RESEARCH ARTICLE

The Effect of Managers' Delta and Vega on the Asymmetric Cost Behavior of Companies

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Abstract

This paper examines the impact of managers' stock incentives on changes in sales and selling, general, and administrative (SG&A) costs, which can help determine whether SG&A costs are sticky or non-sticky. This study employs two criteria for assessing managers' incentives: managers' wealth sensitivity to stock price changes (Delta) and managers' wealth sensitivity to stock returns (Vega). The first hypothesis posits that Delta influences cost stickiness, leading to a more significant cost increase in response to rising sales compared to decreasing sales. Conversely, the second hypothesis suggests that Vega directly affects non-sticky costs, whereby costs increase less in response to growing sales than decreasing ones. The statistical sample for this study comprises 138 companies from 2008 to 2023. A panel regression model was utilized to test the hypotheses, revealing that Delta significantly positively affects cost stickiness, while Vega has a significant negative effect.

1. Introduction

Recent empirical research shows that some costs, including SG&A costs, are asymmetrical in behavior. It is defined as the increase in costs due to the increase in activity level being more significant than the decrease in costs due to the decrease in activity level. Therefore, costs do not always change in proportion to activity level and some cases, it behaves asymmetrically, which is also referred to as stickiness (Anderson et al., 2003). One of the reasons that can create cost stickiness is the adjustment of resources by managers (Chen et al., 2012). To be more precise, managers keep unused resources to avoid the adjustment costs that lead to the consumption of these resources. Especially when activity levels are measured by sales revenue and declines are expected to be temporary. In contrast, managers facing a decline in sales levels delay decisions to cut supplies until demand falls permanently. Resource retention ranges from reducing production volumes to resource adjustment decisions causing cost stickiness (Brisker et al., 2022). This paper investigates the effect of two factors, Delta and Vega, on asymmetric cost behavior.

Cost stickiness is one of the most critical issues related to cost behavior and is one of the main topics of management accounting. Generally, the standard definition of cost behavior in financial and management accounting is expressed as management incentives of short-term earnings. Resource adjustment strategies based on cost behaviors can affect financial reporting choices. In particular, asymmetric cost responses to sales changes should increase revenue volatility (Hartlieb and Loy, 2022). Managers' understanding of asymmetric cost behavior improves their performance and future predictions. In general, wiser decisions can be made when costs are reduced or decreased (Hasani and Lal Bar, 2021). Therefore, managers' capabilities and strategies can affect the performance of the economic unit. Cost behavior also depends on management decisions associated with management's expectations about a future product or service demand or managers' incentives. Moreover, when sales decline, managers' ability to reduce surplus operating assets and unused resources is limited due to the resource adjustment of costs, such as layoffs. Managers' optimistic expectations about future demand, managerial incentives based on self-interest, and avoidance of adjustment costs are three key factors that encourage managers to maintain unused resources when sales decline. Therefore, the tendency of managers not to reduce some resources in the condition of decreasing sales leads to cost stickiness (Parsaei and Sohrabi, 2022).

In this study, managers' incentives on asymmetric behavior of cost using the effect of managerial stocks on the stickiness of SG&A costs have been studied, and the main difference between this study and previous studies is the criteria for measuring managers' incentives, which is based on Delta and Vega. Delta shows the changes in managers' wealth in stock changes and Vega in stock returns. Therefore, this study aims to determine whether Delta significantly positively affects cost stickiness and Vega's non-stickiness of costs.

Delta, which shows the wealth sensitivity of company executives to its share price changes, is used to align the interests of directors with shareholders. Thus, high Delta improves managers' performance because directors share dividends and losses with shareholders in Delta portfolios. However, directors are more exposed to unsystematic risk than the company's common shareholders and thus become risk-averse when making management decisions (Brisker et al., 2022). In contrast, Vega, which shows the wealth sensitivity of the company's management to its stock returns, has a direct relationship with managers' risk-taking. Due to the convergent return structure, the higher the Vega, the more the manager's willingness to take risks (Shirafkan et al., 2017). In the following, theoretical foundations and related research are presented. In the following section, hypotheses and empirical models are presented. Also, these hypotheses are examined. Finally, the conclusion is discussed after reviewing the descriptive statistics and findings.

2. Theoretical foundations
2.1 Theories Backing Assumptions
2.1.1 Managers' incentives

Separating ownership and management leads to a significant conflict of interest between directors and shareholders. Ownership of company shares by directors is critical to eliminate this problem and increase the motivation of managers. Managers who own the company's shares are less likely to do things that lead to a reduction in the company's value. Equity has two different effects on management incentives about risk. The first effect is the wealth sensitivity of management to the stock price, called Delta (Brisker et al., 2022), which means ownership of shares. The second effect is the sensitivity of managers' wealth to stock returns, which is referred to as Vega (Brisker et al., 2022), and mainly this effect is done through granting equity discretion (Low, 2009; Lewellen, 2006; Coles et al., 2006). Delta encourages managers to make decisions that may increase the company's value, which also may increase managers' wealth. For example, managers are more inclined to accept high-risk projects, leveraged decisions and cost of management policies. However, Delta could also dissuade managers from making risky decisions because it increases the effect of change in stock prices on managers' wealth portfolios (Risk Effect). As a result, Delta may provide an incentive for risk-averse managers to reject high-risk projects with positive net present value (Brisker et al., 2022).

