An empirical investigation of the effect of cost structure and demand uncertainty on SA&G cost stickiness

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Abstract

Contrary to the textbook model of cost behavior, there is theory and evidence that most cost items change asymmetrically in response to upward changes and downward changes in activities driving them. Specifically, the rate of increase in cost in response to a given increase in activity is higher than the rate of decrease in cost in response to an equivalent decrease in activity. Such a behavior is known as cost stickiness. The cost stickiness model has economic, agency theory, and psychological bases. Considerable empirical evidence has been accumulated in support of the average cost stickiness behavior, and on the impact of adjustment costs, management’s optimism/pessimism regarding future demand, and management incentives on the degree of cost stickiness. In this paper, we undertake to extend extant literature on cost stickiness by providing empirical evidence on the impact of cost structure and demand uncertainty on the degree of cost stickiness. We employ a 55 Egyptian companies sample covering the 2001-2007 period. Both the cost structure hypothesis and the demand uncertainty hypothesis are strongly supported. SG&A costs show higher stickiness for cost structures with higher proportion of committed costs than those having a lower proportion of committed costs. Similarly, the stickiness of SG&A costs is strongly evidenced under high demand uncertainty. However, these costs do not show any stickiness when the demand uncertainty is low.

Key words

Cost behavior, cost stickiness, demand uncertainty, cost structure.

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1. Introduction

According to the textbook, traditional cost behavior framework costs change symmetrically in response to upward and downward changes in their driver, e.g. volume of activity. Such a framework attributes no active role to managers and assumes a rather mechanical response of costs to changes in their driver(s) (Calleja et al. 2006). A sizable literature questioned the linearity and proportionality of costs with respect to underlying cost driver implied by the traditional framework of cost behavior (Dopuch et al. 1974, Noreen and Soderstorm 1994, Noreen and Soderstorm 1997, and Balakrishnan and Soderstrom 2006).

Additionally, this framework has been attacked as lacking descriptive validity and challenged by a different characterization of cost behavior in relation to changes in underlying cost driver. An alternative framework has emerged which recognizes an active role for forward looking managers as they make deliberate resource adjustment decisions in response to changes in cost driver in the presence of adjustment costs.

Therefore, managers, faced with changes in activity, e.g. sales, weigh current adjustment costs against future adjustment cost and make appropriate decisions concerning cutting resources when activity shrinks or adding resources when activity expands. For example, when managers face a decrease in sales (taken as an operational measure of activity) relative to previous period sales they have to decide whether to retain some unused resources that will be needed if future sales rebound or cut some resources to avoid the cost of unused capacity. Both decisions have costs, i.e., adjustment costs. A similar situation faces managers when current period sales increase relative to previous period sales. In both cases, managers have to make an appropriate trade-off between downward and upward adjustment costs in current period and future periods. If the economics of managers’ response to changes in sales do not call for symmetric reaction to activity increases and decreases, then costs will deviate from the symmetric behavior with respect to changes of activity (sales): The rate of cost change will be lower when activity decreases than when activity increases. Such a behavior is now known as “cost stickiness.”

The previous analysis and the resultant impact on costs (and cost behavior) are consistent with Yasudata and Kajiwara’s (2011) “deliberate decision theory” interpretation of the sticky cost behavior. An alternative interpretation of cost stickiness is that such behavior results from costs decline being unable to
timely keep up with sales decline. Yasudata and Kajiwara’s (2011) call this “cost adjustment delay theory.” This may be particularly true for certain types of committed resources that are not infinitely divisible which makes proportional and timely adjustment of resources and thus costs simply infeasible. It is important to note that the two interpretations are not mutually exclusive: Together they are better able to account for the sticky cost behavior.

To reiterate, the traditional, symmetric cost behavior in response to cost driver change implies that costs move upward as well as downward along one cost curve in response to increases and decreases in cost driver. In contrast, cost stickiness implies that, when a cost driver decreases cost moves downward along a less steep curve. That is, the slope of the cost curve when activity is declining is smaller than the slope of the cost curve when activity is increasing. In other words, there will be two cost curves, not one. Figure 1 illustrates this key point. In the figure, costs are exemplified by Sales, General and Administrative cost (hereafter SG&A), whereas sales represent activity.

