The Effect of Managers' Delta and Vega on Asymmetric Cost Behavior of Companies Listed in the Tehran Stock Exchange

Sana Forsat, Ali Ashtab*, Parviz Piri

Department of Accounting, Faculty of Economics and Management, Urmia university, Urmia, Iran

Abstract

The objective of this paper is to examine the effect of managers' stock on changes in sales, general and administrative (SG&A) costs, which can determine whether SG&A costs are sticky or non-sticky. In this study, two criteria for managers' incentives were used. The first one is managers' wealth sensitivity to stock price changes (Delta) and the second one is managers' wealth sensitivity to stock return (Vega). The first hypothesis of the study states that Delta is effective on cost stickiness while costs experience more significant increase in response to increased sales than decreased sales. On the contrary, the second hypothesis states that Vega has a direct effect on non-sticky costs; while costs experience less increase in response to increased sales than decreased ones. The statistical sample of this study is 138 companies from 2008 to 2023. To test the hypotheses, a panel regression model was used, which showed that Delta has a significant positive effect and Vega has a significant negative effect on cost stickiness.

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 is 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 in 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). In this paper the effect of two factors, Delta and Vega on asymmetric cost behavior is investigated.

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 & Loy, 2022). Managers' understanding of the asymmetric cost behavior improves their performance and future predictions. In general, when there is a reduction or decrease in costs, wiser decisions can be made (Hasani and Lal Bar, ۲۰۲۱). 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 future product or service demand or managers' incentives. Moreover, when there is a decline in sales, the ability of managers to reduce the level of 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 & Sohrabi, ۲۰۲۲).

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 to stock changes and Vega to stock returns. Therefore, this study aims to determine whether Delta has a significant positive effect on cost stickiness and Vega on non-stickiness of costs or not.

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 leads to improved managers' performance, because in Delta portfolios, directors share dividends and losses with shareholders. 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, after reviewing the descriptive statistics and findings, the conclusion is discussed.

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's shares by directors is critical in order to eliminate this problem and increase motivations of managers. Because managers who own company's shares are less likely to do things that lead to company's value reduction. Equity has two different effects on management incentives about risk, the first effect is the wealth sensitivity of management to the stock price which is called Delta (Brisker et al, 2022) and it 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 taking risky decision, because it increases the effect of change in stock prices on managers' wealth portfolio (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 in operational, investment and financial decisions. The portfolio value of manager's stock option increases by 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, higher leverage, and more focus 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

The relationship between activity levels and changes in costs has been studied by many researchers, and there are several theories in this regard. 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, SG&A costs that are examined in this study are sticky. Based on research by Anderson et al (2003), when revenue increase 1%, SG&A costs increase 0.55%, but when sales decrease 1%, SG&A costs decrease 0.35% (Hosseini pour et al, 2019). Generally, cost stickiness is a feature of cost behavior about changes in activity level. It suggests that the increase in costs 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 has an impact on cost stickiness is the information that 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 which the company is operating in its market has a significant impact on 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, that is a vital asset today, has an essential impact on the company's success. Hence, management should consider the costs of losing a part of the human resources when making a decision. 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, when the volume of activity decreases; which is called the cost stickiness (Banker and Chen, 2006). In general, cost stickiness is one of the features of cost behavior about 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 in order to understand the importance of sticky costs, including Restuti et al (2023) that study on 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 represents that the cost stickiness which is created by environmental information uncertainty, is higher in companies with poor management in terms of different strategies. Just as managers' ability is practical on stickiness of costs, weakness in management of company increases the effect of environmental uncertainty on cost stickiness.

Hashemipour et al (2023), by investigating the effect of factors arising from the country's political-economic structure on the stickiness of corporate costs, realize that political decisions, government ownership structure, GDP growth, political communication and the amount of inflation that exist 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 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), in examining the effect of weak internal controls on the stickiness of SG&A costs, 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. This main cause for 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 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), examined the commercial debt and stickiness of costs with emphasis on the agency problem and 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 stickiness of corporate cost. In addition, the agency problem reinforces the inverse link between business debt and corporate cost stickiness.