On the other hand, Vega provides managers with risk-taking incentives for operational, investment, and financial decisions. The portfolio value of a manager's stock option increases the volatility of stock returns due to the convex return structure of options (Heidari and Shirinbakhsh, 2018). Hence, sensitivity to stock return volatility motivates managers to make higher-risk trading decisions (Guay, 1999). Recent research also shows that managers with higher Vega take riskier projects, have higher leverage, and focus more on fewer lines of business. Because these managers directly benefit from stock price fluctuations related to the company's risk levels due to the structure of the convex return on the stock option associated with Vega (Coles et al., 2006).

2.1.2 Asymmetric cost behavior

Many researchers have studied the relationship between activity levels and cost changes, and several theories exist. Costs are divided into fixed and variable categories concerning the level of activity. According to the old Model of cost behavior, when the activity level changes, the cost variable changes proportionally and the managers' decision about resource adjustment is not considered. When the income level increases, the rate of increase in costs is greater than when costs decrease due to the reduction of income level. Therefore, costs increase in proportion to the increase in sales, but costs do not decrease in proportion to the decrease in sales. This asymmetric behavior of cost that follows decreases and increases in sales is called cost stickiness (Calleja et al., 2006). For example, the SG&A costs examined in this study are sticky. Based on research by Anderson et al. (2003), when revenue increases by 1%, SG&A costs increase by 0.55%, but when sales decrease by 1%, SG&A costs decrease by 0.35% (Hosseinipour et al., 2019). Generally, cost stickiness is a feature of cost behavior about changes in activity level. It suggests that the cost increase when the activity level increases is more significant than the decrease in cost when the activity level decreases.

2.1.3 Factors affecting cost stickiness

The delay in adjusting costs and the length of the forecast period of management reflect management's view of the company's future state. Because managers believe that the future state of the company depends on their decisions, management predictions are expected to be one of the factors affecting cost stickiness. The second factor that impacts cost stickiness is the information managers

get from the economic environment. This information affects resource adjustment decisions. For example, the economic situation of the company's products (such as demand stagnation for consecutive periods) assures managers that this recession is sustainable (Mansourfar et al., 2017). In addition, the economic growth of the country where the company is operating in its market significantly impacts management's predictions. Also, the amount of assets and the number of employees are the practical features of the company that can affect cost stickiness. Because of the complexity of the manufacturing process and the machinery used by companies, managers consider resource re-acquisition costs in decisions related to resource adjustment. Also, a trained workforce, a vital asset today, impacts the company's success. Hence, management should consider the costs of losing a part of the human resources when deciding. In addition, when there is an increase in activity level, the rate of increase in costs is greater than the rate of reduction in costs, and when the volume of activity decreases, it is called cost stickiness (Banker and Chen, 2006). In general, cost stickiness is one of the features of cost behavior related to changes in activity level. This definition indicates that the increase in costs when the level of activity increases is more significant than the reduction in costs when the activity level decreases (Calleja et al., 2006). Understanding the importance of cost stickiness is vital, not only for managers but also for other groups as well. For example, understanding cost stickiness is also applicable to analysts, investors, and the implementation of audit procedures.

2.2 Literature review

Many studies have been done to understand the importance of sticky costs, including Restuti et al. (2023), which study cost stickiness behavior and uncertainty of environmental information in different strategies. Their research studies the effect of these two factors on managers' decision making. The study used data from companies in East Asian countries between 2013 and 2019. The results represent that the cost stickiness created by environmental information uncertainty is higher in companies with poor management in terms of different strategies. Just as managers' ability is practical regarding the stickiness of costs, weakness in company management increases the effect of environmental uncertainty on cost stickiness.

Hashemipour et al. (2023) realize that political decisions, government ownership structure, GDP growth, political communication and the amount of inflation that exists for the company affect the stickiness of corporate costs. Managers rely on information for future planning and budgeting, and the more accurate the information is, the fewer deviations there will be and the more accurate the future budgeting and planning will be.

Wu and Wilson (2022), in a study on analysts' understanding of asymmetric cost behavior, state that a lack of adequate understanding of asymmetric cost behavior (cost stickiness) causes this behavior to be not accurately considered in reports and predictions. Also, cost asymmetric behavior has nothing to do with prediction errors in companies with high-cost stickiness. The results provide analysts with a significant understanding of asymmetric cost behavior and cross-sectional differences in the probability of its occurrence.

Kim et al. (2022) found that firms with weak internal controls cannot provide managers with extensive and sufficient information about the company's internal resources. Uncertainty in the accuracy of information causes managers to postpone adjustment reforms in times of resource shortages until they have received complete information to make decisions. The results show that companies with weak internal control have more cost stickiness than others.

Brisker et al. (2022) state that costs change asymmetrically with increases and decreases in sales. The main cause for the asymmetrical behavior of costs is managers' decisions. Also, the results indicate that the ratio of changes in managers' stock to the stock price has a positive effect and the ratio of managers' stock to the stock return has a negative and significant effect on the stickiness of

costs. These results show that when the first ratio increases, cost stickiness increases and when the second ratio increases, the stickiness of costs decreases.

Parsaei and Sohrabi (2022) found that knowing the cost behavior against changes in sales and investigating the factors affecting the asymmetric behavior of costs leads to more awareness about managers' incentives and decisions. Also, the results of this research indicate that business debt has a significant inverse effect on the stickiness of corporate costs. In addition, the agency problem reinforces the inverse link between business debt and corporate cost stickiness.

