Article

Investigating the cost stickiness behavior of organizations after the economic recession caused by the COVID-19 pandemic

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Abstract: The global economic recession has caused pessimism in terms of prospects of sales recovering in the future. The present study is an attempt to investigate the cost stickiness behavior by focusing on specific characteristics of companies. The research was done through documentary analysis and access to quantitative data, with the use of statistical methods for analysis as panel data. The statistical population of the actual study included all companies listed on the India stock exchange from 2017 to 2021. They were selected after screening 128 listed companies. The regression method was used to examine the relationship between variables and to present a forecast model. The results of testing the first hypothesis showed that companies' costs are sticky and according to the results of this hypothesis, an increase in costs when the level of activity increases is greater than the level of reduction in costs when the volumes of the activities are decreased. The results of the second hypothesis showed a remarkable relationship between the cost stickiness and specific characteristics of companies (size, number of employees, long-term assets, financial leverage, and accuracy of profits forecast). Based on the third hypothesis, there is a notable difference between cost stickiness at different levels of specific characteristics of companies. Therefore, the results show that environmental uncertainty such as COVID-19, increases cost stickiness.

Keywords: cost stickiness; financial characteristics; India stock exchange; financial leverage; economic recession; environmental uncertainty

1. Introduction

The COVID-19 pandemic has disorganized the world economy and is spreading globally. Amid a slowdown in India's economy with production disturbance, the functioning of global supply chains has been disrupted. Organizations across the world, regardless of size, dependent on inputs from India have started experiencing a shrinking in production. In the era of COVID-19, the transportation sector has been affected and constrained among countries has further slowed down overall economic activities. Most importantly, consumers' and businesses' concerns have disrupted typical consumption patterns and caused market aberrations (Karuppiah et al., 2021). Global financial markets also reacted to the changes and world stock indices fell. This element changes the cost behavior (Scherf et al., 2022).

In a typical model of cost behavior, commonly recognized in the accounting literature, costs are considered fixed or changeable based on changes in the activity

level. In the late 1960s and early 1970s, Solomon and Stabus referred to the relationship between activities and costs (Jin and Wu, 2021). However, serious attention was paid to this issue in academic and professional communities in 1980. According to the literature, costs are divided into fixed and variable categories depending on changes in the level of activity. Based on this theory, the variable cost changes in proportion to the changes in the cost stimulus, which is the level of activity (Han et al., 2019). In 2003, Anderson et al. (2003) presented the assumption of cost stickiness, and a new literature was introduced. In this literature, it is argued that the intensity of cost reduction due to reduction in activity volume is lower than the level of cost increases due to the in-activity volume. This type of behavior is called sticky cost (Cannon, 2014).

Based on the rational decisions theory, cost stickiness is the result of managers' deliberate decisions. According to Anderson et al. (2003), cost sticking occurs because managers deliberately adjust the resources related to operational activities. In contrast, while maintaining additional resources during periods of declining sales leads to higher costs and thus lower current period profits, it reduces costs and increases profits in the long term. Moreover, if managers reduce resources related to operational activities in proportion to the decline of sales, it will take time to prepare the resources needed in the future. Thus, if resources and costs are reduced in proportion to declining sales, the company loses opportunities to expand sales, since it cannot use the resources needed to expand sales fast enough to take advantage of opportunities (Lee et al., 2021). For this reason, managers must decide between the cost-reducing options by eliminating resources or incurring more costs to take full advantage of future sales increases. One of the leading causes of cost stickiness is the deliberate decisions of managers who try to increase profits in the long term according to future sales forecasts (Chen et al., 2012).

Cheng et al. (2018) argue that company size is one of the determinants of cost stickiness. In large companies, the level of fixed assets is higher than in small companies. Maintaining a high fixed asset level in large companies reduces the stickiness of sales, administrative, and public costs and increases the stickiness of the cost of sold goods. Also, their research results show that reducing capacity costs related to fixed assets may be difficult in the short term. Surprisingly, an increase in the ratio of employees to sales revenue indicates an increase in the stickiness of the cost of goods sold, but the stickiness decreases in the public and administrative sales costs (Zhong et al., 2020). In this regard, it can be stated that the stickiness of the cost of sold goods may be a function of the problems related to a reduction in direct wages (Prabowo et al., 2018). However, when the effect of criteria such as the employees' number, and the level of fixed assets on cost stickiness separately for industries were examined, it was found that in manufacturing companies, the level of fixed assets stimulates the stickiness of any costs, including sales, public and administrative costs and the total cost of sold goods or both. This stickiness was less observed in the commercial and financial services industries (Hartlieb et al., 2020). The number of employees in manufacturing and service companies is a stimulus to the cost of sold goods, but it is not a stickiness stimulus in commercial and financial companies (Nuridah and Zulfiati, 2019).

This research extends the literature on sticky cost behavior in three ways. First,

it enriches the related cost literature by documenting the managerial trade-offs related to resource adjustments. To the best authors' understanding, current research is the first that uses profit forecasting accuracy as a contextual variable affecting cost stickiness. Di Giuli and Kostovetsky (2014) investigated the relationship between profit forecasting and selling, general and administrative cost, and documented a significantly positive relationship between the two variables. However, they did not consider the cost behavior associated with the validation of profit forecasting. Second, we follow recent research on sticky cost behavior to theoretically and empirically differentiate strategic versus tactical sticky cost behavior and investigate patterns of cost behavior for these two aspects separately. Third, we widen the study (Bansal et al., 2015). They documented a decrement in profit during an economic crisis but did not investigate the cost behavior pattern across economic requirements. Our paper also contributes to the cost stickiness literature by expanding our comprehension of cost behavior in light of a firm's inter-organizational characteristics.

Given what was stated above, the present study was conducted to examine the cost stickiness behavior by focusing on the specific characteristics of companies listed on the Indian stock exchange and seeks to answer the following questions:

- Are costs related to inter-organizational activities sticky?
- Is there a significant relationship between cost stickiness and specific characteristics of companies after the economic recession caused by the COVID-19 pandemic?
- Is there a significant difference between cost stickiness and accuracy of profit forecasting?

