Prior Literature and Hypotheses

Using annual earnings, Barth et al. (1999) demonstrate that firms with strings of increasing earnings over five years or longer have higher P/E ratios during the string periods compared to firms without strings. They also find that the P/E ratios of these firms increase with the number of years that a firm has been able to sustain the string and decline significantly once a string of increasing earnings breaks[5]. Using adjusted non-decreasing quarterly EPS over twenty quarters or longer to capture a string, Myers et al. (2007) measure abnormal stock market returns during the string periods and observe phenomena consistent with the findings by Barth et al. (1999). Given the significantly higher market premia, firms clearly have an incentive to report strings of increasing earnings whenever possible. As Myers et al. (2007: p. 249) state, "These market premia, and the rapidity with which they disappear once the strings end, provide managers with incentives to maintain and extend the strings". Barth et al. (1999: p. 388) make a similar point when they note that their inquiry about strings "... is

[4]Holzhacker et al. (2015: p. 2307) measure *cost elasticity* in hospitals as "…change in cost for a change in quantity…" As discussed in the next section of this paper, we measure cost flexibility in terms of change in costs corresponding to change in sales. Our measure of cost flexibility of public firms is similar to that in Banker et al. (2014b).

[5]Using our sample, we replicate the main results of Barth et al. (1999). These results are reported in **Appendix A**.

motivated by the observation that many managers seem focused on maintaining steadily increasing earnings".

The earnings management literature contains studies that have investigated issues related to the way firms are able to maintain strings of increasing earnings. Beatty et al. (2002), for example, allude to the matter of maintaining strings of increasing earnings by examining the small earnings increases reported by publicly held banks vs. privately held banks. They found that publicly held banks are more likely to use discretionary accounting choices to avoid small earnings decreases and report longer strings of increasing earnings. Using cross-sectional data excluding financial and regulated industries, Kao & Na (2013) study accruals and real earnings management during strings of increasing earnings and find both activities intensify towards the end of the strings. In a study that focuses on beating analysts' forecasts of EPS, using a sample of firms that were subject to SEC (Securities and Exchange Commission) enforcement actions, Chu et al. (2019: p. 1969) find that "…pressure to maintain a reputation for beating analysts' expectations can encourage aggressive accounting and, ultimately, earnings manipulation"[6].

In their study that focuses on how increasing earnings via increasing revenues affect the quality of earnings and the earnings response coefficient (ERC), Ghosh et al. (2005: p. 54) find that "…earnings quality and ERCs are the highest when sustained increases in earnings are supported by sustained increases in both revenues and operating earnings." Although Ghosh et al. (2005) focus on sustained earnings via sustained increases in revenues, they also point out that one-third of the firms in their study used a cost-cutting strategy to maintain a string of sustained earnings.

As noted in the Introduction, a prima facie argument can be made that revenue growth is an important driver of sustained strings of increasing earnings over multiple consecutive periods[7]. In fact, if a firm has a positive and stable contribution margin, as well as no increases in fixed costs, increasing revenues would obviously increase a firm's earnings. Evidence supporting the importance of revenue growth to a string of consecutive increasing earnings was provided by Ghosh et al. (2005). The current study employs a much larger and more recent sample than that in the Ghosh et al. (2005) study in confirming the importance of revenue growth to the attainment of a string of consecutive increasing earnings.

To establish a baseline for considering the importance of cost management relative to revenue growth for maintaining strings of increasing earnings, we test that revenue growth is indeed an important driver of strings of increasing earnings. Thus, we formally state our Hypothesis 1 (H_1), in the alternative form as:

[6]An earlier version of the Chu et al. (2019) paper was entitled "The Valuation Premium for a String of Positive Earnings Surprises: The Role of Earnings Manipulation."

[7]The impact of revenue growth on the stock market value of firms is also well documented in the literature (e.g. Jegadeesh & Livnat, 2006; Chen et al., 2014).

Hypothesis 1. *Consecutive revenue growth is an important driver of strings of increasing earnings*.

Much of the early literature on cost management focuses on operating leverage, emphasizing the trade-off between fixed and variable costs. In his seminal paper, Lev (1974: p. 637) links higher operating leverage to higher asset intensity (total assets divided by sales revenue), arguing that managers may increase the operating leverage (i.e. increasing fixed costs relative to variable costs) of firms by increasing capital investments. A concept closely related to operating leverage is cost flexibility, which refers to a firm's ability to adjust its costs. Cost flexibility is affected by the composition of discretionary costs and non-discretionary costs in a firm's cost structure. A cost structure with a higher (lower) ratio of discretionary costs to non-discretionary costs is associated with higher (lower) cost flexibility. Recognizing that non-discretionary costs tend to be fixed and discretionary costs tend to be variable, Balakrishnan et al. (2008: p. 171) make the connection between operating leverage and cost flexibility, stating that "…a cost structure with less operating leverage (i.e. a lower proportion of fixed costs) offers companies flexibility because it involves fewer upfront cost commitments (i.e. fewer fixed costs)." Holzhacker et al. (2015: p. 2331) also note the value of having a cost structure with less operating leverage and "…provide empirical evidence that firms respond to a risky environment by altering their resource procurement choices to increase cost elasticity".

Firms may choose to commit to higher operating leverage (lower cost flexibility) to increase their activity capacity and reduce unit cost, though higher operating leverage exposes firms to greater risk. In this regard, conventional wisdom in managerial accounting textbooks (e.g. Balakrishnan et al., 2008) suggest that firms should move to a higher operating leverage when sales are anticipated to be high and switch to a lower operating leverage when sales are anticipated to be low—a cost management strategy that allows firms to achieve higher profits for a single year. However, firms rarely (if ever) can easily switch back and forth between high and low operating leverage to adjust to anticipated periodic sales levels. Thus, to sustain a string of increasing earnings over consecutive periods of five years or longer, it seems logical for firms to focus on maintaining cost flexibility (i.e. avoiding being locked into an excessive amount of non-discretionary costs).

The above discussion leads us to our second hypothesis, which concerns the role of cost flexibility in facilitating strings of consecutive increasing earnings. We formally state this hypothesis as Hypothesis 2 (H_2), in the alternative form below:

Hypothesis 2. *Firms with strings of increasing earnings have more cost flexibility compared to firms without such strings*.

While our second hypothesis is concerned with the role of cost flexibility in managing costs to maintain strings of increasing earnings, our next hypothesis is concerned with asymmetric cost behavior. The seminal paper by Anderson et al.

(2003) documents that cost changes are asymmetrical in sales increases as compared to sales decreases. They argue that cutting costs often requires additional resource adjustments and managers are reluctant to cut resources when sales decrease. This argument has led to what has become known as the sticky cost phenomenon, which means costs increase more rapidly when sales increase than they decrease when sales decrease[8]. The asymmetric cost behavior literature focuses on managers' decisions related to cost management. In their review of the asymmetric cost behavior literature, Banker & Byzalov (2014: p. 43) note that "While the traditional view of cost behavior envisions a mechanistic symmetric relation between costs and concurrent activity, modeled as fixed and variable costs, this new way of thinking is rooted in an explicit recognition of the role of deliberate managerial decisions in short-run cost behavior"[9].

Studies on asymmetric cost behavior have found that several factors, such as capacity utilization, empire building, earnings targets, strategic orientation, sales forecasts, level of intangible assets, and risk management, moderate the asymmetric cost behavior of firms (e.g. Balakrishnan et al., 2004; Chen et al., 2012; Dierynck et al., 2012; Kama & Weiss, 2013; Banker et al., 2013; Banker et al., 2014a; Holzhacker et al., 2015; Venieris et al., 2015; Banker et al., 2016; Hall, 2016; Ballas et al., 2022). Among these studies, Dierynck et al. (2012) and Kama & Weiss (2013) examine how firms manage costs when managers face incentives to meet a single period earnings target[10].

Dierynck et al. (2012) analyze whether decisions related to labor costs in private Belgian firms have been motivated by management's desire to avoid losses. They find that when these firms report small earnings, labor costs increase at a slower rate when activity increases than they decrease when activity decreases (i.e. labor costs behave in an anti-sticky fashion when firms try to avoid losses). Using a large sample of U.S. firms, Kama & Weiss (2013) also find costs become anti-sticky (i.e. costs decrease more rapidly when sales decrease than they increase when sales increase), when firms are trying to meet a single period earnings target. Kama & Weiss (2013: p. 219), however, note that it is hard for firms to meet earnings targets over multiple periods via accelerating cost reductions.

As discussed above in connection with our first hypothesis, consecutive revenue growth is an important driver of sustained strings of increasing earnings over multiple consecutive periods. We know, however, that many firms maintain strings of increasing earnings over periods that include at least one period of sales decrease (e.g. Ghosh et al., 2005). Maintaining an increase in earnings during a period of declining revenues means that the magnitude of the cost decrease

[8]Banker & Byzalov (2014) use firing skilled indirect labor as an example of resource adjustments that result in sticky costs. Cutting these costs would cause firms to incur severance payments to dismissed workers and/or research and training costs for hiring future workers.

[9]Recent study by Kreilkamp et al. (2021) also points out that investors assess firms' asymmetric cost behavior when adapting their value estimate.

[10]Although Dierynck et al. (2012) use the term "benchmarks" rather than "targets," we group their paper into the stream of research that addresses the relationship between asymmetric cost behavior and earnings targets.

is greater than that of the revenue decrease in a particular year[11]. Such cost behavior is consistent with the notion of anti-sticky costs. Once firms are no longer able to cut costs sufficiently to maintain the strings, we would expect the anti-sticky cost behavior to end.

The above discussion leads us to our third hypothesis concerning the asymmetric cost behavior of firms that experience at least one sales decrease during strings of consecutive increasing earnings. We formally state this hypothesis as Hypothesis 3 (H_3), in the alternative form below:

Hypothesis 3. *Firms that experience at least one sales decrease during a string of consecutive increasing earnings are associated with anti-sticky costs during the string period but exhibit sticky cost behavior when the string ends.*

The second and third hypotheses relate to cost management strategies that firms can employ to maintain strings of consecutive increasing earnings. However, implementing these strategies is clearly a function of a firm's ability to plan for future costs and revenues. A fundamental aspect of being able to plan for future costs and revenues is the demand uncertainty confronting a firm. When the demand uncertainty for a firm's products is high, actual revenues and costs may deviate significantly from anticipated revenues and costs (i.e. profits are highly volatile). This makes maintaining a string of increasing earnings via cost management difficult for two reasons. First, when demand uncertainty is high, forecasts of future sales and costs are less accurate, which limits the ability of firms to prepare accurate budgets. Second, when demand uncertainty is high, unexpected large revenue decreases are likely to occur more frequently. With unexpected large revenue decreases, it is difficult for firms to sustain a string of increasing earnings by managing discretionary costs. Hence, higher demand uncertainty is expected to impede the ability of a firm to maintain strings of increasing earnings via cost management. In this regard, Holzhacker et al. (2015: p. 2328) find that firms can hedge against risks from demand uncertainty by "substituting away from committed resources and toward more flexible resources to allow for higher cost elasticity…". In discussing the optimal cost structure in a different setting, Banker et al. (2014b) find "…that firms will choose a higher capacity of fixed inputs when uncertainty increases in order to reduce congestion costs"[12].

Based on the observations discussed above, we hypothesize that the demand for the products of firms with strings of consecutive increasing earnings are more predictable (i.e. lower demand uncertainty) compared to firms without strings[13]. We formally state this hypothesis as Hypothesis 4 (H_4), in the alternative

[11]As we will be seen later in this paper, the current study also includes strings of increasing earning over periods that include at least one sales decrease.

[12]Although part of demand uncertainty is clearly exogeneous (e.g. global and domestic factors affecting the macro-economy), judicious cost management can also have an impact on demand uncertainty. For example, resources spent on quality control, shipping, customer services, IT systems, and advertisement could enhance customer satisfaction. Customer satisfaction should lower the uncertainty associated with the demand for a firm's products and, in turn, improve a firm's ability to maintain a consecutive string of increasing earnings.

form below:

Hypothesis 4. *Firms with consecutive strings of increasing earnings confront lower demand uncertainty compared to firms without such strings.*

3. Research Design and Methodology

3.1. Research Design

Following Barth et al. (1999), we define a string of increasing earnings as consecutive increases in annual earnings for five years or longer. We identify firms that had reported strings of increasing earnings (i.e. *string firms* subsample) and firms that had never reported strings of increasing earnings (i.e. *non-string firms* subsample) between 1973 and 2018. For the string firms subsample and non-string firm subsample, we measure the frequency of consecutive revenue growth, cost flexibility, asymmetric cost behavior, and demand uncertainty separately. These measures are compared between the string firms and non-string firms to test our hypotheses.