Nekoueizade (2022) shows that cost stickiness cannot be separated from managers' incentives. The results also show a significant relationship between earnings management and cost stickiness; however, corporate governance does not affect the stickiness of costs. In addition, there was no significant relationship between the moderating effect of good corporate governance and the relationship between earnings management and cost stickiness.

Vadiei and Salehi (2022) examined the relationship between labor costs and cost stickiness. The research results indicate that the more employees there are, the stickier the labour force cost will be.

Karimzadeh et al. (2021) examined the moderating effect of agency problems on the relationship between business credit and stickiness of costs and found that using the three criteria in this study, there was no significant relationship between business credit and stickiness of costs. However, among the indicators of agency problem, the effect of capital expenditure on the relationship between the third criterion of business credit (ratio of accounts payable to purchase) and the stickiness of costs is confirmed. In contrast, there was no evidence of the effect of equity acquisition ratio on the relationship between the first criterion of commercial credit (ratio of accounts paid per cost of goods sold) and the second criterion of commercial credit (the ratio of accounts paid by sales) and the stickiness of costs.

2.3. Hypothesis development

As stated, the primary purpose of this study is to examine the effect of managers' incentives on asymmetric cost behavior. Delta and Vega criteria were used to measure managers' incentives. Delta defines the sensitivity of managers' wealth to stock price changes. According to this definition, the number of shares that the directors of a company have can be an influential factor in the management decisions of that company. Moreover, Vega shows the sensitivity of managers' wealth to stock returns, which is precisely calculated by multiplying the number of managerial shares in the stock price of the same year. Price changes are calculated from the difference in the stock price of the last year and the year under review. The stock return is considered to fluctuate returns. In order to examine the stickiness of the cost, SG&A costs will be the sample because these costs are the most considerable part of the costs in a company. Therefore, to examine the effect of Delta and Vega on the stickiness of the SG&A costs, the following hypotheses are proposed:

H1: Managers' wealth Delta has a significant positive effect on sticky costs.

Based on agency theory, equity incentives can align the interests of managers and shareholders in the long run. Managers with higher Delta make more effort to improve long-term performance since they share profits with shareholders in the future. However, Delta could dissuade risk-averse managers from adopting high-risk policies that could intensify the impact of stock price fluctuations on managers' entire wealth portfolios. These Delta-related incentives are considered in developing the first hypothesis about Delta's relationship to sticky costs.

When sales decline, such as in a poor economic condition, high Delta incentivizes managers to make risk-averse decisions (risk effect). So, when it is unclear whether the decline in sales is because of temporary market conditions or constant changes in the market, managers with high Delta are more likely to wait and postpone resource adjustments until they understand the permanent nature of

declining sales. Thus, the high Delta motivates managers to delay decisions to reduce resources intentionally; as a result, it causes cost stickiness. Moreover, when sales declines are temporary, managers with higher Deltas hesitate to reduce resources to avoid inefficient future adjustment costs that return sales to higher levels. In other words, managers with high Deltas are expected to maintain slack resources and accept lower profits in the short term to maximize the company's long-term value (reward effect).

When sales are rising in the current period, such as good economic conditions, high Delta managers are more likely to add resources to gain a first-mover advantage, increase market share and raise barriers to entry, thereby strengthening the company's competitive position and promoting the long-term value of the company as well as their wealth portfolio. Thus, when sales increase, the reward effect is overcome by the risk effect, which leads to cost stickiness. Overall, it is predicted that the Delta of managers' wealth portfolios is positively associated with asymmetric spending behavior. The second hypothesis of the research, which relates to the Vega effect, is presented as follows:

H2: Manager's wealth Vega has a significant negative (positive) effect on sticky costs (anti-sticky).

Since the portfolio value of a manager's stock option increases with volatility in the company's stock returns, Vega increases the CEO's tendency to make riskier operational and financial decisions (Coles et al., 2006). In order to decrease agency costs related to Vega's debts, creditors are likely to strengthen debt monitoring using short-term debt and related financial contracts (Brockman et al., 2010). Banker and Fung (2016) state that careful monitoring of debt through short-term debt and financial contracts creates anti-sticky (sticky) cost behavior because managers with high Vega should focus on short-term rather than long-term performance. When sales fall, intense monitoring by creditors forces top Vega executives to cut back on slack resources immediately after seeing a decline in sales, reduce slack resources to avoid a breach of the contract and pay off short-term debts. Top Vega managers facing financial constraints are also likely to be limited in the upward adjustment of resources when sales rise.

In addition, when there is more uncertainty in demand changes, high-Vega managers are more likely to reduce their resources immediately rather than using stock options and waiting to learn more about permanent demand reductions to reduce the potential risk of resource adjustment decisions. In addition, downward adjustment of resources to increase the company's short-term value may increase the company's risk. Panagopoulos et al. (2018) state that staff cuts are associated with more significant investor uncertainty, which is indicated by increased individual risk. Zorn et al. (2017) also found that downsizing firms were more likely to go bankrupt because these studies show that downward adjustment of resources may increase the risk and volatility of stock prices. According to Coles et al. (2006), Vega forces managers to focus on having fewer lines of business and increasing their wealth through volatility in stock returns. The company's increasing risks resulting from the downward adjustment of resources incentivize high-Vega managers to reduce committed resources immediately after sales decline. As a result, Vega incentivizes managers to make immediate downward adjustments for resources, which creates anti-sticky (sticky) cost behavior. Overall, it is predicted that the wealth portfolio of managers with high Vega directly affects anti-sticky cost behavior.