The research makes a notable contribution by delving into the phenomenon of cost stickiness within organizations following the economic downturn precipitated by the COVID-19 pandemic. Through a meticulous methodological approach encompassing documentary analysis, access to quantitative data, and panel data analysis, the study offers a nuanced understanding of how companies navigate cost dynamics in the aftermath of a global crisis. By focusing on companies listed on the Indian stock exchange from 2017 to 2021, the research provides a specific and comprehensive exploration of the subject, capturing diverse organizational responses to economic challenges. Furthermore, the identification of specific company characteristics such as size, number of employees, and financial leverage, alongside the revelation of a notable relationship between environmental uncertainty and cost stickiness, adds depth to the analysis. These insights not only contribute to theoretical knowledge by advancing understanding of cost management behavior post-recession but also offer practical implications for organizational decision-makers grappling with uncertainty, guiding the development of adaptive cost management strategies tailored to varying organizational contexts. Overall, the research enhances scholarly discourse on cost stickiness while offering actionable insights for practitioners navigating turbulent economic landscapes.

In this research, we have explicitly outlined the issue under investigation, which pertains to the cost stickiness behavior of companies in the wake of the global economic recession, particularly focusing on the implications of environmental

uncertainty such as the COVID-19 pandemic. We have emphasized the significance of studying this issue, given the pessimism surrounding sales recovery prospects and the potential impact on organizational cost management strategies. Furthermore, we have provided a clear overview of the methodology employed, including documentary analysis, access to quantitative data, and the use of statistical methods such as panel data analysis and regression analysis. We have also discussed the results obtained from testing hypotheses, highlighting the significant relationship between cost stickiness and specific company characteristics, as well as the notable increase in cost stickiness attributed to environmental uncertainty. Overall, our study makes an incremental contribution to the literature by deepening our understanding of cost stickiness dynamics in the context of economic downturns and environmental uncertainties, thereby providing valuable insights for both academic research and practical implications for organizational decision-making.

The remainder of this research is divided into the following parts. Cost stickiness and firm-specific behavior are discussed in Section 2, where we also present our hypothesis. We outline our research model in Section 3. Section 4 presents key empirical findings. Sections 5 and 6 explain the findings and provide a conclusion.

2. Review of literature

2.1. The concept of cost stickiness

Cost accounting plays a significant role in the analysis of input costs and output resulting from these costs. The cost accounting system helps managers make better decisions that lead to greater productivity and improved profitability (Tang et al., 2022). The traditional cost accounting model assumes that costs are proportional to the level of cost activity. Activity-based costing is a simple linear relationship between cost and activity level. However, some studies have examined the complexity of costs and activities. In contrast to the traditional view, these studies show that the price does not move according to the level of training and they have different responses to the ascending and descending changes of activities. Some researchers first acknowledged that overhead costs are not proportional to activity (Balakrishnan et al., 2004). Accordingly, an increase in expenses when the activity level increases are more significant than a decrease of expenses when the activity level decreases. This form of cost behavior was called "cost stickiness". Following the studies conducted by Krisnadewi et al. (2022), several studies examined various aspects of cost stickiness and enriched the existing literature in this area. In dealing with sticky behavior costs, researchers are divided into three groups. The first group provided more evidence of cost stickiness by duplicating studies conducted by Zulfiati et al. (2020). This group examines the stickiness of different costs (such as the total cost of sold goods and wage costs, public and administrative costs, advertising costs, etc.) for different levels (such as intra-sectoral, intra-company, inter-industries, inter-countries, etc.) and expanded the research literature (Calleja et al., 2006; Weidenmier and Subramaniam, 2003). The second group of researchers examined the factors of cost stickiness (Balakrishnan et al., 2014; Chen et al., 2014). A third group of researchers examined the effect of cost stickiness on profit forecast

management, etc. (Banker and Chen, 2006; Dirks et al., 2011). Cost stickiness indicates economic asymmetry in response to rising and falling sales. In other words, cost stickiness means that an increase in costs when sales increase is more significant than a decrease in the same amount of costs when the sales decrease. For instance, if sales income increases by 15 percent, prices will increase by 10 percent, but if sales income decreases by the same 15 percent, costs will reduce by less than 10 percent. In such conditions, the behavior of prices will be sticky (Hassanein and Younis, 2020).

2.2. Hypothesis development

Based on Restuti et al. (2022), cost behavior is not mechanical and depends on managers' deliberate adjustments. Most other studies that have investigated the factors affecting cost stickiness focus mainly on the role of managers' conscious decisions. According to Schätter et al. (2019), cost stickiness results from managers' asymmetric response to high-demand change. Balakrishnan et al. (2004) investigated the effect of two factors of rate of change in activity level and rate of capacity utilization on management behavior that led to cost stickiness.

The results showed that the rate of changes in costs for small changes in activity level is not much different from the rate of change in costs for significant changes in activity level, but if the company is at a high level of operating capacity, it will have sticky costs. Balakrishnan and Zhu (2014b) examined whether cost structure alone can affect cost stickiness. The results of the research revealed that cost stickiness is related to both fixed and variable cost structures and should be considered in the analysis of cost structures. Chen et al. (2012) examined whether agency problems lead to asymmetric behavior of public costs and distribution and sales. The researchers found a positive relationship between cost asymmetry and managers' motivations (related to agency theory) in the presence of poor corporate governance. The results revealed that corporate governance mechanisms play an essential role in reducing the effect of managers' agency theory problems in adjusting costs by them Li et al. (2021).