3.2. Research Methodology

To test our first hypothesis regarding the argument that consecutive revenue growth is an important driver of strings of consecutive increases in earnings, we define a firm-level *Consecutive Revenue Growth Ratio* measure. This measure is calculated as the ratio of the number of years in consecutive revenue growth of five years or longer to the total number of years of observations for each firm. This ratio provides a measure of frequency of consecutive revenue growth each firm experienced. We then compare the average *Consecutive Revenue Growth Ratio* of the string firms to that of the non-string firms. Based on our first hypothesis (H_1), we expect that the string firms have a significantly higher *Consecutive Revenue Growth Ratio* than the non-string firms.

To test our second hypothesis regarding the level of cost flexibility of firms with strings versus firms without strings, we assume a log-linear relationship between cost changes and sales changes. We choose the log-linear model over a linear model because the log transformation mitigates the skewedness issue, making variables more comparable across firms and industries. In addition, the coefficients from the log-linear model can be conveniently interpreted as the percentage change of the dependent variable corresponding to one percent change in the independent variable (Banker et al., 2014b: p. 848). Formally, we state our Model (1), as shown below:

$$\ln\left(\frac{OC_{i,t}}{OC_{i,t-1}}\right)=\beta_0+\beta_1\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)+\sum_{s=1}^{4}\gamma_{1,s}\times EconVar_{s,i,t}+\varepsilon_{i,t}, \quad (1)$$

where $OC_{i,t}$ is firm *i*'s operating costs in year *t*, and $Sales_{i,t}$ is firm *i*'s sales revenue

[13]Our hypotheses suggest that firms with strings are associated with higher cost flexibility and lower demand uncertainty, which are consistent with the analysis by Banker et al. (2014b) concerning the optimal cost structure for firms in response to demand uncertainty.

in year *t*.

Following Anderson et al. (2003), Chen et al. (2012), Dierynck et al. (2012), and Banker et al. (2014b), we use *EconVars* to control for the following economic variables: *Employee Intensity*, *Asset Intensity*, *Successive Decrease*, and *Stock Performance*. We control for employee intensity and asset intensity because they both influence the cost commitments in expenditure decisions. *Employee Intensity* is calculated as the ratio of the number of employees to sales revenue. *Asset Intensity* is measured as the ratio of total assets to sales revenue. We follow Chen et al. (2012) and Dierynck et al. (2012) to control for the successive pattern of sales decreases because managers may consider sales decreases in a successive pattern to be a permanent decline when making cost commitment decisions. *Successive Decrease* is an indicator variable that equals 1 if $Sales_{i,t-1} < Sales_{i,t-2}$ and 0 otherwise. Chen et al. (2012) also point out that good stock performance reflects the market's positive expectation about a firm's future earnings and this may also affect the firm's cost commitments. Hence, we control for *Stock Performance*, which is calculated as the raw stock return in the prior fiscal year[14].

When estimating the models, we include industry fixed effects to control for the impact of an industry on a firm's cost structure. In addition, following Petersen (2009), we use pooled cross-sectional regressions, including year effects, and cluster observations by firms to provide standard errors that are robust to autocorrelation and heteroscedasticity.

Our proxy for cost flexibility (i.e. a firm's ability to adjust its costs) is β_1, the coefficient of $\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$ in Model (1). The coefficient β_1 is expected to be positive and represents roughly the percentage change in costs corresponding to a one percentage change in sales. In other words, β_1 captures the sensitivity of costs changes to sales changes. A high β_1 means costs are highly responsive to sales changes, hence suggesting a highly flexible cost structure. Our second hypothesis (H_2) will be supported if β_1 is significantly greater for string firms than for non-string firms.

To test our third hypothesis (H_3) regarding asymmetric cost behavior for firms that experience at least one sales decrease during a string of increasing earnings, we use a modified version of the Anderson et al. (2003) model. Our model is different from the Anderson et al. (2003) model in two ways. First, while Anderson et al. (2003) focus on SG&A expenses, we examine operating costs (*OC*) (i.e. annual sales revenue minus income from operations). Our definition of operating costs, which is consistent with that of Balakrishnan et al. (2004), Balakrishnan & Gruca (2008), Weiss (2010), and Kama & Weiss (2013), captures managerial choices affecting the costs of manufacturing goods, the costs of providing services, and the costs of marketing and distribution. We believe that operating costs are a better measure for our study because it is unlikely

[14]In untabulated tests, we also controlled for discretionary accruals. The results are similar to those reported in the tables and available upon requests.

that managers who are motivated to achieve a specified earnings level would limit their cost management activities to only SG&A costs. Second, in order to examine the asymmetric cost behavior for string firms when the string ends, we add a dummy variable *Break* to indicate the year when earnings stop increasing. We also include all economic control variables identified earlier in Model (1). Formally, we state our Model (2), as shown below:

$$\begin{aligned}\ln\left(\frac{OC_{i,t}}{OC_{i,t-1}}\right) &= \beta_0 + \beta_1 \ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right) + \beta_2 Dec_{i,t} \times \ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right) \\ &+ \beta_3 Break_{i,t} + \beta_4 \ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right) \times Break_{i,t} + \beta_5 Dec_{i,t} \\ &+ \beta_6 \ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right) \times Dec_{i,t} \times Break_{i,t} + \sum_{s=1}^{4} \gamma_{1,s} \times EconVar_{s,i,t} \\ &+ \sum_{s=1}^{4} \gamma_{2,s} \ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right) Dec_{i,t} \times EconVar_{s,i,t} + \varepsilon_{i,t},\end{aligned} \tag{2}$$

where $Dec_{i,t}$ is a dummy variable that equals 1 if $Sales_{i,t} < Sales_{i,t-1}$ and 0 otherwise. $Break_{i,t}$ is an indicator variable that is set to 1 if earnings in year t is less than earnings in year $t-1$ but earnings in year $t-1$ is more than earnings in year $t-2$. Hence, for firm years associated with a string of increasing earnings, $Break_{i,t}$ is 1 for the year immediately after the string of increasing earnings and 0 otherwise. All other variables are as previously defined. Based on the sticky cost phenomenon documented in prior cost behavior literature (e.g. Anderson et al., 2003), we measure asymmetric cost behavior using β_2, the coefficient of $Dec_{i,t} \ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$ in Model (2). We expect β_2 to be negative for all firm years in our sample.

Our third hypothesis (H_3) proposes that costs of firms that experience at least one sales decrease during strings are anti-sticky over the string periods, which will be supported if β_2 is significantly positive for the string firm years for these firms. We also expect costs to become sticky again once the string breaks, which suggests that β_6, the coefficient of $\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right) \times Dec_{i,t} \times Break_{i,t}$, to be negative.

Demand uncertainty refers the variability in the sales of a firm's products. Following Banker et al. (2014b), we measure the demand uncertainty for a firm in a particular year using the standard deviation of log changes in revenues for the past five years (i.e. $\Delta \ln Sales_{i,t}$, or $\ln \frac{Sales_{i,t}}{Sales_{i,t-1}}$)[15]. Our fourth hypothesis (H_4) will be supported if the demand uncertainty of string firms is significantly

[15]As pointed out by Banker et al. (2014b: p. 849), "The use of standard deviation as an empirical proxy for uncertainty is standard in the literature (e.g. Dechow & Dichev, 2002; Kothari et al., 2002; Zhang, 2006; Dichev & Tang, 2009), and the standard deviation of log-changes in sales is commonly used as a measure of demand uncertainty in economics (e.g. Stock & Watson, 2002; Comin & Philippon, 2005; Comin & Mulani, 2006; Davis & Kahn, 2008)".

lower than that of the non-string firms[16].

4. Sample Selection and Results of Empirical Study

4.1. Sample and Data

We construct a sample by first examining a population of all firm years in Compustat from 1973 to 2018[17]. Financial institutions and public utilities (four-digit SIC codes 6000 - 6999 and 4900 - 4999) were excluded from our sample because the structure of their financial statements is difficult to compare with that of firms in other industries (Fama & French, 1992; Dechow et al., 2012). Prior studies on earnings patterns have defined strings of increasing earnings as either consecutive increases in annual earnings (e.g. Barth et al., 1999; Ghosh et al., 2005; Kao & Na, 2013) or consecutive increases in quarterly earnings (e.g. Chu et al., 2019; Ke et al., 2003; Ke & Petroni, 2004; Myers et al., 2007; Shanthikumar, 2012). We follow the former definition (i.e. consecutive increases in annual earnings) so that our results are comparable to prior cost management studies (e.g. Anderson et al., 2003; Kama & Weiss, 2013; Balakrishnan et al., 2014; Banker et al., 2014a, 2014b). Following Ke & Petroni (2004), we omit the left-truncated and right-truncated strings to avoid the truncation problem. We also eliminate outliers that are in the top one percent and the bottom one percent of all continuous variables in the model. In addition, firm years with missing data for regression analysis are excluded from the sample. These results in a final sample of 14,694 firms associated with 157,325 firm years.

Among the 157,325 firm years, we identify 59,557 firm years associated with 2760 firms that have reported at least one string over the entire sample period (hereafter often referred to as the string firms), and 97,768 firm years associated with 11,934 firms that have never reported a string of increasing earnings over the entire sample period (hereafter often referred to as the non-string firms). In total, the string firms have reported 3259 strings associated with 22,189 firm years (hereafter often referred to as the string firm years).

As summarized in **Table 1** Panel A, 828 strings (out of the total 3259 strings) from 774 firms (out of the total 2760 firms with strings) that experience at least one sales decrease during the string periods. In other words, 25.41 percent (828/3259) of the strings of increasing earnings are associated with at least one sales decrease during the string periods, and 28.04 percent (774/2760) of the string firms have experienced at least one sales decrease during the string periods. It is also worth noting that 74.59 percent (2431/3259) of the strings are associated with consecutive sales increases during the string period, consistent with our argument that consecutive revenue increases are an important driver of

[16]See **Appendix B** for definition of key variables.

[17]Since a substantial number of firms in our study have SEC filing dates that do not coincide with the calendar year, we used 2018 as the cut-off year. If we were to include the 2019 SEC filings for the above noted firms, such filings would cover a portion of 2020, which would raise COVID-19 confounding issues.

Table 1. Characteristic of strings of increasing earnings.

Panel A: Distribution of String Length

	Strings without any sales decreases during the string periods	Strings with at least one sales decrease during the string periods	All strings
Mean of Length	7.20	7.70	7.31
Std Dev of Length	3.35	3.97	3.51
Minimum Length	5	5	5
Maximum Length	40	37	40
Number of Strings	2431	828	3259
Number of Firms	2027	774	2760[18]
Number of Firm Years	16,141	6048	22,189

Panel B: Industry Distribution

Industry	String firms	All firms	Concentration of string firms
Consumer Durables	127	461	27.55%
Wholesale, Retail, and Some Services	480	1776	27.03%
Consumer NonDurables	255	987	25.84%
Manufacturing	467	1867	25.01%
Chemicals and Allied Products	97	392	24.74%
Other	430	2456	17.51%
Telephone and Television Transmission	99	602	16.45%
Business Equipment	466	3441	13.54%
Oil, Gas, and Coal Extraction and Products	126	935	13.48%
Healthcare, Medical Equipment, and Drugs	213	1777	11.99%
Total	2760	14,694	18.78%

earnings strings. The length of the strings varies from 5 to 40 years, with an average length of 7.31 years for all strings. For the strings without any sales decrease during the string period, the length varies from 5 to 40 years with an average length of 7.20 years, whereas for the strings with at least one sales decrease during the string period, the length of strings varies from 5 to 37 years with an average length of 7.70 years.

Panel B of Table 1 presents the industry distribution of the string firms. We calculate the percentage of the number of string firms to all firms in each industry to examine if string firms are concentrated in a particular industry (or industries). Among the industries in our sample, the Consumer Durables industry

[18]The total number of string firms (2760) is greater than the sum of the number of string firms without sales decreases during string periods and the number of string firms with sales decreases during the string periods, because some string firms (41) have reported strings of increasing earnings that do not have any sales decreases during the string periods and strings that have at least one sales decrease over the string periods.

(27.55%) and the Wholesale, Retail and Some Services industry (27.03%) have the highest percentages of string firms. The Consumer Nondurables industry, the Manufacturing industry and the Chemicals and Allied Products industry follow the above two industries closely, showing 25.84%, 25.01% and 24.74% as the string firm percentage respectively. The rest of the industries show less than 20% of all firms as string firms, with the Healthcare, Medical Equipment, and Drugs industry having the lowest percentage (11.99%). In sum, while some industries have a higher percentage of string firms than other industries, the industry effect does not appear to be a driving force underlying strings of increasing earnings. We conduct more thorough analyses of the industry effects in Section V, where we discuss the robustness of our results.