3. Research methodology

In order to verify the hypotheses of this paper, the correlation and regression between Delta and Vega with the stickiness of SG&A costs are investigated. The research methodology is ex post facto research (using past information) and in terms of purpose-based classification, it is applied research. EViews, Stata and Spss are used to analyze data. The statistical population of this study includes 138

companies listed on the Tehran Stock Exchange from 2008 to 2023. In this statistical population, the companies listed after 2008, those in the banking, insurance and investment industry, and companies whose financial year ends differently are ignored. Also, companies that are faced with non-trading in some years of the research period or have a trading interruption for more than six months are not included in the statistical population of this study due to incomplete information.

Before examining the effect of managers' incentives on cost stickiness, the stickiness of SG&A costs is estimated based on previous research models (Chen et al., 2012). The first Model is the base model for the study of cost stickiness and the second Model is estimated by considering economic control variables.

$\Delta \ln SG\&A_{it} = \beta_0 + \beta_1 \Delta \ln sale_{it} + \beta_2 \text{Decreasedummy}_{it} \times \Delta \ln sale_{it} + \varepsilon_{it}$ (1)

$\Delta \ln SG\&A_{it} = \beta_0 + \beta_1 \Delta \ln sale_{it} + \beta_2 \text{Decreasedummy}_{it} \times \Delta \ln sale_{it}$
$+ \beta_3 \text{Decreasedummy}_{it} \times \Delta \ln sale_{it} \times \text{Successivedecrease}_{it}$
$+ \beta_4 \text{Decreasedummy}_{it} \times \Delta \ln sale_{it} \times \text{Aassetintensity}_{it}$
$+ \beta_5 \text{Decreasedummy}_{it} \times \Delta \ln sale_{it} \times \text{Employeeintensity}_{it}$
$+ \beta_6 \text{Decreasedummy}_{it} \times \Delta \ln sale_{it} \times \text{Stockperformance}_{it}$
$+ \text{Successivedecrease}_{it} + \text{Assetintensity}_{it} + \text{Employeeintensity}_{it}$
$+ \text{Stockperformance}_{it} + \acute{\varepsilon}_{it}$ (2)

The dependent variable of these two models is $\Delta \ln SG\&A$, which is defined as long-term changes in SG&A costs. $\Delta \ln Sale$ describes long-term changes in sales, and the binary variable Decreasedummy is defined as if sales decrease in a specific year compared to the previous year; the number is 1 otherwise 0 (if sales in year t decrease comparing to t-1,1otherwise 0). The successive decline is also a binary variable; if sales had decreased in the previous year compared to sales in the previous two years, it would be 1; otherwise 0 (If sales in the year t-1 decrease compared to t-2, 1, otherwise 0). Asset intensity represents the ratio of total assets to sales revenue. Employee intensity represents the ratio of employees to sales revenue in the current year and stock performance describes stock returns of the current year.

To examine the research hypotheses, we implement the following Model once with the Delta variable to examine the first hypothesis and again with the Vega variable to examine the second hypothesis.

$$\text{Sticky}_{it} = \beta_0 + \beta_1 \text{Delta}_{it} + \beta_2 \sum \Theta \text{ Governance}_{it} + \acute{\varepsilon}_{it} \text{ (3)}$$

$$\text{Sticky}_{it} = \beta_0 + \beta_1 \text{ Vega}_{it} + \beta_2 \sum \Theta \text{ Governance}_{it} + \acute{\varepsilon}_{it} \text{ (4)}$$

The dependent variable in this Model is the sticky variable, which is the criterion of stickiness and is calculated according to Sajjadi et al.'s research (2014):

$$\text{Sticky}_{it} = \text{SG\&Aratio}_{it} \times D_{it}^{SALES} \times D_{it}^{SG\&A} \text{ (3-1)}$$

In this formula, the SG&A ratio is calculated as follows:

$$\text{SG\&Aratio} = \frac{SG\&A_t}{SALES_t} - \frac{SG\&A_{t-1}}{SALES_{t-1}} \text{ (3-1-1)}$$

SG&A shows sales and general and administrative costs in years t and t-1. The Sales variable

shows sales in the same years. D_{it}^{SALES} is defined as if $\frac{SALES_t}{SALES_{t-1}} < 1$ it would be 1 and if $\frac{SALES_t}{SALES_{t-1}} \geq$ 1 it would be 0 and also $D_{it}^{SG\&A}$ is defined as if SG&Aratio > 0, 1 and if SG&Aratio ≤ 0 , 0 will be assigned.