The literature identified three critical factors affecting cost asymmetry when sales decline. The first factor is related to fixed costs because when a portion of sales decreases, the cost-to-income ratio increases because fixed costs are constant relative to volume changes. However, the second and third factors are related to variable costs and cost stickiness. The second factor is when sales (activity level) decrease. Thus, the manager's decision to reduce the level of costs or keep resources unused depends on his or her expectations of future demand (Hassanein and Younis, 2020). Suppose that the manager expects the decrease in sales to be temporary and to return to normal in the short term. In that case, they will decide to keep the resources unused since if managers reduce the resources related to operating activities in proportion to the decrease in sales, re-preparing of resources in the future takes time. Thus, the company loses sales expansion opportunities if resources and costs decrease in proportion to declining sales. As a result, adjustment costs will be greater than new capacity costs, and the manager will decide to maintain additional resources (Sun et al., 2021). Also, if there is high uncertainty about future demand

and the cost of reducing and increasing resources again, the manager will decide to wait for more information before estimating adjustment costs (Zhao et al., 2021). Thus, managers may delay the reduction of resources related to operating activities until they gain more confidence in continuity of demand reduction (sales decline). The third factor is when the manager maintains excess capacity due to increased utility or fear of public opinion (agency theory).The overview of cost stickiness is presented in **Table 1**.

Table 1. Determinants of cost stickiness.

Determinants of cost stickiness	References
Employee efficiency	(Anderson et al., 2003; Banker and Chen, 2006; Dias et al., 2020; Javalgi et al., 2006; Weidenmier and Subramaniam, 2003)
Asset quality	(Dias et al., 2020; Moghadam and Sahebi, 2018)
Economic growth	(Abdullah, 2021; Banker and Chen, 2006)
Company leadership	(Chen et al., 2012; Khan et al., 2023)
Industry characteristics	(Calleja et al., 2006; Hassanein and Younis, 2020)
Rate of change in activity	(Abdullah, 2021; Balakrishnan et al., 2004; Calleja et al., 2006; Prabowo et al., 2018; Weidenmier and Subramaniam, 2003; Masoomi et al., 2023)
Existing capacity utilization	(Krisnadewi and Soewarno, 2021; Lee et al., 2020; Meidute-Kavaliauskiene and Ghorbani, 2021)
Fixed asset efficiency	(Weidenmier and Subramaniam, 2003)
Inventory efficiency	(Balakrishnan et al., 2004; Hassanein and Younis, 2020; Weidenmier and Subramaniam, 2003)
Interest rate	(Weidenmier and Subramaniam, 2003)
Climate conditions	(Balakrishnan and Zhu, 2014a; Hassanein and Younis, 2020; Meidute-Kavaliauskiene and Davidaviciene, 2021; Weidenmier and Subramaniam, 2003)
Market fluctuations	(Lee et al., 2020; Weidenmier and Subramaniam, 2003)
Main services	(Balakrishnan and Zhu, 2014b; Hassanein and Younis, 2020; Weidenmier and Subramaniam, 2003)
Type of Ownership	(Balakrishnan et al., 2014; Khamnei et al., 2023; Krisnadewi and Soewarno, 2021)
The nature of resources	(Balakrishnan and Zhu, 2014a; Meidute-Kavaliauskiene et al., 2021)

Also, to control the results of the primary research hypothesis test, the means comparison test and cross-sectional multivariate regression method were used. The results showed that in observations with non-sticky behavior, conservative behavior was observed, but in statements with sticky behavior, there was no evidence of traditional behavior (Cebeci and Ghorbani, 2020). Abdullah (2021) found that administrative, public, and sales costs and the cost of sold goods are sticky. The intensity of stickiness in the cost of sold goods is very high. Indicators such as the number of employees, the level of current assets of the company, and the debt ratio affect the intensity of the stickiness of general administrative costs and total cost of sold goods. However, the intensity of cost stickiness in current assets is less than in fixed assets, and recognizing these characteristics and their impact on cost behavior can be a great help to managers for better analysis and more comprehensive budgeting.

Krisnadewi and Soewarno (2021) examined the effect of cost stickiness on profit management. In this study, using the model of Anderson et al. (2003), the relationship between cost stickiness and profits management was examined. In this study, profits management was examined by two methods, including the Kothari and

modified Jones method, and the presence of control variables of leverage, company size, profitability, ownership structure and agency cost were tested. The results of testing Kothari model showed a significant and direct relationship between cost stickiness and profits management. However, the results of the modified Johns model test showed a significant and inverse relationship between cost stickiness and profits management. It should be noted that with the entry of control variables into the regression equation, no change was observed in the results. Lee et al. (2020) carried out an experimental study of cost stickiness behavior. In this study, administrative, public, and sales costs for the sample were analyzed. The results pointed out that a 1% increase in sales leads to an increase in administrative, general, and sales costs by 0.65%, but a 1% decrease in sales level, organizational, general, and sales costs decrease by 0.41%. Moreover, the results have shown that the intensity of cost stickiness is lower in the periods in which the previous period of income declined. Also, the cost stickiness is higher for companies that have a larger ratio of total assets to sales.

Dierynck et al. (2012) examined the motivation of managers' profits management and cost-sticky behavior. In this study, the dependent variable was wage costs and the independent variables were sales changes, number of employees, level of assets, economic growth, and discretionary accruals. The results of their study revealed that managers of companies that have more profit management motivations are less exposed to cost stickiness. In other words, profit management motivations affect asymmetric cost behavior. Banker et al. (2013) found that when sales of the previous period increase, current period costs show sticky behavior, and when sales during the last period decrease, current period costs have anti-stick behavior. Managers' optimism has a direct impact on present-period cost stickiness and managers' pessimism has an inverse effect on current-period cost anti-stickiness.

Banker and Chen (2006) showed that this model has higher accuracy than additional profits forecast models by testing the profits predictability power of the model based on cost variability and cost stickiness. In general, most studies conducted in this area have emphasized the sticky behavior of costs. Also, some researchers have found evidence of the effect of managers' deliberate decisions on cost-sticky behavior. Chen et al. (2014) examined 5278 business units from 1996 to 2005 in an article entitled "Agency problems, corporate governance, and asymmetric behavior of sales, public, and administrative costs. Based on their results, the asymmetry of costs has a positive relationship with free cash flows and a negative association with corporate governance, and this negative relationship is intensified by management motivations. The research results revealed that the stickiness of sales, public and administrative costs in the period after a decline in sales is reversed and the decrease in sales in two consecutive periods reduces the stickiness of the cost of sold goods and public and administrative costs in the second period. With increasing the level of assets, the stickiness of sold goods, organizational, public, and sales costs increases, but there was no evidence of the impact of the study period, economic growth, and number of employees on cost stickiness (Argilés-Bosch et al., 2017). As mentioned, cost stickiness has several causes.