Nekouizadeh (2022) examined the moderating effect of corporate governance on the relationship between earnings management and cost stickiness. According to this study, 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 results of the research indicate that the more employees there are, the stickier the cost on the labor force will be.

Karimzadeh et al (2021), examined the moderating effect of agency problem on the relationship between business credit and stickiness of costs and found that by 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. Changes in price is calculated from the difference in the price of the stock of the last year and the year under review. The stock return is considered as the fluctuation of 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, in order 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 the temporary market conditions or constant changes in the market, managers with high Delta are more likely to wait and postpone resource adjustments until they have a better understanding of 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 which are related to Vega's debts, creditors are likelier to strengthen debt monitoring using short-term debt and related financial contracts (Brockman et al, 2010). Banker and Fung (2014) 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 performance more 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 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 incentivizes high-vega managers to reduce committed resources immediately after sales decline. As a result, Vega incentivizes managers to make downward adjustments for resources immediately, 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 for data analyzing. The statistical population of this study includes 138 companies which are listed in Tehran Stock Exchange during the years 2008 to 2023. In this statistical population, the companies that have been accepted after 2008, the companies present in the banking, insurance and investment industry, and companies that their 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.

$$\Delta lnSG\&A_{it} = \beta_0 + \beta_1 \Delta lnsale_{it} + \beta_2 \text{ Decreasedummy}_{it} \times \Delta lnsale_{it} + \mathcal{E}_{it} \ (1)$$

$$\Delta lnSG\&A_{it} = \beta_0 + \beta_1 \Delta lnsale_{it} + \beta_2 \text{ Decreasedummy}_{it} \times \Delta lnsale_{it}$$
$$+ \beta_3 \text{ Decreasedummy}_{it} \times \Delta lnsale_{it} \times \text{Successivedecrease}_{it}$$
$$+ \beta_4 \text{ Decreasedummy}_{it} \times \Delta lnsale_{it} \times \text{Aassetintensity}_{it}$$
$$+ \beta_5 \text{ Decreasedummy}_{it} \times \Delta lnsale_{it} \times \text{Employeeintensity}_{it}$$
$$+ \beta_6 \text{ Decreasedummy}_{it} \times \Delta lnsale_{it} \times \text{Stockperformance}_{it}$$
$$+ \text{Successivedecrease}_{it} + \text{Assetintensity}_{it} + \text{Employeeintensity}_{it}$$
$$+ \text{Stockperformance}_{it} + \mathcal{E}_{it} \ (2)$$

The dependent variable of these two models is $\Delta lnSG\&A$, which is defined as long-term changes in SG&A costs. $\Delta lnSale$ 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). Successive decrease is also a binary variable that 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 also, stock performance describes stock returns of the current year.

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

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

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

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):

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

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

$$\text{SG\&Aratio} = \frac{SG\&A_t}{SALES_t} - \frac{SG\&A_{t-1}}{SALES_{t-1}} \ (3\text{-}1\text{-}1)$$
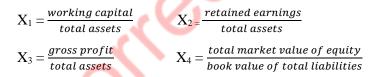
SG&A shows sales, general and administrative costs in year t and t-1. The Sales variable shows sales in the same years. D_{it}^{SALES} is defined as if $\frac{SALES_t}{SALES_{t-1}} < 1$ it would be 1 and if $\frac{SALES_t}{SALES_{t-1}} \geq 1$ it would be 0 and also $D_{it}^{SG\&A}$ is defined as if 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:

$\sum \Theta$ Governance$_{it}$ = Θ_0 + Θ_1Productmarketcompetition$_{it}$ + Θ_2Auditor$_{it}$ + Θ_3 Creditrating$_i$ (3-2)