4.2. Descriptive Statistics

Panel A of Table 2 presents the descriptive statistics of key variables in our sample, where sales and OC are shown in millions of dollars. Panel B of Table 2 presents the results of t-tests on the differences between the descriptive statistics of the string firms and the non-string firms, as well as the string years of the string firms and the non-string years of the string firms. The average number of firm years from each firm is 21.58 (i.e. 59,557/2760) for the string firms, and 8.19 (i.e. 97,768/11,934) for the non-string firm, suggesting that string firms tend to be more mature firms than non-string firms, with a longer history in the stock market. Mean sales revenues (*Sales*) and mean operating costs (*OC*) are $4518.19 million and $4240.20 million for string firms, which are both significantly larger than those of the non-string firms ($1370.26 million for mean *Sales* and $1330.16 million for mean *OC*, respectively). In addition, sales decreases (*Dec*) and successive sales decreases (*Successive Decrease*) are less likely to occur in string firms than in non-string firms. The mean of the indicator variable *Break* is significantly higher for the string firms (0.18) than for the non-string firms (0.16), consistent with the fact that the string firms tend to have more sustained increasing earnings.

The average *Asset Intensity* is significantly lower for string firms (1.09) than for non-string firms (1.91). Given that lower asset intensity is typically associated with lower investment in non-discretionary costs, this result is consistent with our expectation. The average *Employee Intensity* is significantly higher for the string firms (0.0107) than for the non-string firms (0.0105). This is also consistent with our expectation since employee-related costs are typically considered to be discretionary.

Consistent with Barth et al. (1999), we find that the average annual earnings per share (*EPS*) of the string firms (1.71) are significantly higher than that of the non-string firms (0.55). In addition, for the string firms, the average EPS of the string years are significantly higher than that from the non-string years. The raw stock return (*Stock Performance*) of the string firms (0.11) is significantly lower than that of the non-string firms (0.15), which can be explained by the fact that the string firms tend to be larger and more mature firms with lower risk. We

Table 2. Descriptive statistics[19].

Panel A: Descriptive Statistics of Key Variables

Variables	Number of Observations	Mean	Standard Deviation	Min	Max
Sales	157,325	2567.53	13113.82	0.01	511729.00
OC	157,325	2431.79	12437.76	0.02	505059.00
Dec	157,325	0.30	0.46	0.00	1.00
Break	157,325	0.17	0.37	0.00	1.00
Employee Intensity	157,325	0.01	0.01	0.00	0.19
Asset Intensity	157,325	1.60	3.38	0.19	81.45
Successive Decrease	157,325	0.28	0.45	0.00	1.00
Stock Performance	157,325	0.13	0.78	−0.91	8.38
Abnormal Return[20]	157,325	0.00	0.19	−0.97	6.32
EPS	157,325	0.99	82.33	−83.40	98.11
Consecutive Revenue Growth Ratio	157,325	0.22	0.20	0.00	0.89

Definition of variables: *Sales* are firms' sales revenues; *OC* is a firm's operating costs; *Dec* is a dummy variable that equals to 1 if a firm's current year sales are less than last year, and 0 otherwise; *Break* is an indicator variable for earnings decrease and is set to 1 if a firm's current earnings are less than last year; *Employee Intensity* is the ratio of the number of employees to sales revenue; *Asset Intensity* is the ratio of total assets to sales revenue; *Successive Decrease* is an indicator variable that equals to 1 if a firm's last year sales are greater than the year before last year, and 0 otherwise; *Stock Performance* is the raw stock return in the prior fiscal year; *EPS* is earnings per share.

Panel B: Mean of Key Variables and t-tests Results

Variables	(1) String firms	(2) Non-string firms	(1) vs (2) Difference in means	(1) vs (2) t-stat for difference in means		(3) String years of string firms	(4) Non-string years of string firms	(3) vs (4) Difference in means	(3) vs (4) t-stat for difference in means	
Sales	4518.19	1379.26	3138.90	46.36	***	3541.75	5098.00	−1556.20	−10.86	***
OC	4240.20	1330.16	2910.00	45.30	***	3254.21	4825.67	−1571.50	−11.67	***
Dec	0.23	0.34	−0.12	−50.97	***	0.08	0.31	−0.23	−77.08	***
Break	0.18	0.16	0.03	13.78	***	0.13	0.21	−0.08	−26.74	***
Employee Intensity	0.0107	0.0105	0.0002	3.21	***	0.0125	0.0096	0.0029	29.83	***
Asset Intensity	1.09	1.91	−0.82	−59.05	***	0.99	1.15	−0.16	−21.50	***
Successive Decrease	0.22	0.32	−0.10	−44.35	***	0.07	0.31	−0.24	−82.12	***
Stock Performance	0.11	0.15	−0.03	−9.08	***	0.15	0.09	0.06	12.81	***

[19]All financial statement data and number of employees are obtained from Compustat. Stock price data are obtained from CRSP.

[20]We estimate the Fama and French three factor model $r_i - r_f = \alpha_0 + \alpha_1 (r_m - r_f) + \alpha_2 SMB + \alpha_3 HMB + \varepsilon$ to obtain the expected stock return for each firm, where r_i is firm *i*'s stock return, r_f is the risk free rate of return, r_m is the market return, *SMB* is the difference in stock returns between small firms and large firms, *HMB* is the difference in stock returns between high book-to-market firms and low book-to-market firms (Fama & French, 1993). The *Abnormal Return* is the difference between the actual stock return and the expected stock return. We obtained the risk factor data (r_m-r_f, *SMB* and *HMB*) from Kenneth French's website. (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html).

Continued

Abnormal Return	0.04	0.01	0.03	10.03	***	0.10	0.01	0.09	27.19	***
EPS	1.71	0.55	1.16	3.47	***	2.34	1.34	1.00	27.63	***
Consecutive Revenue Growth Ratio	0.34	0.14	0.21	221.25	***	0.39	0.31	0.08	48.51	***
N	59,557	97,768				22,189	37,368			
Number of firms	2760	11,934				2760	2760			

***represents significance level of 0.01.

Panel C: Pearson Correlation Matrix

	Sales	*OC*	*Dec*	*Break*	*Employee Intensity*	*Asset Intensity*	*Successive Decrease*	*Stock Performance*	*EPS*
Sales	1	0.998 ***	−0.007 ***	0.029 ***	−0.099 ***	−0.022 ***	−0.003	−0.017 ***	0.005 **
OC		1	−0.004 *	0.030 ***	−0.099 ***	−0.022 ***	−0.002	−0.018 ***	0.004 *
Dec			1	0.070 ***	−0.012 ***	0.068 ***	0.212 ***	−0.101 ***	−0.009 ***
Break				1	−0.015 ***	−0.045 ***	−0.150 ***	−0.111 ***	0.000
Employee Intensity					1	0.209 ***	−0.013 ***	−0.007 ***	0.000
Asset Intensity						1	0.070 ***	0.001	−0.004 *
Successive Decrease							1	0.052 ***	0.000
Stock Performance								1	0.001
EPS									1

*, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively.

calculate the abnormal stock returns (*Abnormal Return*) using Fama & French (1993) three-factor model. The results show that the average abnormal return of the string firms (0.04) is significantly higher than that of the non-string firms (0.01). For the string firms, the average abnormal return of the string years (0.10) is also significantly higher than that of the non-string years (0.01). Overall, our statistics regarding stock returns are consistent with those documented by Myers et al. (2007).

Panel C of **Table 2** presents the Pearson Correlation Matrix of our key variables. The greatest correlation coefficient in the table is between *Dec* and *Successive Decrease* (i.e. 0.212). None of the other correlation coefficients between the key variables are greater than 0.21. Hence, multicollinearity does not appear to be problem in our regression model[21].

An examination of the data from the current study, which covers the period from 1973 to 2018, reveals that out of the 74,604 firm years exhibiting consecutive revenue growth over at least five years, only 20,162 firm years (27.03 percent) are associated with strings of increasing earnings. Furthermore, out of the

[21]We also calculated the variance inflation factor (VIF) and the results show no indication of multicollinearity. These results are available upon request.

22,189 firm years associated with strings of increasing earnings, 6048 firm years (27.26 percent) are associated with strings of increasing earnings over periods with at least one revenue decrease. The above findings point out that a pattern of consecutive revenue growth, although clearly an important driver of strings of increasing earnings, is neither a sufficient condition nor a necessary condition for a firm to maintain a string of increasing earnings. That is, besides consecutive revenue growth, cost management obviously plays an important role in a firm's ability to report strings of increasing earnings[22]. As already noted in the Introduction of this paper, Ghosh et al. (2005: p. 34) also point out that a large percentage (i.e. 33.33 percent) of strings in their study were the result of a cost-cutting strategy by firms[23].

4.3. Results from Hypotheses Testing

We computed a firm-level *Consecutive Revenue Growth Ratio* measure. This measure is calculated as the ratio of the number of years in consecutive revenue growth of five years or longer to the total number of years of observation for each firm. As shown in **Table 2**, the average *Consecutive Revenue Growth Ratio* is significantly higher for the string firms (0.34) than for the non-string firms (0.14). This difference is significant at the 0.01 level. This comparison shows that string firms are associated with more frequent consecutive revenue growth relative to non-string firms. Thus, the prima facie argument concerning the important role that continuous revenue growth plays in maintaining a string of increasing earnings is supported. More specifically, these findings support our first hypothesis (H_1) stating that consecutive revenue growth is an important driver of strings of increasing earnings.

We tested our second hypothesis (H_2) by estimating Model (1) using the string firm sample and the non-string firm sample separately. The results are reported in Columns (1) and (2) of **Table 3**, respectively. The coefficient for $\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$ is 0.905 for the string firms and 0.594 for the non-string firms, both at a significance level of one percent. Furthermore, the difference between the two coefficients is significant at one percent level. These results show that for the string firms, a one percent change in sales would, on average, lead to 0.905 percent change in operating costs. For the non-string firms, a one percent change

[22]Although not the focus of the current study, factors other than a firm's financial performance may also contribute to a firm's earnings per share. For instance, Myers et al. (2007) show that strings of non-decreasing EPS can result from strategically managing shares outstanding by firms.

[23]As noted above, Ghosh et al. (2005) find that roughly two-thirds of the firms in their sample of firms with sustained increases in earnings were having sustained increases in revenues. Although covering a different time period with a much larger sample (i.e. the current study covers the years 1973-2018 with 157,325 observations, whereas the Ghosh et al. (2005) study covers the years 1975-2000 with 94,687 observations), the current study shows a similar, but slightly higher, ratio of string firms with consecutive revenue growth. As discussed in Section IV, we find that 28.04% of firms reported strings of increasing earnings with at least one revenue decrease over the string period. In other words, 71.96% (i.e. 1 - 28.04%) of firms reporting strings of increasing earnings were experiencing consecutive revenue growth at the same time.

Table 3. Strings of increasing earnings and cost flexibility.

Independent Variables	(1) String firms		(2) Non-string firms		(3) String years of string firms		(4) Non-string years of string firms		(5) All firm years	
	Coef. (t-value)		Coef. (t-value)		Coef. (t-value)		Coef. (t-value)		Coef. (t-value)	
Intercept	−0.007	**	0.050	***	−0.013	***	−0.008	*	0.066	***
	(−2.18)		(8.51)		(−5.11)		(−1.68)		(26.81)	
$\Delta \ln S$	0.905	***	0.594	***	0.990	***	0.867	***	0.646	***
	(126.59)		(89.67)		(193.64)		(87.59)		(109.99)	
Employee Intensity	0.133	***	0.467	***	0.051	*	0.189	***		
	(3.70)		(3.78)		(1.93)		(2.83)			
Asset Intensity	0.010	***	0.006	***	0.004	**	0.011	***		
	(6.47)		(10.78)		(2.36)		(6.15)			
Successive Decrease	−0.018	***	−0.069	***	−0.001		−0.021	***		
	(−10.49)		(−33.19)		(−0.44)		(−10.46)			
Stock Performance	−0.028	***	−0.015	***	−0.016	***	−0.035	***		
	(−18.30)		(−10.84)		(−16.70)		(−15.41)			
Industry Fixed Effects Included	Yes		Yes		Yes		Yes		Yes	
Adj-R^2	0.75		0.42		0.92		0.66		0.46	
N	59,557		97,768		22,189		37,368		157,325	
Number of firms	2760		11,934		2760		2760		14,694	

Tests for Difference in Coefficients between Groups

Variables	(1) vs (2)		(3) vs (4)	
	F-stat		F-stat	
$\Delta \ln S$	924.32	***	141.74	***

Regression model: $\ln\left(\frac{OC_{i,t}}{OC_{i,t-1}}\right) = \beta_0 + \beta_1 \ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right) + \sum_{s=1}^{4} \gamma_{1,s} EconVar_{s,i,t} + \varepsilon_{i,t}$. $\Delta \ln S = \ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$. *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively. See **Appendix B** for variable definition. Source of data: All financial statement data and number of employees are obtained from Compustat. Stock price data are obtained from CRSP.

in sales would only lead to an average 0.594 percent change in operating costs. In other words, operating costs of the string firms are more sensitive to sales changes than operating costs of the non-string firms. This finding supports our second hypothesis (H_2) that firms with strings have more cost flexibility than firms without strings.

For the string firms, we run Model (1) separately for the string years and the non-string years. The results are reported in Column (3) and Column (4) of

Table 3, respectively[24]. The coefficient for $\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$ is 0.990 for the string years and 0.867 for the non-string years, both with a significance level of one percent. The difference between the coefficients for string years and non-string years is also significant at the one percent level. This result shows that for the string firms, strings tend to take place in periods when costs are more flexible.