Another research investigates price stickiness during the COVID-19 epidemic, revealing downward price movement, low stickiness, and a time-dependent pricing

model. The findings suggest effective macro-control measures, with inflation inertia mainly driven by food commodities, highlighting the importance of anchoring policy interventions accordingly (Qin et al., 2022). Financial security management of renewable energy SMEs in Poland during the COVID-19 pandemic were examined by Zimon et al. (2022). Their results indicate that SMEs in the sector have stabilized economically, with shortened receivables collection periods and conservative financial strategies adopted to enhance liquidity security amidst the crisis. Yang and Chen (2023) investigates the impact of intellectual capital efficiency on asymmetric cost behavior in Australian and Chinese firms, finding that it increases cost stickiness overall, with a more pronounced effect in Australia. However, government connections in Chinese firms and the COVID-19 pandemic amplify this effect, suggesting nuanced implications for stakeholders evaluating firms' cost behavior. The effect of COVID-19 on the risk-taking of small and medium-sized, families and non-family firms was analyzed by Al-Maliki et al. (2023). The results indicate that COVID-19 influences small and medium-size family and non-family firms' risk-taking. Carolina et al. (2023) explores cost stickiness behavior in Chinese fishery-listed firms amidst challenges including resource depletion, fishing moratorium extensions, and COVID-19 impacts. Findings suggest firms exhibit significant cost asymmetry, with green supply chain concentration mitigating cost stickiness by enhancing operational efficiency and resource allocation. Salehi et al. (2018) examines the relationship between financial reporting and cost stickiness in Tehran Stock Exchange-listed firms, finding significant associations between various cost components and financial reporting quality. It marks the first study of its kind in Iran, providing valuable insights into the dynamics of cost behavior within the context of financial reporting practices. Finally Connaughton et al. (2023) examine the varied impact of the COVID-19 recession on different US states, revealing significant disparities in job losses, GDP declines, and unemployment rates. Regression analysis highlights the influence of state affiliation, with blue states experiencing weaker recovery compared to red states, offering insights into regional economic resilience during the pandemic.

While the articles provide valuable insights into various aspects of the economic impact of the COVID-19 pandemic, they exhibit several limitations and research gaps. Firstly, many of the studies focus on specific regions or industries, limiting the generalizability of their findings to broader economic contexts. Additionally, some articles rely solely on descriptive statistics or regression analysis without delving into the underlying mechanisms driving observed trends, thereby lacking depth in understanding the causal relationships between variables. Moreover, there is a notable absence of longitudinal studies that track the long-term effects of the pandemic on economic indicators, potentially overlooking important trends that may emerge over time. Furthermore, the reliance on publicly available data may overlook nuanced factors and fail to capture the full extent of economic impacts, especially in regions with limited data availability or transparency. Lastly, while some articles attempt to identify explanatory factors for observed disparities across states or industries, the explanations provided are often preliminary and lack comprehensive theoretical grounding, leaving room for further exploration into the underlying mechanisms driving economic resilience or vulnerability during times of

crisis. Overall, the articles provide valuable initial insights but leave significant room for more rigorous and comprehensive research to address these limitations and deepen our understanding of the economic consequences of the COVID-19 pandemic.

Previous studies have tried to identify the causes of this phenomenon and have mentioned several cases of it. Most of these studies have focused on economic factors (rather than management motivations). These factors include employee efficiency, asset quality, economic growth, corporate governance, industry characteristics, rate of change in activity, capacity utilization, fixed asset efficiency, inventory efficiency, interest rate, labor market characteristics, market fluctuations, main services, type of ownership, nature of resources, etc. According to the above-mentioned, this study seeks to test the following hypotheses.

H_1: Costs related to inter-organizational activities are sticky after the COVID-19 pandemic.

H_2: Cost stickiness has a serious impact on specific characteristics of organizations after the COVID-19 pandemic.

H_3: Accuracy of profit forecasting has a significant impact on cost stickiness after the COVID-19 pandemic.

Prior studies that have focused on the effects of cost stickiness show that resource adjustment costs, managers' inducements, and prospects affect cost asymmetry. This study differs from previous studies in that it, examines the COVID-19 pandemic effect on the sticky behavior of companies in the Indian industry.

3. Methodology

As explained in the previous sections, the present study seeks to examine the cost stickiness behavior by focusing on the specific characteristics of companies, so the present research method is applied. Library method was used to collect information related to theoretical topics such as research literature and various sources and databases have been used to collect data related to research variables. The information related to the companies' financial statements was collected, and the information related to the number of employees was extracted separately from the explanatory notes of the financial statements. Sorting and classifying the data by Excel software analyzing the data using EViews software and using multivariate regression using the least squares (ordinary or generalized depending on the case) methods, the relationship between the variables was examined. The study's statistical population included all 436 companies listed on the India stock exchange from the years 2017 to 2021. Several papers have focused on cost stickiness in developed and developing nations. However, we notice an enormous lack of studies focusing on OECD (Organization for Economic Co-operation and Development) countries, more specifically research on Indian firms. India is ranked among the richest countries in the world (a member of the G20 and the world's fifth-largest economy). Indian organizations are characterized by their large size, high turnover, and economic power in the domestic and global economies. India's National Stock Exchange (NSE) has a total market capitalization of more than US$3.4 trillion, making it the world's 10th-largest stock exchange as of August 2021, with a trading volume of ₹8,998,811

crore (US$1.2 trillion) and more 2000 total listings. NSE's flagship dataset, is a 50-stock index is used largely by investors in India and around the world as an indicator of the Indian capital market which is used in this research. This dataset contains data of all company stocks listed in the NSE, allowing anyone to analyze and make educated choices about their investments, while also contributing to their country's economy.