Product market competition is the Herfindahl-Hirschman Index (HHI) calculated as the sum of squared market share by using firm sales, based on two-digit (SIC) industry classification in year t. Auditor is a variable that defines as, if the company is audited by the audit organization, is 1 otherwise 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

$X_1 = \frac{working\ capital}{total\ assets}$ $X_{2\ =} \frac{retained\ earnings}{total\ assets}$

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

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

$$\Delta lnSG\&A_{it} = \beta_0 + \beta_1 \, Decreasedummy_{it} + \beta_2 \, \Delta lnsale_{it}$$
$$+ \beta_3 \, \Delta lnsale_{it} \times Delta_{it} + \Delta lnsale_{it} \times \sum\lambda \, Economic_{it}$$
$$+ \Delta lnsale_{it} \times \sum\mu \, Agency_{it} + \Delta lnsale_{it} \times \sum\Theta \, Governance_{it}$$
$$+ \beta_4 \, Decreasedummy_{it} \times \Delta lnsale_{it} + \beta_5 \, Decreasedummy_{it}$$
$$\times \Delta lnsale_{it} \times Delta_{it} + Decreasedummy_{it} \times \Delta lnsale_{it}$$
$$\times \sum\lambda Economic_{it} + Decreasedummy_{it} \times \Delta lnsale_{it} \times \sum\mu \, Agency_{it}$$
$$+ Decreasedummy_{it} \times \Delta lnsale_{it} \times \sum\Theta Governance_{it} + Delta_{it}$$
$$+ \sum\lambda \, Economic_{it} + \sum\mu \, Agency_{it}$$
$$+ \sum\Theta \, Governance_{it} + \mathcal{E}_{it} \quad (5)$$

A model similar to the previous model is examined with the Vega variable for the second hypothesis, and $\beta 3$ is expected to be negative and $\beta 5$ positive (Brisker et al, 2022).

$$\Delta lnSG\&A_{it} = \beta_0 + \beta_1 \, Decreasedummy_{it} + \beta_2 \, \Delta lnsale_{it}$$
$$+ \beta_3 \, \Delta lnsale_{it} \times Vega_{it} + \Delta lnsale_{it} \times \sum\lambda \, Economic_{it} + \Delta lnsale_{it}$$
$$\times \sum\mu \, Agency_{it} + \Delta lnsale_{it} \times \sum\Theta \, Governance_{it}$$
$$+ \beta_4 Decreasedummy_{it} \times \Delta lnsale_{it} + \beta_5 \, Decreasedummy_{it}$$
$$\times \Delta lnsale_{it} \times Vega_{it} + Decreasedummy_{it} \times \Delta lnsale_{it}$$
$$\times \sum\lambda \, Economic_{it} + Decreasedummy_{it} \times \Delta lnsale_{it} \times \sum\mu \, Agency_{it}$$
$$+ Decreasedummy_{it} \times \Delta lnsale_{it} \times \sum\Theta \, Governance_{it} + Vega_{it}$$
$$+ \sum\lambda \, Economic_{it} + \sum\mu \, Agency_{it} + \sum\Theta \, Governance_{it} + \mathcal{E}_{it} \quad (6)$$

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

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

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

For calculating free cash flow, profits of common and preferred stock are deducted from cash flows of operating activities and the final number is divided by the total assets. CEO Tenure represents the number of years the CEO has been in that position and CEO horizon is defined as if it is

the year the CEO changes or the year before the CEO changed, the number 1 otherwise 0 would be assigned.