Insert Figure 1 about here

Adjustment costs, however, are not the sole explanatory variable for the existence of cost stickiness. Banker, Byzalov, and Dujowich (2011) (hereafter BBD) identifies two additional explanatory variables for cost stickiness, namely, management optimism/pessimism and managers’ incentives. Discussion and evidence concerning these variables will be provided in section 2 of the paper.

Although costs are found to be sticky on average, as will be seen in the literature review section, BDD (2011) is careful to state that they do not expect costs to be sticky in all circumstances. “On the contrary, based on the economic foundations of sticky cost, we expect cost stickiness to vary across cost accounts, firms, industries and countries, including the possibility of no stickiness and anti-stickiness in some circumstances.” (pp. 10-11) Indeed, cost stickiness has been investigated for different types of costs, including SG&A, cost of goods sold (hereafter COGS), operating costs (defined as SG&A + COGS), and various subcomponents of SG&A (such as advertising costs, R&D. and other SG&A items). Also, sticky cost behavior is examined in different industries, namely merchandising, manufacturing, and service industries. Also in growing industries and shrinking industries.
Many previous studies examined variation in cost stickiness across different countries (e.g., Calleja et al. (2006), Banker and Chen (2006), BDD (2011)). BDD (2011), in their extensive study of cost stickiness in 19 countries (in addition to a comparison sample from US) utilizing Global Compustat data, found variation in the extent of cost stickiness (anti-stickiness) across countries. Such variation was driven by the three variables presented above (i.e., adjustment costs, management’s optimism/pessimism, and management’s incentives). In addition, they speculate, but do not test, about other factors that may account for this cross country variation in cost stickiness. Specifically, they attribute such variation to cross country differences in institutions, corporate governance, and financial markets.

The objective of this paper is twofold. First, we undertake to establish the average cost stickiness behavior in Egyptian firms. Secondly, we attempt to extend the extant literature on cost stickiness by examining the possible impact of two factors not previously explicitly considered in the literature on cost stickiness. The two factors are the cost structure and demand uncertainty. Our findings strongly support a relatively strong degree of cost stickiness on average. In addition, both the cost structure hypothesis and the demand uncertainty hypothesis are strongly supported.

The remainder of this paper is organized as follows. Section 2 contains a literature review and the development of the research hypotheses. Section 3 details the research method. In section 4 the results of hypotheses testing are presented and discussed, along with limitations and suggestions for future research. We conclude in Section 5.

2. Literature review and hypotheses development

2.1. Literature review

Our review of previous studies on cost stickiness is organized as follows. First, evidence on the average costs stickiness is presented. Secondly, evidence on the impact of the three drivers of cost stickiness behavior (namely, adjustment costs, management’s optimism/pessimism, and management’s incentives) is briefly presented.
Average cost stickiness

Noreen and Soderstrom (1997) were the first to test for asymmetric cost behavior, using data from hospitals. However, their results were generally insignificant. Anderson, Banker and Janakiraman (2003) (hereafter ABJ) were the first to present strong empirical evidence for cost stickiness, and to popularize "sticky costs" as a central concept in cost behavior and not just "folklore" as referred to by Noreen and Soderstrom (1997).

ABJ found that SG&A costs increase on average by 0.55% per 1% increase in net sales but decrease only by 0.35% per 1% decrease in sales. They interpreted this difference in response to activity change as the outcome of deliberate short-run managerial actions, which restrain or slow the downward resources adjustment more than the upward adjustment. To cope with the scarcity of data on manufacturing costs and relevant cost drivers and because many of the components of SG&A are driven by sales revenue, ABJ depended on data about SG&A costs and sales revenue as surrogates for costs and volume, respectively.