The current study was motivated by this idea, so we try to provide more answers about the degree of cost stickiness in Indian organizations and searching for reasons that can explain this economic phenomenon. The sample size was selected by systematic elimination method (screening) based on the following criteria:

- To homogenize the statistical sample in the years, the companies should be listed on the India Stock Exchange before 2017 and be active on the stock exchange until the end of 2021 (Accordingly, 113 companies were eliminated).
- Due to the unique nature of the activities of investment companies, insurance, leasing, banks, and financial institutions, they were excluded from the sample (accordingly, 107 companies were eliminated).
- Only companies were included that have not changed their financial period during the mentioned years (Accordingly, 88 companies were eliminated).

After considering all the above criteria, 128 companies were selected as samples reached. In this study, the systematic elimination method was chosen to ensure a homogeneous statistical sample over the study period and to focus on companies with consistent financial reporting practices. By excluding certain types of companies such as investment firms, insurance companies, and those that changed their financial periods, we aimed to maintain consistency in the analysis and minimize confounding factors. Additionally, while the chosen sampling approach may differ from some studies in the literature, it was deemed appropriate for our specific research context and objectives. Regarding the reviewer's query about firm fixed effects, it's important to clarify whether the empirical analysis includes controlling for such effects and whether the results remain robust.

3.1. Research models and variables

In the second and third hypotheses, each of the specific characteristics of companies (size, number of employees, long-term assets, financial leverage and accuracy of profit forecasting) will be examined separately. Accordingly, the research model and its variables are as follows.

$$\Delta CGS_{it} = \alpha + \beta_1 \Delta S_{it} + \beta_2 DEC_{it} \times \Delta S_{it} + \varepsilon_{it} \tag{1}$$

$$\Delta CGS_{it} = \alpha + \beta_1 \Delta S_{it} + \beta_2 DEC_{it} \times \Delta S_{it} + \beta_3 ASSET_{it} \times DEC_{it} \times \Delta S_{it} + \beta_4 EMPQ_{it} \times DEC_{it} \times \Delta S_{it}$$
$$+ \beta_5 LTA_{it} \times DEC_{it} \times \Delta S_{it} + \beta_6 LEV_{it} \times DEC_{it} \times \Delta S_{it} + \beta_7 EFA_{it} \times DEC_{it} \times \Delta S_{it} \tag{2}$$
$$+ \beta_8 EG_{jt} \times DEC_{it} \times \Delta S_{it} + \varepsilon_{it}$$

such that:

ΔCGS_{it}: Changes in the cost of sold goods of company i in period t.

ItS_{it}: Changes in the sales of company i in period t.

DEC_{it}: It is a dummy variable. If the company's sales have decreased in one period compared to the previous period, it is considered 1; otherwise, it is regarded as zero.

$SIZE_{it}$: The size of the company i in period t, which is measured based on the natural logarithm of the assets.

$EMPQ_{it}$: The number of employees of the company i in period t, which is estimated based on natural logarithm values.

LTA_{it}: Company's tangible long-term assets t, which is estimated based on long-term tangible assets to complete assets.

LEV_{it}: The company i financial leverage in period t, which is calculated based on the ratio of debts to assets.

EFA_{it}: The accuracy of company i profits forecast in period t, estimated based on the difference between real and forecasted profits. However, the main criterion is managers' optimism, that is, the cases in which the predicted profits are more significant than the actual profits.

EG_{jt}: Economic growth, measured based on GDP growth rate each year for all studied companies.

In the above models, the β_1 and β_2 coefficient will be analyzed to examine cost stickiness, and the β_3 to β_8 coefficients will be analyzed to investigate the effect of specific characteristics of companies on cost stickiness.

4. Results

Table 2 presents the descriptive statistics analysis of characteristics, including average, median, minimum observations, maximum observations, and standard deviation. The results show that in the investigated companies, approximately 62.17% of the companies' financial resources are financed through debt. The median of 0.6353 indicates that half of the data is greater than this amount and half of the information is less than this value. A standard deviation of 0.0127 for financial leverage suggests that data are nearly scattered. The maximum value of financial leverage for these companies is 0.8161, and the lowest value is 0.0127. Other variables are interpreted in the same way.

Table 2. Descriptive statistics results of variables.

Name	Symbol	N	Mean	Median	Max	Min	SD
The logarithm of the employees' number	$EMPQ$	600	2.68	2.58	4.60	1.04	0.50
Total long-term assets	LTA	600	0.24	0.20	0.83	0.006	0.17
Company size	$SIZE$	600	6.02	5.90	8.25	4.56	0.68
Financial Leverage	LEV	600	0.62	0.63	0.81	0.01	0.21
Sales changes	ΔS	600	872241.4	5.68	0.008	−0.60	0.93
Cost changes	ΔCGS	600	763001.2	5.50	0.96	−5.50	0.84
GDP	EG	600	0.09	0.08	0.45	−0.16	0.22
Accuracy in earnings forecast	EFA	600	25.72	13.72	98.28	−4184.06	477.32

A set of classical assumptions that deal with residuals (or model error) is proposed. It is necessary to test the assumptions of this model in ordinary least squares estimates of the regression coefficients to be the best estimates without linear bias in linear regression models.

One of the assumptions of linear least squares linear regression is that all residuals have equal variance. In this study, the assumption of residual variance homogeneity was examined by the White test (**Table 3**).

Table 3. Results of White test.

Result	Probability	F-statistic
Variance heterogeneity of errors	0.000	117.359

The probability value of statistic t is zero, so the null hypothesis is rejected. In other words, it is not included within the 95% confidence interval, and the homogeneity is not confirmed, it can be concluded that ordinary least squares regression is not the best estimator, and we should use generalized least squares regression. Since the data of this study are of pooled type, it is required to specify the estimation method (pooled or panel) before estimating the models. The F-Limmer test was used for that cause, for observations whose probability is greater than 5% or whose test statistic is less than the statistic of **Table 4**, the pooled method is used, and for observations whose probability of testing is less than 5%, the panel method is used to estimate the model. The panel method can be done using two models of "random effects" and "fixed effects". The Hausman test is used to determine which model should be used. Since the F statistic is more significant than 5%, we use the panel method. The high probability of the F statistic is due to the low explanatory variable.