Before testing our third hypothesis (H_3) regarding asymmetric cost behavior, we compute the regression results based on our full sample using the original Anderson et al. (2003) model. As shown in Column (5) of Table 4, the coefficient of $Dec_{i,t} \times \ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$ is significantly negative (−0.157) at the one percent level. That is, for our full sample, the costs of firms decrease less rapidly when sales decrease than they increase when sales increase, which is consistent with findings from prior studies (e.g. Anderson et al., 2003; Banker & Byzalov, 2014). Hence, our full sample exhibits sticky cost behavior in line with the prior literature.

We then estimate Model (2) using the string firm sample and the non-string firm sample separately. The results are reported in Columns (1) and (2) of Table 4, respectively. The coefficient of $Dec_{i,t} \times \ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$ is insignificant for the string firms (−0.063), but significant at the one percent level for the non-string firms (−0.063). The coefficients of $\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right) \times Dec_{i,t} \times Break_{i,t}$ are −0.238 and −0.468 for the string firms and the non-string firms, respectively, both are significant at the one percent level[25].

We formally test H_3 by estimating Model (2) separately using the string years of the firms that experience at least one sales decrease during the strings and all non-string years of string firms[26]. The results are reported in Columns (3) and (4) of Table 4. For string years of firms that experience at least one sales decrease during the string period, the coefficient of $Dec_{i,t} \times \ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$ is significantly positive (0.213) at the one percent level, indicating anti-sticky cost behavior of

[24]Although not shown in the tables, the standard error of each estimated coefficient can be derived using the estimated coefficient divided by the reported t-value.

[25]A possible explanation regarding the negative coefficient of $\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right) \times Dec_{i,t} \times Break_{i,t}$ is that when earnings decrease after a string of increasing earnings, managers may want to take the "big-bath" approach. That is, by taking on more costs deliberately in the break year, firms increase the chance that earnings increases will be reported in future periods.

[26]We exclude the string years from firms that do not experience any sales decreases during the string periods because asymmetric cost behavior can only be measured when both directions of sales changes are observed. We also run Model (2) using string years of all string firms, including those firms that do not experience any sales decreases during the string periods. The results are similar to the results in Column (3) of Table 4 and available upon request.

Table 4. Strings of increasing earnings and asymmetric cost behavior.

Independent Variables	(1) String firms		(2) Non-string firms		(3) String years of firms that experience sales decrease(s) during string periods		(4) Non-string years of string firms		(5) All firm years	
	Coef. (t-value)		Coef. (t-value)		Coef. (t-value)		Coef. (t-value)		Coef. (t-value)	
Intercept	−0.013	***	0.059	***	−0.009	**	−0.013	**	0.053	***
	(−3.58)		(10.10)		(−2.40)		(−2.24)		(20.30)	
Δln*S*	0.953	***	0.595	***	1.039	***	0.888	***	0.701	***
	(99.88)		(61.18)		(123.95)		(54.08)		(91.43)	
Δln*S***Dec*	−0.063		−0.063	***	0.213	***	−0.017		−0.157	***
	(−1.64)		(−3.66)		(4.71)		(−0.42)		(−14.00)	
Δln*S***Dec***Break*	−0.238	***	−0.468	***	−0.566	***	−0.290	***		
	(−6.63)		(−15.64)		(−4.93)		(−6.59)			
Δln*S***Break*	0.200	***	0.513	***	0.244	***	0.265	***		
	(10.67)		(35.00)		(2.97)		(10.54)			
Break	0.036	***	0.030	***	0.038	***	0.036	***		
	(17.26)		(11.23)		(6.07)		(13.44)			
Dec	−0.002		−0.044	***	0.001		−0.005	**		
	(−1.06)		(−17.02)		(0.53)		(−1.99)			
Δln*S***Dec** *Employee Intensity*	0.182		−2.706	***	−2.129	*	−0.541			
	(0.15)		(−5.12)		(−1.72)		(−0.39)			
Δln*S***Dec** *Asset Intensity*	−0.043	**	−0.014	***	−0.050	*	−0.037	**		
	(−2.52)		(−9.96)		(−1.87)		(−2.16)			
Δln*S***Dec** *Successive Decrease*	−0.036		0.041	**	−0.035		−0.018			
	(−1.31)		(2.52)		(−0.58)		(−0.64)			
Δln*S***Dec** *Stock Performance*	0.134	***	0.013		−0.059		0.117	***		
	(6.32)		(1.53)		(−1.63)		(5.30)			
Employee Intensity	0.118	***	−0.132		0.059		0.139	**		
	(3.30)		(−1.15)		(1.01)		(1.99)			
Asset Intensity	0.002		0.001		−0.003		0.004	*		
	(1.20)		(1.50)		(−0.95)		(1.73)			
Successive Decrease	−0.015	***	−0.050	***	0.003		−0.014	***		
	(−8.24)		(−22.60)		(1.43)		(−6.71)			
Stock Performance	−0.019	***	−0.013	***	−0.009	***	−0.024	***		
	(−13.16)		(−9.87)		(−4.94)		(−11.26)			

Continued

Industry Fixed Effects Included	Yes	Yes	Yes	Yes	
Adj-R^2	0.76	0.45	0.93	0.68	0.46
N	59,557	97,768	6048	37,368	157,325
Number of firms	2760	11,934	774	2760	14,694

Regression model: $\ln\left(\frac{OC_{i,t}}{OC_{i,t-1}}\right)=\beta_0+\beta_1\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)+\beta_2 Dec_{i,t}\times\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)+\beta_3 Break_{i,t}+\beta_4\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)\times Break_{i,t}+\beta_5 Dec_{i,t}$ $+\beta_6\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)\times Dec_{i,t}\times Break_{i,t}+\sum_{s=1}^{4}\gamma_{1,s}\times EconVar_{s,i,t}+\sum_{s=1}^{4}\gamma_{2,s}\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)\times Dec_{i,t}\times EconVar_{s,i,t}+\varepsilon_{i,t}$.

$\Delta\ln S=\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$. *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively. See **Appendix B** for variable definition. Source of data: All financial statement data and number of employees are obtained from Compustat. Stock price data are obtained from CRSP.

these firms during the string periods (i.e. costs decrease more rapidly when revenues decrease then they increase when revenues increase). For non-string years of all string firms, the coefficient of $Dec_{i,t}\times\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$ is statistically insignificant (−0.017). The coefficients of $\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)\times Dec_{i,t}\times Break_{i,t}$ are −0.566 for the string years of firms that experience at least one sales decrease during the string periods and −0.290 for the non-string years, which are both significant at the one percent level. These results are consistent with our expectation that costs of string firms become sticky when the strings end. As predicted in hypothesis H_3, our findings show that, compared to non-string firms, the string firms that experience sales decreases during the string periods exhibit different asymmetric cost behavior, i.e. anti-sticky cost behavior during the string periods and sticky cost behavior when string ends.

To test our fourth hypothesis (H_4), we calculate the average demand uncertainty for the string firms and the non-string firms. The results are reported in Column (1) and Column (2) of **Table 5**. The average demand uncertainty is 0.15 for string firms and 0.31 for non-string firms. The difference is statistically significant at the one percent level. This finding supports our last hypothesis (H_4) that string firms are confronted with lower demand uncertainty compared to non-string firms. The average demand uncertainty is 0.13 for the string years of the string firms and 0.16 for the non-string years of the string firms. The difference is also statistically significant at the one percent level. These results show that, for the string firms, strings of increasing earnings tend to take place in years when demand uncertainty is lower. Taken together, these findings support our hypothesis (H_4) that lower demand uncertainty facilitates a firm's ability to maintain strings of increasing earnings through cost management.

Table 5. Strings of increasing earnings and demand uncertainty.

Variable	(1) String firms	(2) Non-string firms	(1) vs (2) Difference in means	(1) vs (2) t-stat for difference in means	(3) String years of string firms	(4) Non-string years of string firms	(3) vs (4) Difference in means	(3) vs (4) t-stat for difference in means
Demand Uncertainty	0.15	0.31	−0.16	−131.47 ***	0.13	0.16	−0.03	−28.29 ***
N	59,557	97,768			22,189	37,368		
Number of firms	2760	11,934			2760	2760		

Demand Uncertainty is the standard deviation of $\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$ for the past five years. ***represents significance level of 0.01.

Source of data: All financial statement data and number of employees are obtained from Compustat. Stock price data are obtained from CRSP.

5. Additional Robustness Tests

5.1. Cost Flexibility, Demand Uncertainty and Number of Strings

In our sample, some firms managed to report more than one string of increasing earnings. In this subsection, we investigate whether higher cost flexibility and lower demand uncertainty contribute to more strings reported by the same firm. We begin by breaking our 2760 string firms into the following three groups: 1) 2051 firms that have reported only one string, 2) 520 firms that have reported two strings, and 3) 189 firms that have reported at least three strings. We then conduct our tests of cost flexibility for the three groups of string firms separately. The results from estimating Model (1) are reported in Panel A of Table 6. The coefficients of $\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$ are statistically significant at the one percent level for firms with one string (0.889), two strings (0.934) and at least three strings (0.995). The difference between the coefficients for firms with one string and firms with two strings is significant at the five percent level, and the difference between the coefficients for firms with two strings and firms with at least three strings is significant at the one percent level. These results suggest that a higher level of cost flexibility also contributes to the ability of a firm in reporting more strings of increasing earnings (i.e. the findings are consistent with H_2).

Our next step was to calculate the demand uncertainty for each group separately. The results of this analysis are presented in Panel B of Table 6. The average demand uncertainty is 0.17, 0.13 and 0.11 for firms with one string, two strings and at least three strings, respectively. The differences between the average demand uncertainty are significant at the one percent level as shown in the t-test results. These results support the argument that a lower level of demand uncertainty facilitates a firm's ability to report more strings of increasing earnings (i.e. the findings are consistent with H_4).

Table 6. Number of strings and firm characteristics.

Panel A: Number of Strings and Cost Flexibility

Independent Variables	Group (1) Firms with one string		Group (2) Firms with two strings		Group (3) Firms with at least three strings	
	Coef. (t-value)		Coef. (t-value)		Coef. (t-value)	
Intercept	−0.007	*	−0.005		−0.012	
	(−1.86)		(−1.12)		(−1.18)	
$\Delta \ln S$	0.889	***	0.934	***	0.995	***
	(98.32)		(94.88)		(73.36)	
Control Variables Included	Yes		Yes		Yes	
Industry Fixed Effects Included	Yes		Yes		Yes	
Adj-R^2	0.72		0.80		0.84	
N	37,374		15,079		7104	
Number of firms	2051		520		189	

Tests for Difference in Coefficients between Groups

Variable	(1) vs (2) F-stat		(2) vs (3) F-stat	
$\Delta \ln S$	6.26	**	10.79	***

Regression model: $\ln\left(\frac{OC_{i,t}}{OC_{i,t-1}}\right) = \beta_0 + \beta_1 \ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right) + \sum_{s=1}^{4} \gamma_{1,s} EconVar_{s,i,t} + \varepsilon_{i,t}$.

$\Delta \ln S = \ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$.

Panel B: Number of Strings and Demand Uncertainty

Variable	Group (1) Firms with one string	Group (2) Firms with two strings	Group (3) Firms with at least three strings	(1) vs (2) Difference in means (1)-(2)	(1) vs (2) t-stat for difference in means	(2) vs (3) Difference in means (2)-(3)	(2) vs (3) t-stat for difference in means
Demand Uncertainty	0.17	0.13	0.11	0.04	31.73 ***	0.02	10.95 ***
N	37,374	15,079	7104				
Number of firms	2051	520	189				

*, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively. See **Appendix B** for variable definition. Source of data: All financial statement data and number of employees are obtained from Compustat. Stock price data are obtained from CRSP.

5.2. Cost Flexibility and Demand Uncertainty by String Length

Strings of increasing earnings vary significantly in length[27]. Thus, we examine whether higher cost flexibility and lower demand uncertainty contribute to the length of the strings. We group the strings based on their length into the following three groups: 1) 2857 strings that are shorter than 10 years, 2) 359 strings that are 10 to 20 years long, and 3) 43 strings that lasted longer than 20 years. Figure 1 shows the average demand uncertainty and the average cost flexibility for each group. We observe that the degree of cost flexibility is highest for strings longer than 20 years and lowest for strings shorter than 10 years. In contrast, the average demand uncertainty is the highest for strings shorter than 10 years and lowest for strings longer than 20 years[28]. These results show that lower demand uncertainty and higher cost flexibility also contribute to a firm's ability to report longer strings (i.e. the findings are consistent with H_2 and H_4).