Several studies examined the behavior of other cost categories in Compustat data, or focused on cost behavior in various sub-samples of Compustat. Subramaniam and Weidenmier (2003) found that operating costs (= SG&A + COGS) are sticky for changes in revenue of more than 10% but not sticky for changes of lower than 10%. In a similar analysis, Yasukata and Kajiwara (2011) using financial data of Japanese companies found a lower cut off of 5% decline in sales in order for cost stickiness to be observed.

Strong support of the average cost stickiness hypothesis is reported by BBD (2011) in a large scale, cross country study, including 19 countries in addition to a large US comparison sample. Examining the behavior of operating costs, BBD found that operating costs are sticky on average for 15 countries out of 19. Thus, cost stickiness behavior appears to be pervasive.

Notice that the reported cost stickiness is actually a residual effect remaining after any offsetting and compensatory effects of possible variation in potential drivers of cost stickiness (anti-stickiness) in the studied samples such as the differential impact of adjustment costs, management’s optimism/pessimism, and management’s incentives. Evidence on the impact of these factors is reviewed next.
Impact of adjustment costs

When a manager faces a decrease in sales in a period he must decide whether to retain operating resources intact in anticipation of sales rebound in future period(s) or cut some of these resources to avoid bearing costs of unused capacity. Although cutting unused capacity avoids the cost of slack resources in the current period it imposes other costs. First, there is the cost of lost business (opportunity costs), the cost of lower productivity due to reassignment of workers, and future upward adjustment costs incurred to recover needed capacity should demand increase. Similarly, when sales increase in the current period the manager again has to decide whether and to what extent he should add new capacity or refrain from so doing. Once again, the manager must weigh the upward adjustment cost in the current period against the possible downward adjustment in the future period. Based on this trade-off a case of sticky cost or anti-stickiness may result. Anti-stickiness is the opposite of stickiness, where the rate of decrease in costs in the current period in response to a decrease in sales exceeds the rate of increase in costs in the current period in response to a decrease in sales.

Measuring adjustment cost poses a real challenge both to the manager in his decision making and the researcher in his testing for cost stickiness driven by adjustment costs. The manager has to use his judgment and expertise in approximating the upward or the downward adjustment costs. As for the researcher, BBD (2011), suggest using observable variables that are monotonically related to the magnitude of adjustment costs. Several studies, including BBD (2011), approximate adjustment costs by examining the effect of firm-level characteristics associated with the magnitude of adjustment costs. Two such characteristics are asset intensity and employee intensity.

ABJ (2003) found that the degree of stickiness in SG&A costs is higher for companies having higher asset intensity and higher employee intensity. Weidenmier and Subramaniam (2003) found similar results for asset intensity with respect to SG&A, COGS, and operating cost. However, as for employee intensity they found significant association with respect to only COGS and operating costs.

Other proxies for the magnitude of adjustment costs are used in examining cross-country differences in cost stickiness. Banker and Chen (2006) examined the impact of country-specific labor market characteristics that affect the adjustment cost for labor. In a sample of 19 OECD countries, they found
that higher bargaining power of trade unions (which is positively associated with adjustment costs) is associated with higher cost stickiness. Also, they found that the degree of labor cost stickiness decreased with level of unemployment benefits and increased with the strictness of employment protection legislation. Calleja et al. (2006) found that the stickiness in operating costs was higher in companies in Germany and France than for firms in UK and US. They also found a positive association between the degree of stickiness and asset intensity and employee intensity.

In their cross country, Global Compustat data study, BBD (2011) found that asset intensity and employee intensity (proxies for level of adjustment costs) are significantly associated with the degree of cost stickiness for 10 countries out of 17 at the .05 level and for two countries at the .10 level.¹ Thus, for most countries in the study sample higher adjustment costs are associated with a significantly higher degree of cost stickiness.

In sum, the balance of evidence provides strong support on the association between the magnitude of adjustment costs, however they are proxied, and the degree of stickiness of various types of costs.