4. Research Findings

Tables (1) to (4) show descriptive statistics. In Table (1), the mean, median, standard deviation, maximum and minimum of quantitative variables are described. For instance, the sticky variable with a mean of 0.001 and median of 0.000 shows a normal distribution. Table (2) includes count and percentage of the binary variables that has been used in the research; as an example, for decrease dummy, value 1 is 440 which means there are 440 year-company that experienced decrease in their sales compered to the last year. Table (3) is reporting the credit rating variable of the companies. Number 3 represents the financial health of the company and 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	2.04e+08	70749195	۳/۱۲E+08	9.31E+08	-97585053
Vega	2.42e+14	4.13e+14	8.18E+14	2.09E+15	-9.20E+14
Sticky	0.001	0.000	0.004	0.014	0.000
Δlnsale	0.221	0.207	۰/۲۷۳	۰/۷۵۲	-0.290
ΔlnSG&A	0.214	0.208	۰/۲۷۴	۰/۷۷۳	-۰/۳۳۷
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	۰/۹۳۹	۱/۵۷۷	-1.357
Governance	-0.040	-0.293	0.872	2.244	-0.925
Asset intensity	1.387	1.238	۰/۶۹۱	۳/۱۶۰	۰/۴۹۶
Employee intensity	0.000	0.000	0.000	0.002	3.56E-05
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	80.07	19.93	100
CEO horizon	1534	674	2208	69.47	30.53	100
Auditor	1719	489	2208	77.85	22.15	100
Successive decrease	1752	456	2208	79.35	20.65	100
Dsale	1768	440	2208	80.07	19.93	100
DSG&A	1134	1074	2208	51.36	48.64	100

Table (3) Descriptive statistics of Credit rating

Value	Count	Percent
1	116	5.25
2	118	5.34
3	1974	89.40
Total	2208	100

Table (4) Descriptive statistics of CEO Tenure

Value	Count	Percent
1	674	30.53
2	483	21.88
3	344	15.58
4	224	10.14
5	142	6.43
6	95	4.30
7	67	3.03
8	48	2.17
9	37	1.67
10	27	1.22
11	19	0.86
12	16	0.72
13	11	0.50

14	7	0.32
15	4	0.18
16	4	0.18
17	3	0.14
18	3	0.14
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, 0.000 median is reported for this variable. In general, all data in this variable ranges from 0 to 0.014. In Table (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, 1974 year-company which is about 90% of all year-companies, are in the financial health zone.

The results of the examination for evaluating the existence of SG&A cost stickiness, show an asymmetric behavior in these costs. The results of model (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
Δlnsales	0.5008	0.257	0.00	1.06
Decreasedummy $\times$ Δlnsales	-0.3346	0.0887	0.00	1.06
Chow	F		3.886	
	Sig		0.00	
Hausman	Chi2		5.943	
	Sig		0.0512	
Wiggins and Poi	Chi2		305.35	
	Sig		0.00	
Wooldridge	F		3.901	
	Sig		0.0503	
Wald	Chi2		529.69	
	Sig		0.00	

Table (6) Results of the Model (٢); Examination of SG&A Costs with Economic Variables

variables	Coefficient	Std. err	Sig	VIF
Δlnsales	0.3763	0.0170	0.00	2.20
Decreasedummy × Δlnsales	-0.2566	0.1220	0.035	6.54
Decreasedummy × Δlnsale × Successivedecrease	-2.8969	1.8685	0.121	1.74
Decrease dummy × Δlnsale × Assetintensity	-0.0974	0.1298	0.453	8.96
Decrease dummy × Δlnsale × Employeeintensity	-274.5588	414.6949	0.508	8.03
Decrease dummy × Δlnsale × Stockperformance	-0.2887	0.3818	0.450	1.08
Successive decrease	-0.0738	0.0207	0.00	5.80
Asset intensity	0.0027	0.0058	0.639	3.21
Employee intensity	-50.7510	7.0212	0.00	2.17
Stock performance	-0.0013	0.0038	0.728	1.51
Chow	F		3.8561	
	Sig		0.00	
Hausman	Chi2		12.7911	
	Sig		0.2356	
Wiggins and Poi	Chi2		334.59	
	Sig		0.00	
Wooldridge	F		3.238	
	Sig		0.0742	
Wald	Chi2		1085.29	
	Sig		0.00	

Fisher statistics of Chow test model (1) and model (2) are equal to 3.886 and 3.8561, respectively. Both of them are significant (0.00), also, both of these models are in the form of panel. The Chi2 statistics of the