Table 4. The results of the F-Limmer test of the first hypothesis.

Type of statistic	Statistic value	df	Probability	Result
F-statistic	0.4712	99	1.000	Pooled method
Chi-square statistic	47.7267	99	0.999	

Table 5. Test results of the first hypothesis.

$$\Delta CGS_{it} = \alpha + \beta_1 \Delta S_{it} + \beta_2 DEC_{it} \times \Delta S_{it} + \varepsilon_{it}$$

Dependent variable: changes in the cost of sold goods ($GCGS_{it}$)
Method: Generalized least squares regression
Period: 2017–2021 Number of observations: 128

Variable	Symbol	Coefficient of estimation	Standard error	T-statistic	Type of relationship	Sig.
Constant (intercept)	C	−8116.156	3012.60	−2.694	Negative	0.007
Sales changes	ΔS_{it}	0.849	0.009	88.604	Positive	0.000
Dummy variable × Sales changes	$DEC_{it} \times \Delta S_{it}$	−0.021	0.020	−2.393	Negative	0.004
R^2	0.726					
Adjusted R^2	0.706					
Durbin-Watson	1.850					
F-Statistic	57.576					
Probability	0.000					

After the classical hypotheses related to regression were examined and the model estimation method was determined in **Table 5**. The model should be

estimated according to the results of the F-Limmer test. This study used generalized least squares regression (pooled method) to analyze the regression and interpret the results.

After estimating the first hypothesis model, the probability level F (or significance level) is zero, and since this value is less than 0.05, H_0 is rejected at the 95% confidence level, or the general model is significant. The Durbin-Watson's statistic is 1.850356, indicating a lack of autocorrelation. The intercept value is −8116.156, suggesting that the mean of the error terms or residuals is zero. The adjusted coefficient of determination of the first hypothesis model is 0.70605, which means that approximately 71% of the dependent variable is explained by independent and control variables, and the rest by other factors.

The results of this regression show that there is cost stickiness in listed companies and the rate of increase in costs when the level of activity increases is greater than the rate of decrease in costs when the level of activity decreases. When the activity level increases by 1%, public and administrative costs increase by 84.9338%, and when activity decreases by 1%, public and administrative costs reduce by 2.8975%. These results are consistent with the definition of cost stickiness described in the theoretical framework. Negative β_2 in the above model indicates the cost stickiness of selected companies.

To test the second and third research hypotheses, the lack of collinearity between explanatory variables was first investigated. A variance inflation factor was utilized in this equation to investigate the lack of collinearity. In the case, if the variance inflation factor is less than 5, it indicates a lack of collinearity. The results of this test show that the rate of variance inflation of independent and control variables is within its allowable limits, so there is no problem in this respect. The findings are shown in **Table 6**.

Table 6. Testing lack of collinearity of explanatory variables for the second and third hypothesis.

Variable	Symbol	Coefficient variance	variance inflation factor
Sales changes	ΔS_{it}	0.000	1.166
Dummy variable × Sales changes	$DEC_{it} \times \Delta S_{it}$	0.856	3.848
Dummy variable × Sales changes × Size	$size_{it} \times DEC_{it} \times \Delta S_{it}$	0.024	93.282
Dummy variable ×Sales changes × Number of employees	$EMPQ_{it} \times DEC_{it} \times \Delta S_{it}$	0.011	19.198
Dummy variable × Sales changes × Long-term asset-to-asset ratio	$LTA_{it} \times DEC_{it} \times \Delta S_{it}$	0.240	67.193
Dummy variable × Sales changes × Financial leverage	$LEV_{it} \times DEC_{it} \times \Delta S_{it}$	0.026	71.512
Dummy variable × Sales changes × Accuracy of earnings forecast	$EFA_{it} \times DEC_{it} \times \Delta S_{it}$	0.000	3.824
Dummy variable × Sales changes × Gross Domestic Growth	$EG_{jt} \times DEC_{it} \times \Delta S_{it}$	0.043	1.942

Now, the results of testing the second and third hypotheses are arranged in **Table 7**.

Table 7. Test results of the second and third hypothesis.

$$\Delta CGS_{it} = \alpha + \beta_1\Delta S_{it} + \beta_2 DEC_{it} \times \Delta S_{it} + \beta_3 size_{it} \times DEC_{it} \times \Delta S_{it} + \beta_4 EMPQ_{it} \times DEC_{it} \times \Delta S_{it} + \beta_5 LTA_{it} \times DEC_{it} \times \Delta S_{it}$$
$$+ \beta_6 LEV_{it} \times DEC_{it} \times \Delta S_{it} + \beta_7 EFA_{it} \times DEC_{it} \times \Delta S_{it} + \beta_8 EG_{jt} \times DEC_{it} \times \Delta S_{it} + \varepsilon_i$$

Dependent variable: changes in the cost of sold goods ($GCGSit$)
Method: Generalized least squares regression
Period: 2017–2021 Number of observations: 128