5.3. Cost Flexibility and Demand Uncertainty after Controlling for Industry

As noted earlier and shown in Panel B of Table 1, industries do not seem to be a

	All Strings	Strings without any sales decreases during the string periods	Strings with at least one sales decrease during the string periods
Number of strings shorter than 10 years	2,857	2,155	702
Number of strings length between 10 and 20 years	359	247	112
Number of strings longer than 20 years	43	29	14

Average Cost Flexibility

Average Demand Uncertainty

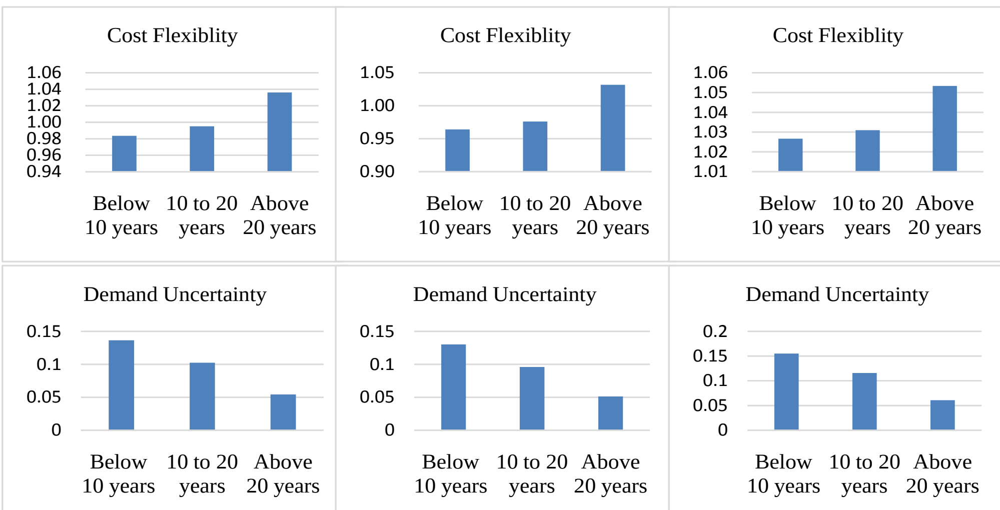


Figure 1. Demand uncertainty and cost flexibility by string length. Source of data: All financial statement data and number of employees are obtained from Compustat. Stock price data are obtained from CRSP.

[27]As shown in Table 1 Panel A, while the average string length is 7.20 years, the shortest string is 5 years long and the longest string in our sample is 40 years long.

[28]As shown in Figure 1, we also examine the two types of strings (strings without any sales decreases during the string periods, and strings with at least one sales decrease during the string periods) separately. The results from both types of strings are consistent with those from all strings.

driving factor of strings of increasing earnings. The above notwithstanding, there may be some differences in cost flexibility and demand uncertainty among industries. Thus, to examine this issue more closely, we calculate measures for cost flexibility and demand uncertainty at the industry level (see **Table 7**, Panel A). The results are presented in descending order by string firm concentration of the industries. In **Table 7** Panel B, we calculate the industry adjusted cost flexibility of the string firms as the difference between the average cost flexibility of the string firms in an industry and the average cost flexibility of all firms in the industry. A similar definition of industry adjusted cost flexibility applies for the non-string firms. In a similar manner, we calculate the industry adjusted demand uncertainty for the string firms and the non-string firms.

For all industries, the differences in average cost flexibility between the string firms and the industry are positive. The differences in average cost flexibility between the non-string firms and the industry are negative across all industries. These results show that the degree of cost flexibility for string firms (non-string firms) is higher (lower) than the industry average. For all industries, the differences in average demand uncertainty between the string firms and the industry are negative. Similarly, the differences in average demand uncertainty between the non-string firms and the industry are positive across all industries. In other words, the average demand uncertainty for string firms (non-string firms) is always lower (higher) than the industry average. In addition, the differences between the string firms and the non-string firms are all significant at the one percent level for both cost flexibility and demand uncertainty. Hence, these results regarding cost flexibility and demand uncertainty show that our findings persist after controlling for industry factors.

5.4. Cost Flexibility and Demand Uncertainty after Controlling for Firm Size

As noted in the descriptive statistics section and shown in **Table 2**, the string firms are significantly larger than the non-string firms (measured by *Sales*). We now investigate if it is size that drives our results regarding cost flexibility and demand uncertainty. To control for the inflation over our long sample period (1973-2018), we calculated the GDP-adjusted sales for each firm year[29]. We then construct a firm level *SIZE* measure by taking the average of the GDP-adjusted sales for each firm. A firm is grouped into the big firm group if its *SIZE* measure is greater than the median of all firms and grouped into the small firm group otherwise. Within the big firm group and the small firm group, we calculate the average cost flexibility and demand uncertainty for string firms and non-string firms separately. **Table 8** presents these results.

The cost flexibility for string firms (non-string firms) in the big firm group is 0.93 (0.83), and the cost flexibility for string firms (non-string firms) in the small firm group is 0.84 (0.56). The differences in cost flexibility for string firms versus non-string firms are significant at the one percent level for both the big firm

[29]We use 1973 as the base year for GDP adjusted sales.

Table 7. Cost flexibility and demand uncertainty after controlling for industry.

Panel A: Industry Average Level of Cost Flexibility and Demand Uncertainty

Industry	Concentration of string firms	Cost flexibility (β_1)	Demand uncertainty
Consumer Durables	27.55%	0.78	0.2
Wholesale, Retail, and Some Services	27.03%	0.89	0.17
Consumer NonDurables	25.84%	0.86	0.17
Manufacturing	25.01%	0.81	0.21
Chemicals and Allied Products	24.74%	0.72	0.2
Other	17.51%	0.75	0.26
Telephone and Television Transmission	16.45%	0.85	0.22
Business Equipment	13.54%	0.69	0.28
Oil, Gas, and Coal Extraction and Products	13.48%	0.71	0.37
Healthcare, Medical Equipment, and Drugs	11.99%	0.58	0.38

Panel B: Industry Adjusted Cost Flexibility and Demand Uncertainty

	Industry adjusted cost flexibility (β_1)†				Industry adjusted demand uncertainty†			
Industry	String firms	Non-string firms	Difference		String firms	Non-string firms	Difference	
Consumer Durables	0.17	−0.03	0.20	***	−0.05	0.05	−0.10	***
Wholesale, Retail, and Some Services	0.08	−0.03	0.11	***	−0.05	0.05	−0.10	***
Consumer NonDurables	0.13	−0.03	0.17	***	−0.05	0.05	−0.10	***
Manufacturing	0.12	−0.04	0.16	***	−0.05	0.04	−0.10	***
Chemicals and Allied Products	0.22	−0.04	0.26	***	−0.07	0.06	−0.13	***
Other	0.20	−0.04	0.24	***	−0.10	0.05	−0.15	***
Telephone and Television Transmission	0.19	−0.01	0.20	***	−0.07	0.04	−0.11	***
Business Equipment	0.20	−0.04	0.24	***	−0.10	0.04	−0.14	***
Oil, Gas, and Coal Extraction and Products	0.13	−0.02	0.14	***	−0.12	0.06	−0.18	***
Healthcare, Medical Equipment, and Drugs	0.43	−0.03	0.45	***	−0.20	0.07	−0.28	***

***represents significance level of 0.01. †Industry adjusted cost flexibility of the string firms is calculated as the difference between the average cost flexibility of the string firms in an industry and the average cost flexibility of all firms in the industry. A similar definition of industry adjusted cost flexibility applies for the non-string firms. In a similar manner, we calculate the industry adjusted demand uncertainty for the string firms and the non-string firms. Source of data: All financial statement data and number of employees are obtained from Compustat. Stock price data are obtained from CRSP.

Table 8. Cost flexibility and demand uncertainty after controlling for SIZE.

Variables	Big Firms (Firms with *SIZE* above sample medium)					Small Firms (Firms with *SIZE* below sample medium)				
	String firms	Non-string firms	Difference in means	t-stat for Difference in means		String firms	Non-string firms	Difference in means	t-stat for Difference in means	
Cost Flexibility	0.93	0.83	0.10	5.88	***	0.84	0.56	0.28	8.03	***
Demand Uncertainty	0.14	0.24	−0.10	−73.93	***	0.19	0.39	−0.20	−72.82	***
N	51,140	50,839				8417	46,929			
Number of Firms	2175	5172				585	6762			

SIZE is calculated as GDP-adjusted average sales for each firm, assuming 1973 as the base year for GDP adjustment. ***represents significance level of 0.01. Source of data: All financial statement data and number of employees are obtained from Compustat. Stock price data are obtained from CRSP.

group and the small firm group. Similarly, the demand uncertainty for string firms (non-string firms) in the big firm group is 0.14 (0.24), and the demand uncertainty for string firms (non-string firms) in the small firm group is 0.19 (0.39). The differences in demand uncertainty for string firms versus non-string firms are significant at the one percent level for both the big firm group and the small firm group. Thus, our results regarding cost flexibility and demand uncertainty persist after controlling for size.

5.5. The Percentage Change Model by Balakrishnan et al. (2014)

Balakrishnan et al. (2014) argue that the logarithm specification introduces a bias towards sticky cost behavior. Accordingly, they suggest using a percentage change model to mitigate the bias[30]. Since we anticipate anti-sticky cost behavior for the string firm years, the bias towards sticky cost behavior introduced by the log-linear model lowers the sensitivity of our tests. That is, any anti-sticky cost behavior results found from using the log-linear model are, in fact, weakened by the log-linear model specification. Nonetheless, running the percentage change model provides an opportunity to examine our second and third hypotheses using an alternative model setting. Therefore, we test our hypotheses again using the percentage change models, formally stated as Model (3) and Model (4) below:

$$\frac{\Delta OC_{i,t}}{OC_{i,t-1}} = \beta_0 + \beta_1 \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}} + \sum_{s=1}^{4} \gamma_{1,s} \times EconVar_{s,i,t} + \varepsilon_{i,t}, \tag{3}$$

and

[30]Balakrishnan et al. (2014) also suggest a third model using sales as the deflator for the dependent variable, arguing that the sales-deflated model would mitigate the instability problem in the log-linear and the percentage change models. However, they also admit that the estimated β_1 from this specification is merely the variable cost ratio and can no longer be interpreted as the percentage change in costs when there is a one percentage change in sales. Since our main interest is in how total operating costs change with sales changes, we do not adopt this last specification in our paper.

$$\frac{\Delta OC_{i,t}}{OC_{i,t-1}} = \beta_0 + \beta_1 \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}} + \beta_2 Dec_{i,t} \times \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}} + \beta_3 Dec_{i,t} \times \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}} \times Break_{i,t}$$
$$+ \beta_4 \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}} \times Break_{i,t} + \beta_5 Break_{i,t} + \beta_6 Dec_{i,t} + \sum_{s=1}^{4} \gamma_{1,s} \times EconVar_{s,i,t} \quad (4)$$
$$+ \sum_{s=1}^{4} \gamma_{2,s} Dec_{i,t} \times \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}} \times EconVar_{s,i,t} + \varepsilon_{i,t},$$

where ΔOC_i is the difference between $OC_{i,t}$ and $OC_{i,t-1}$; $\Delta Sales_{i,t}$ is the difference between $Sales_{i,t}$ and $Sales_{i,t-1}$; and all other variables are as previously defined. All prior predictions apply on the estimated coefficients from Model (3) and Model (4).

The results based on Model (3) are summarized in Panel A of Table 9. The coefficients of $\frac{\Delta Sales_{i,t}}{Sales_{i,t-1}}$ are 0.937 for the string firms and 0.539 for the non-string firms. Both coefficients are significantly positive at the one percent level. The difference between the string firms and the non-string firms is also significant at the one percent level. Thus, the results based on the Balakrishnan et al. (2014) percentage model also support our second hypothesis H_2 that the string firms have more cost flexibility compared to those of non-string firms. When estimating Model (3) using string years and non-string years of the string firms separately, we find that the coefficients of $\frac{\Delta Sales_{i,t}}{Sales_{i,t-1}}$ are 1.036 for the string years and 0.885 for the non-string years. These results are consistent with those from Model (1). Hence, our findings regarding the second hypothesis (H_2) are robust using the percentage change model.

The results based on Model (4) are reported in Panel B of Table 9. The coefficient of $Dec_{i,t} \times \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}}$ is statistically insignificant for the string firms (−0.039), and significant at the one percent level for the non-string firms (−0.093). The coefficients of $Dec_{i,t} \times \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}} \times Break_{i,t}$ are statistically significant for both the string firms (−0.197) and the non-string firms (−0.743) at the one percent level. These results are consistent with those from our Model (2), indicating that while the non-string firms are associated with sticky cost behavior regardless of earnings increases or decreases, the string firms exhibit sticky costs only when earnings strings end.

For the string years of the string firms that experience at least one sales decrease during the string periods, the coefficient of $Dec_{i,t} \times \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}}$ is significantly positive (0.240) at the one percent level. This result shows that costs of these firms during the string years are anti-sticky, which supports our hypothesis H_3. The coefficient of $Dec_{i,t} \times \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}} \times Break_{i,t}$ is significantly negative (−0.410)

Table 9. Cost flexibility and asymmetric cost behavior based on Balakrishnan et al. (2014) model.