Hausman test for model (1) is 5.943 with a significance level of 0.0512, which indicates that variables are random. In the model (2), the Chi2 statistics of 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 the information of Wiggins and Poi test about model (1) and (2), both of these models have variance heterogeneity problem. The data related to these two models in table (1) and (2) show that the significance level of Wooldridge test is above 5% and these two models have no problem in 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, shows the increase percentage in SG&A costs per 1% increase in sales. For example, in table (5), this coefficient is 0.5008, which represents a 0.5% increase SG&A costs for a 1% increase in sales. The total coefficients of Δlnsale and decreasedummy × Δlnsale represent the reduction percentage in SG&A costs per 1% reduction in sales, which in model (1) it 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 model (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. The results of Table (7) are used to prove the first hypothesis and Table (8) are 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) of these 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 data about Wiggins and Poi test and Wooldridge test in table (7), the model (3) has no heterogeneity of variance and no autocorrelation problem. According to the table (8), the significance level of Wiggins and Poi test shows that there is no heterogeneity problem but there is an autocorrelation problem based on the significance level of 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	-2.03e-12	6.01e-13	0.001	1.00
Governance	0.0008888	0.000189	0.00	1.00
Chow	F		12.99	
	Sig		0.00	
Hausman	Chi2		1.42	
	sig		0.2330	
Wiggins and Poi	Chi2		-5616.25	
	sig		1.00	
Wooldridge	F		0.00	
	Sig		0.9956	
Wald	Chi2		22.12	
	Sig		0.00	

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

Variables	Coefficient	Std. err	Sig	VIF
Vega	3.43e-18	1.73e-18	0.048	1.00
Governance	0.0011168	0.0008515	0.190	1.00
Chow test	F		10.36	
	Sig		0.00	
Hausman test	Chi2		3.65	
	sig		0.0560	
Wiggins and Poi test	chi2		-10528.13	
	sig		1.00	
Wooldridge test	F		8.562	
	Sig		0.0040	
Wald	Chi2		1.72	
	Sig		0.00	

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. The coefficient of Delta is negative, which means Delta increases the degree

of stickiness. The positive coefficient of Vega indicate 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 $\times$ Delta	4.44e-10	9.79e-11	0.00	4.59
Decreasedummy $\times \Delta$lnsales $\times$ Delta	-2.16e-08	6.91e-09	0.002	4.59
Decreasedummy	-0.0532	0.0291	0.068	5.35
Δlnsale	0.1308	0.0203	0.00	1.64
Δlnsale $\times$ economic	-0.1411	0.0329	0.00	2.60
Δlnsale $\times$ agency	-0.0028	0.0337	0.932	3.64
Δlnsale $\times$ governance	-0.0514	0.0280	0.066	1.51
Decreasedummy $\times \Delta$lnsale	0.2714	0.1342	0.043	4.71
Decreasedummy $\times \Delta$lnsale $\times$ economic	6.8521	3.4675	0.048	3.96
Decreasedummy $\times \Delta$lnsale $\times$ agency	0.0664	0.3001	0.825	2.88
Delta	-1.10e-10	3.08e-11	0.00	4.35
Economic	-0.0560	0.0126	0.00	2.93
agency	-0.0085	0.0111	0.443	3.99
governance	-0.0023	0.0073	0.755	1.46
Chow	F		3.9181	
	Sig		0.00	

	Chi2	3.9181
Hausman	Sig	0.00
Wiggins and Poi	Chi2	322.72
	Sig	0.00
Wooldridge	F	3.615
	Sig	0.594
Wald	Chi2	278.68
	Sig	0.00