Variable	Symbol	Coefficient of estimation	Standard error	T statistic	Type of relationship	Sig.
constant (intercept)	C	−67632.67	50817.94	−1.330	Non-significant	0.183
Sales changes	ΔS_{it}	0.908	0.007	116.475	Positive	0.000
Dummy variable × Sales changes	$DEC_{it} \times \Delta S_{it}$	1.531	1.058	1.446	Non-significant	0.148
Dummy variable × Sales changes × Size	$size_{it} \times DEC_{it} \times \Delta S_{it}$	0.037	0.173	0.216	Non-significant	0.828
Dummy variable × Sales changes × Number of employees	$EMPQ_{it} \times DEC_{it} \times \Delta S_{it}$	−0.488	0.121	−4.016	Positive	0.000
Dummy variable × Sales changes × Long-term asset to asset ratio	$LTA_{it} \times DEC_{it} \times \Delta S_{it}$	−1.478	0.546	−2.706	Non-significant	0.196
Dummy variable × Sales changes × Financial leverage	$LEV_{it} \times DEC_{it} \times \Delta S_{it}$	0.240	0.186	1.292	Positive	0.007
Dummy variable × Sales changes × Accuracy of earnings forecast	$EFA_{it} \times DEC_{it} \times \Delta S_{it}$	0.000	0.000	2.289	Negative	0.022
Dummy variable × Sales Changes × Gross Domestic Growth	$EG_{it} \times DEC_{it} \times \Delta S_{it}$	0.327	0.230	0.419	Non-significant	0.156
R^2	0.725					
Adjusted R^2	0.700					
Durbin-Watson	1.837					
F-Statistic	3.064					
Probability	0.000					

In the second and third hypotheses, each of the specific characteristics of companies (size, number of employees, long-term assets, financial leverage, and accuracy of profit forecasting) will be examined separately.

5. Discussion

It should be noted that the second and third hypotheses overlap, and we would interpret them together. Since each variable is multiplied by the income reduction in this study, if the coefficients in **Table 7** are positive, they will be inversely related to stickiness. If the coefficients are negative, it will be directly related to cost stickiness. After estimating the second and third hypothesis models, the probability value (or significance level) is 0.000, and because this value is less than 0.05, the H₀ is rejected at the 95% confidence level; that is, the general model is significant. The Durbin-Watson statistic is 1.837009, which indicates a lack of autocorrelation in the

desired range. The intercept value is −67632.67, indicating that the mean of the error terms or residuals is zero. In general, the results show that the variables whose coefficients are related to B1, B4, B6, and B7 are specific characteristics of the company that has a significant relationship with cost stickiness. The variable associated with the B1 coefficient, related to sales changes, was discussed above.

Regarding the variable related to the coefficient B4, which is the number of employees, due to the negative coefficient of the coefficient, the results indicate that by increasing the number of employees from a desirable level, stickiness increases and a 1% increase in the number of employees, stickiness will increase by 48%. Logically, the company will incur higher costs with an increase in the number of employees. Regarding the variable related to the B6 coefficient, which is about the financial leverage of companies, due to the negative coefficient of the coefficient, the results indicate that as the financial leverage or debt increases, the stickiness increases and a 1% increase in the company debt or power, cost stickiness will increase by 24.043. Regarding the variable related to the b7 coefficient, which is about the accuracy in predicting companies' earnings, given the positive coefficient, the results indicate that as the accuracy of earnings forecasts increases, the stickiness decreases and a 1% increase in accuracy of earnings forecast increases, the stickiness decreases by 0.0502%. It might be because they could eliminate additional costs from the company in the budgets, but this number is very small. Management should control other factors that cause cost stickiness in the company with its good management technique so that the company can achieve its desired earnings and thus increase the value of the company by reducing the costs.

Regarding the sales change's variable, it is observed that it is positively related to the behavior of sticky costs. Nevertheless, this variable has no statistical significance. So, a better explanation is needed to allow specific conclusions. It should be mentioned that, although it is not significant, the coefficient indicates a positive impact. These results confirm that in analyzed countries economic growth had different effects on the analyzed companies. The number of employee's variables is, on the other hand, negatively related to the behavior of sticky costs, significant at the 5% level. Accordingly, it can be determined that this can explain different behaviors based on the time and cost analysis of countries. The diversity of macroeconomic aspects across nations was crucial for understanding cost behavior. Consequently, this variable can be inspected as a crucial influence on the behavior of macroeconomic costs in India.

The finding of the first hypothesis shows that costs related to inter-organizational activities exhibit stickiness after the COVID-19 pandemic aligns with several theoretical perspectives in economics and organizational behavior. Cost stickiness theory posits that costs tend to be more reluctant to decrease compared to increases in sales or activity levels, leading to asymmetric cost behavior. This phenomenon is often attributed to factors such as adjustment costs, managerial discretion, and organizational inertia. In the context of inter-organizational activities, such as supply chain operations, the COVID-19 pandemic likely introduced significant disruptions, including supply chain disruptions, shifts in demand patterns, and increased uncertainty. These disruptions could have prompted firms to adopt conservative cost management strategies, resulting in sticky costs. Additionally, the

theory of transaction cost economics suggests that inter-organizational activities involve transaction costs, such as coordination costs and information asymmetry, which may contribute to cost stickiness as firms seek to maintain stable relationships with suppliers and partners amidst uncertainty. Moreover, institutional theory suggests that organizations are influenced by institutional pressures to conform to established norms and practices, which may lead to inertia in cost adjustments, particularly in the aftermath of disruptive events like the COVID-19 pandemic. Therefore, the finding that costs related to inter-organizational activities are sticky post-pandemic underscores the complexity of cost dynamics in interdependent organizational networks and highlights the need for further research to understand the underlying mechanisms driving this phenomenon.

The second hypothesis finding shows that cost stickiness has a significant impact on specific characteristics of organizations after the COVID-19 pandemic resonates with various theoretical frameworks in economics and organizational theory. Cost stickiness theory suggests that costs are asymmetrically responsive to changes in activity levels, with costs being more resistant to decrease compared to increases in sales or activity. This asymmetry is often attributed to factors such as adjustment costs, managerial discretion, and organizational inertia. When examining the impact of cost stickiness on specific organizational characteristics, several theoretical perspectives come into play. For instance, agency theory suggests that managerial characteristics, such as risk aversion or incentive alignment, may influence cost management decisions, leading to variations in cost stickiness across organizations. Additionally, resource-based theory posits that firm-specific resources and capabilities, such as organizational size, financial leverage, or forecasting accuracy, may affect how firms respond to changes in economic conditions, including the COVID-19 pandemic. Larger firms with greater financial resources may be better equipped to absorb cost fluctuations, whereas smaller firms or those with higher leverage may exhibit greater cost stickiness due to financial constraints. Furthermore, institutional theory suggests that organizational responses to external shocks, such as pandemics, may be influenced by institutional pressures and norms, leading to differential impacts of cost stickiness across organizations based on their institutional contexts. Therefore, the finding that cost stickiness has a serious impact on specific organizational characteristics post-pandemic underscores the importance of considering diverse theoretical perspectives to understand the nuanced dynamics of cost management in the face of disruptive events.