Panel A: Strings and Cost Flexibility

Independent Variables	(1) String firms Coef. (t-value)		(2) Non-string firms Coef. (t-value)		(3) String years of string firms Coef. (t-value)		(4) Non-string years of string firms Coef. (t-value)	
Intercept	−0.012	*	0.078	***	−0.019	***	−0.012	
	(−1.87)		(7.50)		(−3.50)		(−1.24)	
ΔS	0.937	***	0.539	***	1.036	***	0.885	***
	(56.91)		(43.02)		(128.39)		(34.82)	
Employee Intensity	0.148	*	0.053		0.061		0.185	
	(1.83)		(0.22)		(1.54)		(1.22)	
Asset Intensity	0.020	***	0.009	***	0.009	**	0.024	***
	(5.41)		(8.46)		(2.42)		(5.09)	
Successive Decrease	−0.014	***	−0.078	***	0.005		−0.019	***
	(−5.05)		(−20.74)		(1.39)		(−6.04)	
Stock Performance	−0.031	***	−0.012	***	−0.023	***	−0.035	***
	(−10.72)		(−4.70)		(−13.62)		(−8.24)	
Industry Fixed Effect Included	Yes		Yes		Yes		Yes	
Adj-R^2	0.66		0.31		0.87		0.55	
N	59,557		97,768		22,189		37,368	
Number of firms	2760		11,934		2760		2760	

Tests for Difference in Coefficients between Groups

Variable	(1) vs (2) F-stat (*p*-value)		(3) vs (4) F-stat (*p*-value)	
ΔS	322.80	***	26.30	***

Regression model: $\frac{\Delta OC_{i,t}}{OC_{i,t-1}} = \beta_0 + \beta_1 \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}} + \sum_{s=1}^{4} \gamma_{1,s} EconVar_{s,i,t} + \varepsilon_{i,t}$. $\Delta S = \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}}$. *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively. See **Appendix B** for other variable definition. Source of data: All financial statement data and number of employees are obtained from Compustat. Stock price data are obtained from CRSP.

Panel B: Strings and Asymmetric Cost Behavior

Independent Variables	(1) String firms Coef. (t-value)		(2) Non-string firms Coef. (t-value)		(3) String years of firms that experience sales decreases during string periods Coef. (t-value)		(4) Non-string years of string firms Coef. (t-value)	
Intercept	−0.003		0.031	***	−0.002		−0.002	
	(−1.34)		(3.62)		(−0.48)		(−0.45)	

Continued

ΔS	0.957	***	0.659	***	1.004	***	0.896	***
	(184.91)		(57.98)		(164.13)		(91.08)	
*ΔS*Dec*	−0.039		−0.093	***	0.240	***	0.007	
	(−1.11)		(−3.05)		(4.43)		(0.19)	
*ΔS*Dec*Break*	−0.197	***	−0.743	***	−0.410	***	−0.233	***
	(−7.31)		(−9.18)		(−5.83)		(−7.16)	
*ΔS*Break*	0.188	***	0.763	***	0.177	***	0.238	***
	(16.88)		(14.70)		(4.71)		(15.92)	
Break	0.037	***	0.014	*	0.044	***	0.036	***
	(22.72)		(1.88)		(10.09)		(17.73)	
Dec	0.002		−0.025	***	−0.003		−0.002	
	(1.16)		(−6.17)		(−1.12)		(−0.97)	
*ΔS*Dec*Employee Intensity*	0.641		−3.730	***	−2.458	*	0.129	
	(0.65)		(−2.86)		(−1.84)		(0.11)	
*ΔS*Dec*Asset Intensity*	−0.049	***	−0.011	***	−0.066	**	−0.045	**
	(−2.79)		(−2.95)		(−2.08)		(−2.49)	
*ΔS*Dec*Successive Decrease*	−0.054	***	0.027		−0.064		−0.036	*
	(−2.71)		(0.84)		(−1.13)		(−1.70)	
*ΔS*Dec*Stock Performance*	0.098	***	−0.013		−0.048		0.069	***
	(5.11)		(−0.76)		(−1.18)		(3.39)	
Employee Intensity	0.107	***	0.075		0.020		0.110	**
	(3.91)		(0.39)		(0.37)		(2.19)	
Asset Intensity	−0.001		0.008	***	−0.003		0.000	
	(−0.65)		(6.66)		(−1.07)		(−0.16)	
Successive Decrease	−0.014	***	−0.042	***	0.000		−0.013	***
	(−10.30)		(−10.76)		(−0.08)		(−8.23)	
Stock Performance	−0.020	***	−0.020	***	−0.008	***	−0.027	***
	(−18.50)		(−9.69)		(−4.44)		(−16.36)	
Industry Fixed Effect Included	Yes		Yes		Yes		Yes	
Adj-R^2	0.82		0.32		0.94		0.73	
N	59,557		97,768		6048		37,368	
Number of firms	2760		11,934		774		2760	

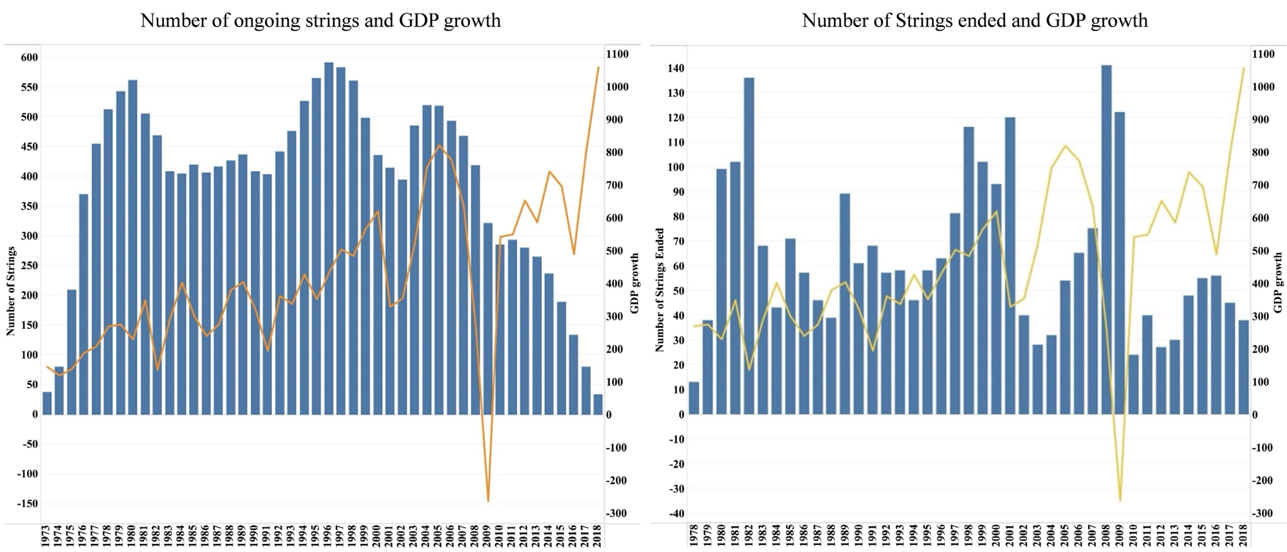
Regression model: $\frac{\Delta OC_{i,t}}{OC_{i,t-1}} = \beta_0 + \beta_1 \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}} + \beta_2 Dec_{i,t} \times \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}} + \beta_3 Dec_{i,t} \times \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}} \times Break_{i,t} + \beta_4 \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}} \times Break_{i,t}$ $+\beta_5 Break_{i,t} + \beta_6 Dec_{i,t} + \sum_{s=1}^{4} \gamma_{1,s} \times EconVar_{s,i,t} + \sum_{s=1}^{4} \gamma_{2,s} Dec_{i,t} \times \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}} \times EconVar_{s,i,t} + \varepsilon_{i,t}$. $\Delta S = \frac{\Delta Sales_{i,t}}{Sales_{i,t-1}}$. *, **, and *** represent significance levels of 0.10, 0.05, and 0.01, respectively. See **Appendix B** for other variable definition. All financial statement data and number of employees are obtained from Compustat. Stock price data are obtained from CRSP.

at the one percent level, indicating that costs of these firms become sticky once the string ends. The above results are in line with those from Model (2). Hence, our findings from the percentage change model are supportive of the third hypothesis (H_3).

5.6. GDP Growth and Strings of Increasing Earning

Macro-economic factors such as GDP growth may also contribute to the occurrence of strings of increasing earnings. Thus, to understand the extent to which macro-economic factors affect the occurrence of the strings in our study, we plot the number of ongoing strings and US GDP growth over our entire sample period (see Figure 2). As illustrated in Figure 2, there does not appear to be any indication that GDP growth is driving the occurrence of strings. The results of an OLS regression with the number of strings as the dependent variable and GDP growth as the independent variable are reported at the bottom of Figure 2. The coefficient of GDP growth is statistically insignificant (−0.078). Hence, we conclude that GDP growth does not significantly contribute to the occurrence of strings of increasing earnings.

We further examine if GDP growth contributes to the ending of strings, by plotting the number of strings ended and GDP growth from 1978 to 2018[31]. The results of regressing number of strings ended on GDP growth are also reported in Figure 2. The coefficient of GDP growth is statistically significant (−0.057) at



Model: Number of strings ongoing = a + b GDP growth

Independent Variables	*Coefficients*	*t Stat*	*P-value*	*Adj. R^2*
Intercept	423.506	9.447	0.000	-0.65%
GDP Growth	-0.078	-0.842	0.4046	

Model: Number of strings ended = a + b GDP growth

Independent Variables	*Coefficients*	*t Stat*	*P-value*	*Adj. R^2*
Intercept	90.164	8.959	0.000	15.28%
GDP Growth	-0.057	-2.866	0.007	

Figure 2. Strings and GDP Growth from 1973 to 2018[32]. Legends: Bar: Number of strings; Line: GDP Growth in billions of dollars.

[31]Given that strings must last at least five years, the earliest year when strings ended is 1978 in our sample.

[32]GDP data are obtained from the US Bureau of Economic Analysis.

the one level. Our result indicates that GDP growth is negatively associated with the ending of strings of increasing earnings. Thus, it appears, as one would expect, that it is more difficult for firms to show increases in earnings when the economy is declining[33]. Overall, our tests suggest that GDP growth does not seem to contribute to the occurrence of strings.

6. Implications

Firms that maintain a string of consecutive increasing earnings over five years or more tend to have significantly higher P/E ratios and higher abnormal stock market returns compared to firms not generating such strings. Consequently, firms have a strong incentive to achieve a string of consecutive increasing earnings over five years or more.

Although consecutive revenue growth plays an important role in generating consecutive increasing earnings, the current study shows that cost management can play a proactive role in a firm's ability to sustain a consecutive string of increasing earnings. In fact, the current study finds that over 27% of the increasing earnings strings include at least one period where sales were decreasing. These findings are consistent with other studies that have looked at this issue (e.g. Ghosh et al., 2005).

The above noted findings raise the following question: Are there specific factors associated with firms that successfully use cost management techniques to sustain a string of consecutive increasing earnings? As shown in the current study, one key factor facilitating such cost management is the degree to which a firm has cost flexibility, where cost flexibility refers to the ratio of a firm's discretionary costs relative to its non-discretionary costs. More to the point, when compared to firms that were not able to maintain a string of increasing earnings over periods of five years or longer, firms with strings have a lower level of non-discretionary costs relative to discretionary costs. In addition, for strings that included at least one sales decrease, the string firms were able to aggressively practice what has become known in the literature as anti-sticky costing. These findings suggest that the conventional wisdom espoused in most textbooks concerning a firm's desirability of taking on more fixed costs relative to variable costs during periods of high product demand needs to be modified to consider a firm's motivation to sustain a string of consecutive increasing earnings over a period of five years or more. In other words, the additional fixed costs may increase profits in the short run but lower a firm's ability to maintain a consecutive string of increasing earnings over a period of five years or longer due to the reduction in cost flexibility.

The current study also found that lower demand uncertainty facilitates the ability of a firm to sustain strings of increasing earnings. That is, lower demand uncertainty places a firm in a better position to plan for, and strategically man-

[33]We also plot the graph and run the OLS regression for strings with at least one sales decrease during the string periods and strings without any sales decreases during the string periods versus GDP growth separately. The results are similar to the whole string sample and available upon request.

age, future costs. Indeed, part of the cost management process could include the hoarding of resources for a "rainy day" (i.e. firms with more certainty of demand for their products can essentially plan for, and manage, anticipated downturns in revenues). In other words, cost management and revenue management are related activities that do not have to be thought of as pejorative activities[34]. In fact, we agree with Ittner & Aguilar (2019), when he noted that "It's about managing cost structures in conjunction with revenue growth and in conjunction with changing the product and service offerings"[35]. Thus, managers in firms motivated to achieve strings of increasing earnings over periods of five years or longer may wish to focus on products with highly predictable sales or on diversifying their product lines as a means of reducing overall sales fluctuations.