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	-1.09e-19	2.79e-20	0.00	6.46
Decreasedummy × Δlnsales × Vega	8.32e-19	3.05e-19	0.006	1.02
Decreasedummy	0.0550	0.0312	0.078	2.05
Δlnsale	0.4642	0.0546	0.00	1.25
Δlnsale × Economic	-0.0446	0.0189	0.018	2.13
Δlnsale × Agency	0.0192	0.0396	0.49	2.82
Δlnsale × Governance	-0.0649	0.0469	0.167	2.74
Decreasedummy × Δlnsale	-0.2122	0.1213	0.080	4.16
Decreasedummy × Δlnsale × Governance	0.0913	0.0986	0.355	3.22
Decreasedummy × Δlnsale × Agency	-0.0359	0.0849	0.672	2.69
Vega	6.81e-21	6.52e-21	0.296	6.46
Economic	-0.0565	0.0153	0.00	1.30
Agency	-0.0152	0.0147	0.299	2.50

Governance	0.0161	0.0195	0.83	2.39
Chow	F		2.3232	
	Sig		0.00	
Hausman	Chi2		2.3232	
	Sig		0.00	
Wiggins and Poi	Chi2		1635.09	
	Sig		0.00	
Wooldridge	F		0.855	
	Sig		0.3568	
Wald	Chi2		127.01	
	Sig		0.00	

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 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, there is no autocorrelation problem in these two models, because the significance levels of both of them 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 decrease 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.

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 the 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, which indicates the first hypothesis of the research is correct. Moreover, in the 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 correct as well.

5. Conclusion

In this paper, the relationship between managers' incentives and asymmetric cost behavior, was examined and the sensitivity of managers' wealth to the changes in stock price (Delta) and stock return (Vega) was used as measures of managers' incentives. The results of 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 but they will lower these costs in response to delays of declining sales, so the first hypothesis of this research is confirmed. In contrast, Vega has a significant inverse effect on sticky costs and the results of the research show that high-vega managers avoid increasing SG&A costs in response to increased sales, but in response to decreased sales, they will 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. In general, managers with high Deltas are more inclined to manage SG&A costs in order to increase the company's long-term costs. In contrast, high-vega managers try to manage SG&A costs with the aim of monitoring credits. Adequate understanding about the effect of managers' incentives on cost stickiness will reduce conflicts of interest caused by agency problem. In addition, understanding the asymmetric cost behavior contributes to more efficient reporting. The results of this research conform 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 outcome of the decision will be more reliable.

References

Anderson, M. C., R. D. Banker and S. N. Janakiraman (2003). "Are selling, general, and administrative costs "sticky"?" Journal of Accounting Research 41(1): 47-63.

Banker, R. D. and L. Chen (2006). "Predicting earnings using a model based on cost variability and cost stickiness." The accounting review 81(2): 285-307.

Banker, R. D., and S. Fang. 2016. Real cost management around loan financing. Working paper, Temple University

Brisker, E. R., J. C. Park and H. Song (2022). "Managers' equity incentives and asymmetric cost behavior." Journal of Management Accounting Research 34(2): 43-69.

Brockman, P., X. Martin and E. Unlu (2010). "Executive compensation and the maturity structure of corporate debt." The Journal of Finance 65(3): 1123-1161.

Calleja, K., M. Steliaros and D. C. Thomas (2006). "A note on cost stickiness: Some international comparisons." Management Accounting Research 17(2): 127-140.

Chen, C. X., H. Lu and T. Sougiannis (2012). "The agency problem, corporate governance, and the asymmetrical behavior of selling, general, and administrative costs." Contemporary Accounting Research 29(1): 252-282.

Coles, J. L., N. D. Daniel and L. Naveen (2006). "Managerial incentives and risk-taking." Journal of financial Economics 79(2): 431-468.

Guay, W. R. (1999). "The sensitivity of CEO wealth to equity risk: an analysis of the magnitude and determinants." Journal of financial economics 53(1): 43-71.

Hartlieb, S. and T. R. Loy (2022). "The impact of cost stickiness on financial reporting: evidence from income smoothing." Accounting & Finance 62(3): 3913-3950.

Hasani, M, and Lal Bar,A (2021). "The Impact of Competitive Strategies (Cost Leadership and Differentiation) and Management Ability on Earnings Quality and Cost Adhesion in Stock Companies." National Defense Strategic Management Studies 5(18): 229-262.