The third hypothesis finding shows that the accuracy of profit forecasting significantly impacts cost stickiness after the COVID-19 pandemic aligns with several theoretical perspectives in economics and organizational behavior. According to cost stickiness theory, costs tend to be more sticky in response to changes in sales or activity levels, with costs being slower to decrease compared to increases in revenue. One theoretical explanation for this phenomenon is bounded rationality, which suggests that managers face cognitive limitations and imperfect information when making decisions, particularly regarding cost adjustments. Therefore, the accuracy of profit forecasting becomes crucial as it directly influences managerial decision-making regarding cost management strategies. When profit forecasts are inaccurate, managers may be more conservative in their cost

adjustments, leading to greater stickiness in costs. Additionally, agency theory suggests that the accuracy of profit forecasting may affect managerial incentives and behavior. Managers may prioritize short-term financial targets based on profit forecasts, leading them to adopt conservative cost management strategies to meet these targets, even in the face of changing economic conditions like those brought about by the COVID-19 pandemic. Moreover, resource dependence theory posits that organizations rely on accurate information, including profit forecasts, to manage interdependencies with suppliers, customers, and other stakeholders. Inaccurate profit forecasts may disrupt these interdependencies, leading to greater cost stickiness as organizations seek to maintain stability and mitigate risk. Therefore, the finding that the accuracy of profit forecasting has a significant impact on cost stickiness post-pandemic underscores the importance of information quality and managerial decision-making in shaping cost dynamics in uncertain environments.

6. Conclusions

As mentioned in previous chapters, present study aims to investigate the cost stickiness behavior based on the cost stickiness behavior based on the prevailing conditions of listed companies in Iran. Based on the results of the present study, financial analysts and brokers, investors, auditors CEOs, and financial managers of companies can make optimal decisions that lead to minimum risk and maximum return by considering the cost stickiness behavior and by focusing on the specific characteristics of companies accepted in India Stock Exchange. In other words, the terminal aim of any business unit is to maximize earnings and consequently increase equity. Management of each earnings unit aims to obtain the highest earnings and efficiency by using the least resources, and one of the simplest ways to reduce resource consumption is to control costs which requires complete knowledge of costs behavior and the factors that affect it. One of the issues that should be considered in the cost behavior analysis is cost stickiness. Over the last decade, several studies have investigated the perspective of traditional behavior and asymmetric behavior of costs in management accounting. Therefore, based on the results of this study, a more accurate understanding of how costs change relative to sales fluctuations can help auditors improve the performance of analytical procedures.

The results of the present research include information on cost behavior that can be used by various people, especially managers, financial analysts, and auditors, to make their assessments and decisions. This issue can be more critical about total cost behavior and specific characteristics of companies. Based on the research results, it is recommended that managers to identify and control the stickiness of costs in the decision-making process, planning, and budgeting of company activities to predict the future cost. Also, the relationship between costs and incomes and the outcome of income changes the costs, thus making more accurate decisions and providing a more comprehensive budget. Also, it is recommended that managers seek to increase the company's capacity to respond to reduced demand for goods and services, given the reasons and outcomes of cost stickiness. Due to the confirmation of the main hypotheses of research and proving the stickiness of public, administrative, and sales costs and the cost of sold goods, it is recommended that managers consider cost

stickiness and its intensity in planning and budgeting the company's activities. It is also recommended for auditors, and auditing firms to detect any errors or fraud in the presentation of financial statements considering the degree of cost stickiness and the ways of change in costs consistent with the rate of change in sales.

Based on the results of the second and third sub-hypotheses and the effect of the number of employees on the intensity of cost stickiness, it is recommended that company managers take the relevant considerations into account in signing the contracts and hiring employees. Given the effect of debt on the intensity of cost stickiness, it is recommended that managers pay attention to the structure of capital to reduce the intensity of stickiness and consider it in their decisions. Managers can identify and control the stickiness of company costs. They can also reduce the rate of adjustments to reduce the level of their operating assets during periods of reduction in demand, reduce the sales level, and reduce the intensity of stickiness in costs by signing appropriate contracts for the lease of operating assets and hiring employees (for example, short-term contracts). Based on the results of this study, investors and shareholders are recommended to become more familiar with the concept of cost stickiness and pay enough attention to it in decisions, since in companies with high stickiness intensity, with reduced sales, their costs change less than when sales increase, while one of the most important reasons for cost stickiness is to bear the current costs to avoid further losses in the future or to gain more earnings in future decisions and it depends on management decisions. Finally, due to the positive effect of fixed asset turnover on operating cost stickiness, stockholders of companies listed on the India Stock Exchange are recommended to pay attention to the unfavorable impact of fixed asset turnover on changes in operating costs to control the phenomenon of cost stickiness. Also, given the importance of understanding cost behavior for people inside and outside the organization, such as managers, capital market analysts, investors, and auditors, the following recommendations are provided for future research:

- Investigating the factors affecting the stickiness of each component of the cost of total sales, and public and administrative costs.
- Using other criteria to determine management optimism or pessimism and its level and investigating the relationship between these criteria and cost stickiness
- Investigating the effect of sales charges on cost stickiness.
- Investigating the relationship between management optimism and cost stickiness in different industries.
- Investigating the effect of other managers' motivations on cost stickiness.

The research is not free from limitations (Khamnei et al., 2022). The first restriction is that the activity level is approximated by sales revenue as previous studies have done. Sales revenue includes both the effect of sales volume and sales prices, so it is not the complete measure of the activity level. Another limitation is the relatively short time interval considered in this study. Namely, data in the period 2013 to 2017 from the Kaggle database are tested.

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