The independent variables of this Model are Delta and Vega, where Delta shows changes in the wealth of managers in the company (management stock) to changes in the share price of the same company. Vega is defined as changes in the wealth of managers of a company (management stock) to the volatility of shares (stock returns) of the same company. The governance variable is also obtained through factor analysis from the following three variables:

$$\sum\Theta \text{ Governance}_{it} = \Theta_0 + \Theta_1 \text{Productmarketcompetition}_{it} + \Theta_2 \text{Auditor}_{it} + \Theta_3 \text{ Creditrating}_{it} \quad (3\text{-}2)$$

Product market competition is the Herfindahl-Hirschman Index (HHI) calculated as the sum of squared market share using firm sales, based on two-digit (SIC) industry classification in year t. Auditor is a variable defined as, if the audit organization audits the company, is 1; otherwise, it gets 0. Finally, the credit rating variable of companies is determined based on Jafari and Ahmadvand's (2015) calculation of Z and its domain.

$$Z = 3.25 + 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$$

$$X_1 = \frac{\text{working capital}}{\text{total assets}} \qquad X_2 = \frac{\text{retained earnings}}{\text{total assets}}$$

$$X_3 = \frac{\text{gross profit}}{\text{total assets}} \qquad X_4 = \frac{\text{total market value of equity}}{\text{book value of total liabilities}}$$

The ranking of companies based on the specified numerical domains can be determined depending on the number obtained from Z that can be calculated for each year-company. If z is less than 4.15, the year-company is in the financial distress range; if z is between 4.15 and 5.58, it is in the financial uncertainty zone; if Z is greater than 5.58, the year-company is in the financial health zone.

In addition to these two models, the following models that have additional criteria to examine the effect of Delta and Vega on the SG&A cost stickiness have also been examined. According to the first hypothesis, β_3 is expected to be positive and β_5 negative (Brisker et al., 2022).

$\Delta\text{lnSG\&A}_{it} = \beta_0 + \beta_1 \text{ Decreasedummy}_{it} + \beta_2 \Delta\text{lnsale}_{it}$
$+ \beta_3 \Delta\text{lnsale}_{it} \times \text{Delta}_{it} + \Delta\text{lnsale}_{it} \times \sum\lambda \text{ Economic}_{it}$
$+ \Delta\text{lnsale}_{it} \times \sum\mu \text{ Agency}_{it} + \Delta\text{lnsale}_{it} \times \sum\Theta \text{ Governance}_{it}$
$+ \beta_4 \text{Decreasedummy}_{it} \times \Delta\text{lnsale}_{it} + \beta_5 \text{Decreasedummy}_{it}$
$\times \Delta\text{lnsale}_{it} \times \text{Delta}_{it} + \text{Decreasedummy}_{it} \times \Delta\text{lnsale}_{it}$
$\times \sum\lambda\text{Economic}_{it} + \text{Decreasedummy}_{it} \times \Delta\text{lnsale}_{it} \times \sum\mu \text{ Agency}_{it}$
$+ \text{Decreasedummy}_{it} \times \Delta\text{lnsale}_{it} \times \sum\Theta\text{Governance}_{it} + \text{Delta}_{it}$
$+ \sum\lambda \text{ Economic}_{it} + \sum\mu \text{ Agency}_{it}$
$+ \sum\Theta \text{ Governance}_{it} + \acute{\epsilon}_{it} \quad (5)$

A model similar to the previous Model is examined with the Vega variable for the second hypothesis, and β_3 is expected to be negative and β_5 positive (Brisker et al., 2022).

$\Delta\text{lnSG\&A}_{it} = \beta_0 + \beta_1 \text{ Decreasedummy}_{it} + \beta_2 \Delta\text{lnsale}_{it}$
$+ \beta_3 \Delta\text{lnsale}_{it} \times \text{Vega}_{it} + \Delta\text{lnsale}_{it} \times \sum\lambda \text{ Economic}_{it} + \Delta\text{lnsale}_{it}$
$\times \sum\mu \text{ Agency}_{it} + \Delta\text{lnsale}_{it} \times \sum\Theta \text{ Governance}_{it} + \beta_4\text{Decreasedummy}_{it} \times \Delta\text{lnsale}_{it} + \beta_5 \text{Decreasedummy}_{it}$
$\times \Delta\text{lnsale}_{it} \times \text{Vega}_{it} + \text{Decreasedummy}_{it} \times \Delta\text{lnsale}_{it}$

$\times \sum \lambda\ Economic_{it} + Decreasedummy_{it} \times \Delta lnsale_{it} \times \sum \mu\ Agency_{it}$
$+ Decreasedummy_{it} \times \Delta lnsale_{it} \times \sum \Theta\ Governance_{it} + Vega_{it}$
$+ \sum \lambda\ Economic_{it} + \sum \mu\ Agency_{it} + \sum \Theta\ Governance_{it} + \acute{\varepsilon}_{it}$ (6)

In these two models, the agency and the economy variables are calculated through the factor analysis approach by the following variables:

$\sum \lambda\ Economic_{it} = \lambda_0 + \lambda_1\ Successivedecrease_{it} + \lambda_2\ Assetintensity_{it} + \lambda_3\ Employeeintensity_{it} + \lambda_3\ stockperformance_{it}$ (5-1)

$\sum \mu\ Agency_{it} = \mu_0 + \mu_1\ Freecashflow_{it} + \mu_2\ CEOtenure_{it} + \mu_3 CEOhorizon_{it}$ (5-2)

For calculating free cash flow, common and preferred stock profits are deducted from operating activities' cash flows, and the final number is divided by the total assets. CEO Tenure represents the number of years the CEO has been in that position. The CEO horizon is defined as the year the CEO changes or the year before the CEO changes, the number 1; otherwise, 0 would be assigned.