Hashemipour, Z., Mansouri, F., Gholami, R. and Safa, M. (۲۰۲۳). "The effect of factors arising from the country's political-economic structure on the stickiness of corporate costs." Financial Accounting and Auditing Research 15 (1): 239-258

Heidari Haratmeh, M. & Shirinbakhsh, Sh. (2018). "Investigating the Effect of Flexibility on Stock Returns." Financial knowledge of Securities Analysis 11(39): 49-67

Hosseinipour, R, Nasirizadeh, F, and Abbaszadeh, M (2019). "Determinants of Cost Adhesion Behavior." Accounting knowledge 39(10): 177-214.

Jafari, S.M and Ahmadvand, M (2015). "Credit Ranking of Listed Companies in Tehran Stock Exchange Using Emerging Market Rating Approach." Journal of Economics and Business 10(6): 37-56.

Karimzadeh, A., Rezaei, N., Hajiha, Z. and Abdi, R. (۲۰۲۲). "Investigating the moderating effect of agency issues on the relationship between business credit and stickiness of costs." Quarterly Capital Market Analysis 1 (3): 124-151

Kim, J.-B., J. J. Lee and J. C. Park (2022). "Internal control weakness and the asymmetrical behavior of selling, general, and administrative costs." Journal of Accounting, Auditing & Finance 37(1): 259-292.

Lewellen, K. (2006). "Financing decisions when managers are risk averse." Journal of financial economics 82(3): 551-589.

Low, A. (2009). "Managerial risk-taking behavior and equity-based compensation." Journal of financial economics 92(3): 470-490.

Mansourfar, Gh., Heydari, M. and Koolani, T. (۲۰۱۷). "The Impact of Real Profit Management and Management Incentives on Cost Adhesion." Quarterly Journal of Asset Management and Financing 5(1): 1-16

Nekoueizade, Sh (2022). "Investigating the Moderating Effect of Corporate Governance on the Relationship between Earnings Management and Cost Adhesion in Companies Listed in Tehran Stock Exchange." Journal of Research in Accounting and Economic Sciences 6(4): 1-11

Panagopoulos, N. G., R. Mullins and P. Avramidis (2018). "Sales force downsizing and firm-idiosyncratic risk: The contingent role of investors' screening and firm's signaling processes." Journal of Marketing 82(6): 71-88.

Parsaei, M, and Sohrabi, S. (2022). "Business Debt and Stickiness of Costs with Emphasis on Problem of agency and Customer Focus." Empirical Research of Accounting, 12(44), 65-90.

Restuti, M. D., L. Gani, E. R. Shauki and L. Leo (2023). "Cost stickiness behavior and environmental uncertainty in different strategies: Evidence from Southeast Asia." Business Strategy & Development 6(1):972–985

Sajadi, S.H., Hajizad, S. and Nikkar, J. (2014). "The effect of cost adhesion on the time symmetry of profit with an emphasis on the relationship between cost adhesion and conditional conservatism." Journal of Accounting Knowledge 5(16): 81-99.

Shirafkan Lemso, M, Masoumzadeh Soureh, S&Sayareh, M (2017). "Investigating the convergence of stock markets returns in Iran: Inder lunch approach and beta convergence." Applied Economics 7 (No. 23): 77-87.

Vadiei, M. and Salehi, M (2022)"Investigating the relationship between labor force adjustment costs and stickiness of costs." Ethics and Behavior Studies in Accounting and Auditing 2 (1):7-28

Wu, M. and M. Wilson (2022). "How well do analysts really understand asymmetric cost behavior?" Accounting & Finance 62(3): 3951-3985.

Zorn, M. L., P. M. Norman, F. C. Butler and M. S. Bhussar (2017). "Cure or curse: Does downsizing increase the likelihood of bankruptcy?" Journal of Business Research 76: 24-33.