The findings from the current study also have capital market implications. The identification of firms with high-cost flexibility and low demand uncertainty could assist investors and analysts in predicting which firms are likely to maintain strings of consecutive increasing earnings in the future. Indeed, investors and analysts could develop and test models for predicting firms that are likely to have strings of increasing earnings based not only on revenue growth, but on the cost flexibility and demand uncertainty of firms. Given the vast amount of publicly available data on costs and product demand for firms, developing predictive models for identifying firms that are likely to have increasing earnings strings would be an excellent candidate for machine learning techniques.

The findings from the current study also show that firms with strings that experience at least one sales decrease during the string periods are associated with anti-sticky cost behavior during the string period, and sticky cost behavior once the string ends. These findings make it clear that managers adjust costs differently when trying to maintain a string of increasing earnings than during non-string periods. Although anti-sticky cost behavior has been identified in a variety of settings (e.g. see Banker & Byzalov, 2014), our findings provide empirical evidence of such behavior in a setting not previously examined. Investors should, however, be cautious when investing in a firm with consecutive increasing earnings in which reductions in costs appear to be a dominant factor driving the increasing earnings (i.e. a cost-cutting strategy that will ultimately become unsustainable for a firm).

7. Concluding Comments

Prior studies found that firms maintaining strings of increasing earnings, compared to firms without such strings, are associated with higher price-earnings (P/E) ratios and receive abnormal stock market returns during the string periods. Thus, firms have an incentive to maintain strings of increasing earnings. Investors also have an incentive to better understand the way firms can achieve strings of increasing earnings.

[34]For an interesting discussion of revenue management, see Harrison et al. (2021).

[35]Chris Ittner and Omar Aguilar from Deloitte Consulting discuss their research on how cost management is changing (see: https://knowledge.wharton.upenn.edu/article/how-cost-management-is-changing/).

Strings of increasing earnings result from consecutive revenue growth and/or cost management. Although revenue growth is an important driver of strings, we observe that having a pattern of consecutive revenue growth is neither necessary nor sufficient to maintain a string of increasing earnings. Indeed, cost management can play a proactive role in maintaining strings. This fact notwithstanding, little is known about the way firms manage costs to facilitate strings. To fill this void, the primary objective of the current study is to improve our understanding of how firms successfully manage their costs to facilitate maintaining a consecutive string of increasing earnings, especially during periods that include decreasing revenues (i.e. periods when consecutive revenue growth is clearly not the driver of a string of increasing earnings).

The findings from our study show that firms with strings of increasing earnings have higher cost flexibility compared to firms without such strings. Furthermore, our results show that the string firms experiencing at least one sales decrease during the string periods exhibit anti-sticky cost behavior during the string periods. Once the string ends, however, the costs of firms with strings over a period of declining sales become sticky. Taken together, the findings from the current study show that firms with strings, in contrast to firms without such strings, tend to commit to less non-discretionary costs and use management discretion in cost adjustment decisions to sustain strings of increasing earnings. In addition, we find that string firms are associated with lower demand uncertainty relative to firms without a string. This latter finding indicates that lower demand uncertainty facilitates a firm's ability to sustain a string of increasing earnings through improved cost planning.

As with all empirical studies, the one discussed in this paper has its limitations. One limitation is the lack of a stable measure of cost flexibility over multiple time periods. Another limitation is that our results are based on cross-sectional regressions that do not easily map to the cost management of individual firms. These limitations notwithstanding, we believe the findings from the current study further our understanding of the factors that contribute to the ability of firms to maintain a string.

Acknowledgements

We thank Shijun Cheng, Yi Cao, Juan Castillo, Jin Kyung Choi, Sebahattin Demirkan, Augustine Duru, Ruyun Feng, Charles Ham, Cody Hyman, Congcong Li, Laurel Mazur, Linda Myers, Ariel Rava, Noami Soderstrom, Tashfeen Sohail, Gerald Ward, and Lu Yan for their valuable comments on this paper. All remaining errors are our own.

Data Availability

Data are available from the public sources cited in the text.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

Anderson, M., Banker, R. D., & Janakiraman, S. (2003). Are Selling, General, and Administrative Costs "Sticky"? *Journal of Accounting Research, 41,* 47-63. https://doi.org/10.1111/1475-679X.00095

Balakrishnan, R., & Gruca, T. S. (2008). Cost Stickiness and Core Competency: A Note. *Contemporary Accounting Research, 25,* 993-1006. https://doi.org/10.1506/car.25.4.2

Balakrishnan, R., Labro, E., & Soderstrom, N. S. (2014). Cost Structure and Sticky Costs. *Journal of Management Accounting Research, 26,* 91-116. https://doi.org/10.2308/jmar-50831

Balakrishnan, R., Peterson, M. J., & Soderstrom, N. S. (2004). Does Capacity Utilization Affect the "Stickiness" of Costs? *Journal of Accounting Auditing & Finance, 19,* 283-300. https://doi.org/10.1177/0148558X0401900303

Balakrishnan, R., Sivaramakrishnan, K., & Sprinkle, G. (2008). *Managerial Accounting.* John Wiley & Sons.

Ballas, A., Naoum, V.-C., & Vlismas, O. (2022). The Effect of Strategy on Asymmetric Cost Behavior of SG&A Expenses. *European Accounting Review, 31,* 409-447. https://doi.org/10.1080/09638180.2020.1813601

Banker, R. D., & Byzalov, D. (2014). Asymmetry Cost Behavior. *Journal of Management Accounting Research, 26,* 43-79. https://doi.org/10.2308/jmar-50846

Banker, R. D., Basu, S., Byzalov, D., & Chen, J. Y. (2016). The Confounding Effect of Cost Stickiness on Conservatism Estimates. *Journal of Accounting and Economics, 61,* 203-220. https://doi.org/10.1016/j.jacceco.2015.07.001

Banker, R. D., Byzalov, D., & Chen, L. T. (2013). Employment Protection Legislation, Adjustment Costs and Cross-Country Differences in Cost Behavior. *Journal of Accounting and Economics, 55,* 111-127. https://doi.org/10.1016/j.jacceco.2012.08.003

Banker, R. D., Byzalov, D., & Plehn-Dujowich. J. M. (2014b). Demand Uncertainty and Cost Behavior. *The Accounting Review, 89,* 839-865. https://doi.org/10.2308/accr-50661

Banker, R. D., Byzalov, D., Ciftci, M., & Mashruwala, R. (2014a). The Moderating Effect of Prior Sales Changes on Asymmetric Cost Behavior. *Journal of Management Accounting Research, 26,* 221-242. https://doi.org/10.2308/jmar-50726

Barth, M. E., Elliott, J. A., & Finn, M. W. (1999). Market Rewards Associated with Patterns of Increasing Earnings. *Journal of Accounting Research, 37,* 387-413. https://doi.org/10.2307/2491414

Beatty, A. L., Ke, B., & Petroni, K. R. (2002). Earnings Management to Avoid Earnings Declines across Publicly and Privately Held Banks. *The Accounting Review, 77,* 547-570. https://doi.org/10.2308/accr.2002.77.3.547

Chen, C. X., Lu, H., & Sougiannis. T. (2012). The Agency Problem, Corporate Governance, and the Asymmetrical Behavior of Selling, General, and Administrative Costs. *Contemporary Accounting Research, 29,* 252-282. https://doi.org/10.1111/j.1911-3846.2011.01094.x

Chen, H. Y., Chen, S. S., Hsin, C. W., & Lee, C. F. (2014). Does Revenue Momentum Drive or Ride Earnings or Price Momentum? *Journal of Banking & Finance, 38,* 166-185. https://doi.org/10.1016/j.jbankfin.2013.09.021

Chu, J., Dechow, P. M., Hui, K. W., & Wang, A.Y. (2019). Maintaining a Reputation for Consistently Beating Earnings Expectations and the Slippery Slope to Earnings Manipulation. *Contemporary Accounting Research, 36,* 1966-1998. https://doi.org/10.1111/1911-3846.12492

Cohen, D. A., & Zarowin, P. (2010). Accrual-Based and Real Earnings Management Activities around Seasoned Equity Offerings. *Journal of Accounting and Economics, 50,* 2-19. https://doi.org/10.1016/j.jacceco.2010.01.002

Comin, D., & Mulani, S. (2006). Diverging Trends in Aggregate and Firm Volatility. *Review of Economics and Statistics, 88,* 374-383. https://doi.org/10.1162/rest.88.2.374

Comin, D., & Philippon, T. (2005). The Rise in Firm-Level Volatility: Causes and Consequences. *NBER Macroeconomics Annual, 20,* 167-201. https://doi.org/10.1086/ma.20.3585419

Davis, S., & Kahn, J. (2008). Interpreting the Great Moderation: Changes in the Volatility of Economic Activity at the Macro and Micro Levels. *Journal of Economic Perspectives, 22,* 155-180. https://doi.org/10.1257/jep.22.4.155

Dechow, P. M., & Dichev, I. D. (2002). The Quality of Accruals and Earnings: The Role of Accrual Estimation Errors. *The Accounting Review, 77,* 35-59. https://doi.org/10.2308/accr.2002.77.s-1.35

Dechow, P. M., Hutton, A. P., Kim, J. H., & Sloan, R. G. (2012). Detecting Earnings Management: A New Approach. *Journal of Accounting Research, 50,* 275-334. https://doi.org/10.1111/j.1475-679X.2012.00449.x

Dichev, I. D., & Tang, V. W. (2009). Earnings Volatility and Earnings Predictability. *Journal of Accounting and Economics, 47,* 160-181. https://doi.org/10.1016/j.jacceco.2008.09.005

Dierynck, B., Landsman, W. R., & Renders, A. (2012). Do Managerial Incentives Drive Cost Behavior? Evidence about the Role of the Zero Earnings Benchmark for Labor Cost Behavior in Private Belgian Firms. *The Accounting Review, 87,* 1219-1246. https://doi.org/10.2308/accr-50153

Fama, E. F., & French, K. R. (1992). The Cross-Section of Expected Stock Returns. *The Journal of Finance, 47,* 427-465. https://doi.org/10.1111/j.1540-6261.1992.tb04398.x

Fama, E. F., & French, K. R. (1993). Common Risk Factors in the Returns on Stocks and Bonds. *Journal of Financial Economics, 33,* 3-56. https://doi.org/10.1016/0304-405X(93)90023-5

Ghosh, A., Gu, Z., & Jain, P. C. (2005). Sustained Earnings and Revenue Growth, Earnings Quality, and Earnings Response Coefficients. *Review of Accounting Studies, 10,* 33-57. https://doi.org/10.1007/s11142-004-6339-3

Hall, C. M. (2016). Does Ownership Structure Affect Labor Decisions? *The Accounting Review, 91,* 1671-1696. https://doi.org/10.2308/accr-51384

Harrison, J., Ng, F., Rouse, P., & Swain, M. R. (2021). The Four Levers of Revenue Management. *Strategic Finance, 103,* 32-41.

Holzhacker, M., Krishnan, R., & Mahlendorf, M. D. (2015). Unraveling the Black Box of Cost Behavior: An Empirical Investigation of Risk Drivers, Managerial Resource Procurement, and Cost Elasticity. *The Accounting Review, 90,* 2305-2335. https://doi.org/10.2308/accr-51092

Ittner, C., & Aguilar, O. (2019). *How Cost Management Needs to "Save to Transform".* https://knowledge.wharton.upenn.edu/article/how-cost-management-is-changing/

Jegadeesh, N., & Livnat, J. (2006). Revenue Surprises and Stock Returns. *Journal of Accounting and Economics, 41,* 147-171. https://doi.org/10.1016/j.jacceco.2005.10.003

Kama, I., & Weiss, D. (2013). Do Earnings Targets and Managerial Incentives Affect Sticky Costs? *Journal of Accounting Research, 51,* 201-224. https://doi.org/10.1111/j.1475-679X.2012.00471.x

Kao, J., & Na, K. (2013). *Earnings Management to Sustain Consecutive Earnings Increase* *and Market Response.* Working Paper, University of Alberta.

Ke, B., & Petroni, K. R. (2004). How Informed Are Actively Trading Institutional Investors? Evidence from Their Trading Behavior before a Break in a String of Consecutive Earnings Increases. *Journal of Accounting Research, 42,* 895-927. https://doi.org/10.1111/j.1475-679X.2004.00160.x

Ke, B., Huddart, S., & Petroni, K. R. (2003). What Insiders Know about Future Earnings and How They Use It: Evidence from Insider Trades. *Journal of Accounting and Economics, 35,* 315-346. https://doi.org/10.1016/S0165-4101(03)00036-3

Kothari, S. P., Laguerre, T. E., & Leone, A. J. (2002). Capitalization versus Expensing: Evidence on the Uncertainty of Future Earnings from Capital Expenditures versus R&D Outlays. *Review of Accounting Studies, 7,* 355-382. https://doi.org/10.1023/A:1020764227390

Kreilkamp, N., Teichmann, S., & Wöhrmann, A. (2021). The Effect of Cost Stickiness on Peer-Based Valuation Models. *European Accounting Review, 30,* 913-938. https://doi.org/10.1080/09638180.2021.1976662

Lev, B. (1974). On the Association between Operating Leverage and Risk. *Journal of Financial and Quantitative Analysis, 9,* 627-641. https://doi.org/10.2307/2329764

Myers, J. N., Myers, L. A., & Skinner, D. J. (2007). Earnings Momentum and Earnings Management. *Journal of Accounting Auditing and Finance, 22,* 249-284. https://doi.org/10.1177/0148558X0702200211

Petersen, M. A. (2009). Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches. *The Review of Financial Studies, 22,* 435-480. https://doi.org/10.1093/rfs/hhn053

Porter, M. E. (1985). *Creating and Sustaining Superior Performance*. The Free Press.