4. Research findings

Tables (1) to (4) show descriptive statistics. Table (1) describes quantitative variables' mean, median, standard deviation, maximum and minimum. For instance, the sticky variable with a mean of 0.001 and median of 0.000 shows a normal distribution. Table (2) includes the count and percentage of the binary variables used in the research; for example, for the decrease dummy, value 1 is 440, which means there are 440 year-company that experienced a decrease in their sales compared to the last year. Table (3) reports the credit rating variable of the companies. Number 3 represents the company's financial health; based on the results, around 90% of all year-companies are in the financial health zone. Table (4) shows the number of years the CEO has been in office, which varies between 1 to 18 years.

Table 1. Descriptive Statistics of Quantitative Variables of Research

variables	Mean	Median	Std. Dev.	Maximum	Minimum
Delta	2.040	70749195	3.120	9.310	-97585053
Vega	2.420	4.130	8.180	2.090	-9.200
Sticky	0.001	0.000	0.004	0.014	0.000
Δlnsale	0.221	0.207	0.273	0.752	-0.290
ΔlnSG&A	0.214	0.208	0.274	0.773	-0.337
SG&A ratio	0.000	0.000	0.022	0.048	-0.050
Economic	-0.052	-0.264	0.726	1.615	-0.965
Agency	-0.026	0.158	0.939	1.577	-1.357
Governance	-0.040	-0.293	0.872	2.244	-0.925
Asset intensity	1.387	1.238	0.691	3.160	0.496
Employee intensity	0.000	0.000	0.000	0.002	3.560
Stock performance	0.616	0.257	1.053	3.680	-0.415
Free cash flow	0.028	0.030	0.100	0.213	-0.178
Product market competition	0.168	0.154	0.105	0.366	0.036

Table 2. Descriptive Statistics of Binary Variables of Research

Variables	count			Percent		
	Value 0	Value 1	Total	Value 0	Value 1	Total
Decrease dummy	1768	440	2208	80.070	19.930	100
CEO horizon	1534	674	2208	69.470	30.530	100
Auditor	1719	489	2208	77.850	22.150	100
Successive decrease	1752	456	2208	79.350	20.650	100
Dsale	1768	440	2208	80.070	19.930	100
DSG&A	1134	1074	2208	51.360	48.640	100

Table 3. Descriptive statistics of Credit rating

Value	Count	Percent
1	116	5.250
2	118	5.340
3	1974	89.400
Total	2208	100

Table 4. Descriptive statistics of CEO Tenure

Value	Count	Percent
1	674	30.530
2	483	21.880
3	344	15.580
4	224	10.140
5	142	6.430
6	95	4.300
7	67	3.030
8	48	2.170
9	37	1.670
10	27	1.220
11	19	0.860
12	16	0.720
13	11	0.500
14	7	0.320
15	4	0.180
16	4	0.180
17	3	0.140
18	3	0.140
Total	2208	100

In Table (1), which is related to descriptive statistics of quantitative variables, there is the Sticky variable with an average of 0.001. also, a 0.000 median is reported for this variable. In general, all data in this variable ranges from 0 to 0.014. In Tables (2), (3) and (4), descriptive statistics for multimodal variables are reported. In Table (4), all-year companies are classified into three categories. Based on the credit rating variable, in the 1974 year company, about 90% of all-year companies are in the financial health zone.

The examination results for evaluating the existence of SG&A cost stickiness show an asymmetric behavior in these costs. The results of Models (1) and (2) that are shown in tables (5) and (6) show that the Chi2 of the first Model is 529.69 and for the second Model is 1085.29 and since the significance level of both models is zero, SG&A costs are sticky.

Table 5. Results of the Model (1): Examination of SG&A Costs

variables	Coefficient	Std. err	Sig	VIF
lnsalesΔ	**0.5008**	**0.257**	**0.00**	**1.06**
Decreasedummy × Δlnsales	**-0.3346**	**0.0887**	**0.00**	**1.06**
Chow	F		3.886	
	Sig		0.000	
Hausman	Chi2		5.943	
	Sig		0.051	
Wiggins and Poi	Chi2		305.350	
	Sig		0.000	
Wooldridge	F		3.901	
	Sig		0.0503	
Wald	Chi2		529.690	
	Sig		0.000	

Table 6. Results of the Model (2); Examination of SG&A Costs with Economic Variables

variables	Coefficient	Std. err	Sig	VIF
lnsalesΔ	**0.376**	**0.017**	**0.000**	**2.200**
Decreasedummy × Δlnsales	-0.256	0.122	0.035	6.540
Decreasedummy × Δlnsale × Successive decrease	-2.896	1.868	0.121	1.740
Decrease dummy × Δlnsale × Asset intensity	-0.097	0.129	0.453	8.960
Decrease dummy × Δlnsale × Employee intensity	-274.558	414.694	0.508	8.030
Decrease dummy × Δlnsale × Stock performance	-0.288	0.381	0.450	1.080
Successive decrease	-0.073	0.020	0.000	5.800
Asset intensity	0.002	0.005	0.639	3.210
Employee intensity	-50.751	7.021	0.000	2.170
Stock performance	-0.001	0.003	0.728	1.510
Chow	F		3.856	
	Sig		0.000	
Hausman	Chi2		12.791	
	Sig		0.235	
Wiggins and Poi	Chi2		334.590	
	Sig		0.000	
Wooldridge	F		3.238	
	Sig		0.074	
Wald	Chi2		1085.290	
	Sig		0.000	

Fisher statistics of Chow test model (1) and model (2) are equal to 3.886 and 3.8561, respectively. Both are significant (0.00); both models are in the form of a panel. The Chi2 statistics of the Hausman test for model (1) is 5.943 with a significance level of 0.0512, which indicates that the variables are random. In model (2), the Chi2 statistics of the Hausman tests is 12.7911 and the significance level is 0.2356, which indicates that the variables of this Model are also random. According to Wiggins and Poi test information about models (1) and (2), both models have variance heterogeneity problems. The data related to these two models in Tables (1) and (2) show that the significance level of the Wooldridge test is above 5% and these two models have no problem with autocorrelation of error terms. In addition, the VIF of all variables in these two models is below 9, which indicates the absence of collinearity between variables.

In both models, the coefficient of Δlnsale represents long-term sales changes; more specifically, it shows the increased percentage in SG&A costs per 1% increase in sales. For example, in Table (5), this coefficient is 0.5008, representing a 0.5% increase in SG&A costs for a 1% increase in sales. The total coefficients of Δlnsale and decrease-dummy × Δlnsale represent the reduction percentage in SG&A costs per 1% reduction in sales, which in Model (1) is 0.1664 and in Model 2 it is 0.1197. In other words, according to the Model (1), for a 1% reduction in SG&A costs is reduced by 0.16%. In

general, in Models (1) and (2), the coefficient of Δlnsale and the coefficient of decrease dummy × Δlnsale are expected to be negative. The results of models (1) and (2) show that the changes in SG&A costs are not proportional to the changes in sales ٬which proves the existence of cost stickiness.

Tables (7) and (8) show the results of the models (3) and (4). These results examine the decrease and increase of stickiness according to Delta and Vega, which measures managers' incentives. Table (7) results are used to prove the first hypothesis and Table (8) is used to prove the second hypothesis.

Fisher's statistic Chow test models (3) and (4) are 12.99 and 10.36 and also are significant (0.00), which shows that both of these models are also in the shape of the panel. Hausman Chi2 test measures whether the Model is random or fixed. Based on Tables (7) and (8) the statistics for the models (3) and (4) are 1.42 and 3.65 and the significance levels of both of them are higher than 5%, which indicates the randomness of both of these models. According to the Wiggins Poi and Wooldridge test data in Table (7), the Model (3) has no heterogeneity of variance and no autocorrelation problem. According to Table (8), the significance level of the Wiggins and Poi test shows that there is no heterogeneity problem but an autocorrelation problem based on the significance level of the Wooldridge test. The VIF of all variables in these two models is around 1, indicating no collinearity problem.

Table 7. Results of the Model (3), Examination of Stickiness with Delta Variable

variables	Coefficient	Std. err	sig	VIF
Delta	**-2.030**	**6.010**	**0.001**	**1.000**
Governance	**0.0008**	**0.0001**	**0.000**	**1.000**
Chow	F		12.990	
	Sig		0.000	
Hausman	Chi2		1.420	
	sig		0.233	
Wiggins and Poi	Chi2		-5616.250	
	sig		1.000	
Wooldridge	F		0.000	
	Sig		0.995	
Wald	Chi2		22.120	
	Sig		0.000	

Table 8. Results of the Model (4), Examination of Stickiness with Vega Variable

Variables	Coefficient	Std. err	Sig	VIF
Vega	**3.430**	**1.730**	**0.048**	**1.000**
Governance	**0.0011**	**0.0008**	**0.190**	**1.000**
Chow test	F		10.360	
	Sig		0.000	
Hausman test	Chi2		3.650	
	sig		0.056	
Wiggins and Poi test	chi2		-10528.130	
	sig		1.000	
Wooldridge test	F		8.562	
	Sig		0.004	
Wald	Chi2		1.720	
	Sig		0.000	

The (3) and (4) models can be implemented with and without the governance variable. In both cases, the results show the negative coefficient for Delta and the positive coefficient for Vega. Delta's coefficient is negative, meaning Delta increases the degree of stickiness. The positive coefficient of Vega indicates that Vega reduces stickiness, so the first and second hypotheses are confirmed generally.

In order to reconfirm the research hypotheses, models (5) and (6) that include more variables were

also estimated. The results of the Model (5) in Table (9) confirm the first hypothesis and the results of the Model (6) in Table (10) confirm the second hypothesis of the research.

Table 9. Results of Model (5), Examination for Stickiness of SG&A Costs with Delta and Other Related Factors

variables	Coefficient	Std. err	Sig	VIF
Δlnsale × Delta	4.440	9.790	0.000	4.590
Decreasedummy × Δlnsales × Delta	-2.160	6.910	0.002	4.590
Decreasedummy	-0.053	0.029	0.068	5.350
Δlnsale	0.130	0.020	0.00	1.640
Δlnsale × economic	-0.141	0.032	0.00	2.600
Δlnsale × agency	-0.002	0.033	0.932	3.640
Δlnsale × governance	-0.051	0.028	0.066	1.510
Decreasedummy × Δlnsale	0.271	0.134	0.043	4.710
Decreasedummy × Δlnsale × economic	6.852	3.467	0.048	3.960
Decreasedummy × Δlnsale × agency	0.066	0.300	0.825	2.880
Delta	-1.100	3.080	0.00	4.350
Economic	-0.056	0.012	0.00	2.930
agency	-0.008	0.011	0.443	3.990
governance	-0.002	0.007	0.755	1.460
Chow	F		3.918	
	Sig		0.000	
Hausman	Chi2		3.9181	
	Sig		0.000	
Wiggins and Poi	Chi2		322.720	
	Sig		0.000	
Wooldridge	F		3.615	
	Sig		0.594	
Wald	Chi2		278.680	
	Sig		0.000	