Shanthikumar, D. M. (2012). Consecutive Earnings Surprises: Small and Large Trader Reactions. *The Accounting Review, 87,* 1709-1736. https://doi.org/10.2308/accr-50188

Stock, J. H., & Watson, M.W. (2002). Has the Business Cycle Changed and Why? *NBER Macroeconomics Annual, 17,* 159-218. https://doi.org/10.1086/ma.17.3585284

Venieris, G., Naoum, V. C., & Vlismas, O. (2015). Organization Capital and Sticky Behavior of Selling, General and Administrative Expense. *Management Accounting Research, 26,* 54-82. https://doi.org/10.1016/j.mar.2014.10.003

Weiss, D. (2010). Cost Behavior and Analysts' Earnings Forecasts. *The Accounting Review, 85,* 1441-1471. https://doi.org/10.2308/accr.2010.85.4.1441

Zhang, X. F. (2006). Information Uncertainty and Stock Returns. *The Journal of Finance, 61,* 105-137. https://doi.org/10.1111/j.1540-6261.2006.00831.x

Appendix A: Market Performance for Firms with Strings of Increasing Earnings

Using our sample consisting of firm years from 1973 to 2018, we examine the market performance of firms experiencing strings of increasing earnings.[36] Following Barth et al. (1999): we estimate Models (A1) and (A2) below:

$$\begin{aligned} Price_{it} &= a_0 + \sum_{yr=1974}^{2018} a_{0,yr} D_{yr,it} + a_1 NI_{it} + \sum_{yr=1974}^{2018} a_{1,yr} \left(D_{yr,it} \times NI_{it} \right) \\ &\quad + a_{1,up} D_{up,it} \times NI_{it} + a_2 Growth_{it} \times NI_{it} + a_3 EVAR_{it} \times NI_{it} \\ &\quad + a_4 DE_{it} \times NI_{it} + a_5 BVE_{it} + \varepsilon_{it}, \end{aligned} \tag{A1}$$

$$\begin{aligned} Price_{it} &= a_0 + \sum_{yr=1974}^{2018} a_{0,yr} D_{yr,it} + a_1 NI_{it} + \sum_{yr=1974}^{2018} a_{1,yr} \left(D_{yr,it} \times NI_{it} \right) \\ &\quad + \sum_{N=1}^{9} a_{1,up,N} \left(D_{up,N,it} \times NI_{it} \right) + a_2 Growth_{it} \times NI_{it} \\ &\quad + a_3 EVAR_{it} \times NI_{it} + a_4 DE_{it} \times NI_{it} + a_5 BVE_{it} + \varepsilon_{it}, \end{aligned} \tag{A2}$$

where

Price = fiscal year-end share price;

NI = net income per share before extraordinary items and discontinued operations;

D = indicator dummy variables for years (D_{yr}): firm with at least five consecutive years of increasing earnings including year *t* (D_{up}): or firm with *N* consecutive years of increasing earnings ($D_{up,N}$);

Growth = five-year compound annual growth rate of book value of equity, i.e. $\left(BVE_t / BVE_{t-6} \right)^{1/5} - 1$;

EVAR = variance of past six years' percentage change in earnings $\left(NI_t - NI_{t-1} \right) / abs / NI_{t-1} /$;

BVE = book value of equity per share.

Model (A1) tests if firms with strings of increasing earnings outperform firms without such strings. The results are summarized in **Table A1**. Consistent with Barth et al. (1999): our coefficient on $D_{yr,it} \times NI_{it}$ is significantly positive (3.170), suggesting that the P/E ratios are higher for firms with strings than for firms without strings. Model (A2) examines whether the earnings multiples change with the length of the string. As shown in **Table A1**, the coefficients for $D_{up,N,it}$ represent the excess P/E ratios for firms in the *N*th year of the string. All coefficients are statistically significant. The estimates are 1.067, 2.016, 2.049, 2.744 and 3.556 for $N = 1, 2, 3, 4, 5$, respectively. The results show that the P/E ratios are monotonically increasing in the number of years a firm has been maintaining the strings, i.e. the longer the string, the higher the excess P/E ratio the stock market awards the firm.

In order to examine how the P/E ratio change when a string of increasing earnings ends, we modify Model (A2) by adding a dummy variable *Break* for the year the string of increasing earnings ends, formally stated as (A3) below:

[36]We also run all of the tests in **Appendix A** using only strings with at least one sales decrease over the string periods. The results are similar to those of all strings and available upon request.

Table A1. Price regression for strings of increasing earnings of five years or longer.

Independent Variables	Model (A1)			Model (A2)			Model (A3)		
	Coefficient		t-Stat	Coefficient		t-Stat	Coefficient		t-Stat
Intercept	10.089	***	91.55	9.770	***	89.32	9.459	***	86.90
NI	5.064	***	101.59	4.219	***	79.25	3.135	***	53.93
$D_{up} \times NI$	3.170	***	71.99						
$D_{up,1} \times NI$				1.067	***	16.04	2.423	***	33.37
$D_{up,2} \times NI$				2.016	***	31.21	3.376	***	47.57
$D_{up,3} \times NI$				2.049	***	30.63	3.422	***	46.79
$D_{up,4} \times NI$				2.744	***	39.87	4.125	***	55.03
$D_{up,5} \times NI$				3.556	***	43.32	4.941	***	56.68
$D_{up,6} \times NI$				3.901	***	43.66	5.265	***	56.14
$D_{up,7} \times NI$				4.478	***	38.75	5.834	***	49.16
$D_{up,8} \times NI$				3.623	***	28.60	4.993	***	38.57
$D_{up,9} \times NI$				5.173	***	72.32	6.548	***	84.63
$Break \times NI$							2.760	***	44.85
$GROWTH \times NI$	0.346	***	5.42	−0.037		−0.58	−0.374	***	−5.84
$EVAR \times NI$	−0.001	***	−16.78	−0.001	***	−14.68	−0.001	***	−11.78
$DE \times NI$	−0.072	***	−12	−0.051	***	−8.48	−0.032	***	−5.44
BVE	0.813	***	181.45	0.792	***	177.05	0.760	***	168.85
N	143,249			143,249			143,249		
Adj. R^2	0.55			0.55			0.56		
F-Statistic	2100.75***			1980.95***			2008.79***		
p-value	(<0.0001)			(<0.0001)			(<0.0001)		

Regression model: Model (A1): $Price_{it} = a_0 + \sum_{yr=1974}^{2018} a_{0,yr} D_{yr,it} + a_1 NI_{it} + \sum_{yr=1974}^{2018} a_{1,yr}\left(D_{yr,it} \times NI_{it}\right) + a_{1,up} D_{up,it} \times NI_{it} + a_2 Growth_{it} \times NI_{it} + a_3 EVAR_{it} \times NI_{it} + a_4 DE_{it} \times NI_{it} + a_5 BVE_{it} + \varepsilon_{it}$; **Model (A2):** $Price_{it} = a_0 + \sum_{yr=1974}^{2018} a_{0,yr} D_{yr,it} + a_1 NI_{it} + \sum_{yr=1974}^{2018} a_{1,yr}\left(D_{yr,it} \times NI_{it}\right) + \sum_{N=1}^{9} a_{1,up,N}\left(D_{up,N,it} \times NI_{it}\right) + a_2 Growth_{it} \times NI_{it} + a_3 EVAR_{it} \times NI_{it} + a_4 DE_{it} \times NI_{it} + a_5 BVE_{it} + \varepsilon_{it}$; **Model (A3):** $Price_{it} = a_0 + \sum_{yr=1974}^{2018} a_{0,yr} D_{yr,it} + a_1 NI_{it} + \sum_{yr=1974}^{2018} a_{1,yr}\left(D_{yr,it} \times NI_{it}\right) + \sum_{N=1}^{9} a_{1,up,N}\left(D_{up,N,it} \times NI_{it}\right) + a_2 Break_{it} \times NI_{it} + a_3 Growth_{it} \times NI_{it} + a_4 EVAR_{it} \times NI_{it} + a_5 DE_{it} \times NI_{it} + a_6 BVE_{it} + \varepsilon_{it}$. **Definition of variables:** *Price* is the fiscal year-end share price; *NI* is net income per share before extraordinary items and discontinued operations; *D* represents indicator dummy variables for years (D_{yr}): firm with at least five consecutive years of increasing earnings including year *t* (D_{up}): or firm with *N* consecutive years of increasing earnings ($D_{up,N}$); *Growth* is the five-year compound annual growth rate of book value of equity, i.e. $\left(BVE_t / BVE_{t-6}\right)^{1/5} - 1$; *EVAR* is the variance of past six years' percentage change in earnings, i.e. $\left(NI_t - NI_{t-1}\right)/abs\left(NI_{t-1}\right)$; *BVE* is the book value of equity per share; and *Break* is a dummy variable that takes value of 1 for the year when earnings decrease, and 0 otherwise. ***represents significance level of 0.01. Source of data: All financial statement data are obtained from Compustat. Stock price data are obtained from CRSP.

$$\begin{aligned} Price_{it} &= a_0 + \sum_{yr=1974}^{2018} a_{0,yr} D_{yr,it} + a_1 NI_{it} + \sum_{yr=1974}^{2018} a_{1,yr}\left(D_{yr,it} \times NI_{it}\right) \\ &\quad + \sum_{N=1}^{9} a_{1,up,N}\left(D_{up,N,it} \times NI_{it}\right) + a_2 Break_{it} \times NI_{it} + a_3 Growth_{it} \times NI_{it} \\ &\quad + a_4 EVAR_{it} \times NI_{it} + a_5 DE_{it} \times NI_{it} + a_6 BVE_{it} + \varepsilon_{it}, \end{aligned} \tag{A3}$$

where $Break_{it}$ is a dummy variable that takes value of 1 for the year when earnings decrease, and 0 otherwise.

The results based on Model (A3) are also shown in **Table A1**. The excess P/E ratios of the first five years of the string are 2.423, 3.376, 3.422, 4.125 and 4.941, all statistically significant. The P/E ratios are again monotonically increasing as the string gets longer. When the string ends, the excess P/E ratio declines to 2.760, suggesting the market reacts to the end of strings of increasing earnings by reducing the firm's P/E ratio.

Appendix B: Definition of Key Variables

Variables	Definition
Asset Intensity	Ratio of total assets to sales revenue
Asymmetric Cost Behavior	The difference in a firm's cost changes responding to positive versus negative changes in sales, measured using β_2, the coefficient of $Dec_{i,t} \ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$ in Model (2)
Break	Indicator variable set to 1 if earnings in year t is less than earnings in year $t-1$ but earnings in year $t-1$ is more than earnings in year $t-2$, and 0 otherwise
Cost Flexibility	A firm's ability to adjust its costs, measured using β_1, the coefficient of $\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$ in Model (1)
Dec	Dummy variable that equals to 1 if a firm's current year sales are less than last year, and 0 otherwise
Demand Uncertainty	Standard deviation of $\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$ for the past five years
Employee Intensity	Ratio of the number of employees to sales revenue
EPS	Earnings per share
Operating Costs (*OC*)	Annual sales revenue minus income from operations
$\Delta OC_{i,t}$	Difference between $OC_{i,t}$ and $OC_{i,t-1}$
Sales	Sales revenue
$\ln\left(\frac{Sales_{i,t}}{Sales_{i,t-1}}\right)$, *or* $\Delta \ln S$	Difference between $\ln Sales_{i,t}$ and $\ln Sales_{i,t-1}$, noted as $\Delta \ln S$ in **Table 3**, **Table 4** and **Table 6**
$\Delta Sales_{i,t}$ *or* ΔS	Difference between $Sales_{i,t}$ and $Sales_{i,t-1}$, noted as ΔS in **Table 9**
Consecutive Revenue Growth Ratio	Firm-level measure defined as the ratio of the number of years in consecutive sales increases to the total number of years of observation
SIZE	Firm-level measure for size, calculated as GDP-adjusted average sales for each firm, assuming 1973 as the base year for GDP adjustment.
Stock Performance	Raw stock return in the prior fiscal year
Successive Decrease	Indicator variable that equals to 1 if a firm's last year sales are less than the year before last year, and 0 otherwise

Source of data: All financial statement data and number of employees are obtained from Compustat. Stock price data are obtained from CRSP.