Tables (9) and (10) represent the results of models (5) and (6). These two models are in panel form based on their Fisher statistic of the Chow test. The Chi2 statistics of the Hausman test in Tables (9) and (10) are equal to 3.9181 and 2.3232, respectively. According to their significance level, the variables of these two models are fixed. Both models have the problem of heterogeneity variance, based on the results of Wiggins and Poi's test. However, these two models have no autocorrelation problem because their significance levels are above 5%. There is no collinearity problem among variables, given that VIF is lower than 9.

The coefficient of Δlnsale represents a percentage increase in SG&A costs for a 1% increase in sales. In contrast, the total coefficient of Δlnsale and decrease dummy × Δlnsale represents a percentage reduction in SG&A costs for a 1% reduction in sales. When the cost behavior is sticky, the coefficient of Δlnsale is expected to be positive and the coefficient of decreasing dummy × Δlnsale is negative. In addition, the coefficients of Δlnsale × Delta and Δlnsale × Vega indicate a percentage increase in SG&A costs followed by a 1% increase in sales based on Delta and Vega levels.

Table 10. Results of the Model (6), Examination of Stickiness SG&A Costs with Vega and Other Related Factors

variables	Coefficient	Std. err	Sig	VIF
Δlnsale × Vega	-1.090	2.790	0.000	6.460
Decreasedummy × Δlnsales × Vega	8.320	3.050	0.006	1.020
Decreasedummy	0.055	0.031	0.078	2.050
Δlnsale	0.464	0.054	0.000	1.250
Δlnsale × Economic	-0.044	0.018	0.018	2.130
Δlnsale × Agency	0.019	0.039	0.490	2.820
Δlnsale × Governance	-0.064	0.046	0.167	2.740
Decreasedummy × Δlnsale	-0.212	0.121	0.080	4.160
Decreasedummy × Δlnsale × Governance	0.091	0.098	0.355	3.220
Decreasedummy × Δlnsale × Agency	-0.035	0.084	0.672	2.690
Vega	6.810	6.520	0.296	6.460
Economic	-0.056	0.015	0.000	1.300
Agency	-0.015	0.014	0.299	2.500
Governance	0.016	0.019	0.830	2.390
Chow	F			2.323
	Sig			0.000
Hausman	Chi2			2.323
	Sig			0.000
Wiggins and Poi	Chi2			1635.090
	Sig			0.000
Wooldridge	F			0.855
	Sig			0.356
Wald	Chi2			127.010
	Sig			0.000

Also, the coefficients of Decreasedummy×Δlnsale×Delta and Decreasedummy×Δlnsale×Vega in both models indicate a percentage reduction in SG&A costs followed by a 1% decrease in sales based on Delta and Vega levels. In Model (5), due to the sticky costs, the coefficient sign of Δlnsale×Delta is positive and the coefficient sign of Decreasedummy×Δlnsale×Delta is negative, indicating the research's first hypothesis is correct. Moreover, in Model (6), the coefficient sign Δlnsale×Vega is negative and the coefficient sign Decreasedummy×Δlnsale×Vega is positive, considering that costs are anti-sticky. They are proving the second hypothesis of the research, indicating that the second hypothesis is also correct.

5. Conclusion

This paper examined the relationship between managers' incentives and asymmetric cost behavior, and the sensitivity of managers' wealth to the changes in stock price (Delta) and stock return (Vega) was used as measures of managers' incentives. This study showed that Delta has a significant direct effect on sticky costs. Managers in companies with higher Deltas increase SG&A costs quickly in response to rising sales. Still, they will lower these costs in response to delays in declining sales, so the first hypothesis of this research is confirmed. In contrast, Vega has a significant inverse effect on sticky costs, and the research results show that high-Vega managers avoid increasing SG&A costs in response to increased sales. Still, in response to decreased sales, they cut the costs quickly. This conclusion proves the second hypothesis of the research, which represents the negative and significant

effect of Vega on the cost stickiness. Managers with high Deltas are generally more inclined to manage SG&A costs to increase the company's long-term costs. In contrast, high-Vega managers try to manage SG&A costs by monitoring credits. An adequate understanding of the effect of managers' incentives on cost stickiness will reduce conflicts of interest caused by agency problems. In addition, understanding asymmetric cost behavior contributes to more efficient reporting. The results of this research conform to the studies of Brisker et al. (2022) and Anderson et al. (2003). According to the confirmation of the effect of Delta and Vega, which represents managers' incentives on the asymmetric behavior of costs, information about the stickiness of costs is used by managers for making decisions about planning, budgeting, pricing and generally predicting how costs behave based on changes in activity level or sales level. Also, the results of this research provide helpful information for managers, financial analysts, researchers and students; by considering the phenomenon of cost stickiness, decisions can be made based on facts; moreover, the decision outcome will be more reliable.

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