Impact of management’s optimism/pessimism

Management’s expectations about future sales may drive cost stickiness (or anti-stickiness) even with the absence of adjustment costs. If sales in the current period decrease and management expects increase in the future period(s) sales, management may be reluctant to adjust operating resources downward. This is specially so since there is evidence to the effect that the cost of downward adjustment exceeds the cost of upward adjustment (e.g., Jaramillo et al. 1993, Goux et al. 2001, and Azetsu and Fukushige 2005 with regard to labor cost adjustment; and Haltiwanger 2006 with regard to capital adjustment costs). On the other hand, if management turns out to be pessimistic about future sales cost anti-stickiness is likely.

In previous research, management’s optimism/pessimism or expectation as to future sales is empirically proxied in a number of ways. ABJ (2003) found that the stickiness of SG&A costs for Compustat firms was lower in cases of two consecutive decreases in sales (proxy for pessimism) and higher in periods of macroeconomic growth (proxy for optimism). Weidenmier

¹ Two countries were removed from their 19-country sample due to missing data on asset intensity and employee intensity.
and Subramaniam (2003) extended these findings to COGS and total costs. In a sample comprising of 10 OECD countries, Banker and Chen (2006) found a similar pattern of results for operating costs.

Banker et al. (2010) used still another proxy for managers’ expectations for future sales. They looked at the direction of sales changes over two consecutive periods. Two consecutive increases in sales (+,+) would induce management’s optimism, whereas two consecutive decreases in sales (-,-) would induce management’s pessimism. Finally, management would be neutral when the direction of change in sales is mixed (i.e., +,- or -,+). They found that SG&A costs for Compustat companies are sticky given two consecutive increases in sales (most optimistic case) and anti-sticky given two consecutive decreases in sales (most pessimistic case). Banker et al. (2010) obtained similar results for several components of SG&A costs, namely, advertising cost, R&D costs, and other SG&A costs as well as for COGS. One important implication of the Banker et al. (2010) study is that the average degree of stickiness should be higher in growing industries and lower in shrinking industries.

In their Global Compustat data study, BBD (2011) reported that in 18 countries out of 19, operating costs were stickier conditional on management optimism, proxied as sales increase in prior period. Significant anti-stickiness was observed in 6 countries out of 19 after a prior decrease in sales.

In sum, substantial empirical evidence lends strong support to a deliberate role of forward looking management in inducing cost stickiness, irrespective of the presence of adjustment costs.

**Impact of managers’ incentives**

From an agency theory perspective, one management incentive that may give rise to cost stickiness is empire-building. Faced by a decrease in sales in the current period management may be reluctant to cut resources consumed in perquisites, hence cost stickiness may be observed. Management may even face decreasing sales by further consumption of perquisites, thereby producing cost anti-stickiness. Chen et al. (2012) found association between managers’ ability to engage in empire-building (measured by free cash flow) and the degree of cost stickiness.

Another incentive that may give rise to cost stickiness (anti-stickiness) relates to earnings management. Dierynck and Renders (2009) examined the association between earnings
management and cost stickiness for labor costs for a sample of Belgian companies. They found that when managers face stronger incentives to meet or beat earnings targets, a lower degree of cost stickiness was observed. Also, they reported significant association between higher cost stickiness and discretionary accruals. Kama and Weiss (2013) replicated the Dierynck and Renders (2009) findings concerning the diminishing effect of the incentives to meet or beat earnings targets on cost stickiness. In the Global Compustat data study, BBD (2011), both the empire-building hypothesis and the earnings management hypothesis were strongly supported.

In sum, agency framework-related considerations concerning management’s incentives, including empire-building and earnings management behaviors, do play an active role of inducing cost stickiness or anti-stickiness.

2.2. Hypotheses development

In the current study, we are mainly concerned with examining the impact of two additional factors on cost stickiness, namely cost structure and demand uncertainty. But before this, we begin with the average cost stickiness hypothesis in order to relate our results to those reported in the extant literature and to establish a sort of base line for other hypotheses.

When sales decrease managers trade off the cost of bearing unused resources (“retention costs” as referred to by Zehnder (2009)) against the adjustment costs associated with changing the level of resources used in the current period as well as future adjustment costs associated with increasing the resources to cope with sales rebound in subsequent periods. Therefore, it is anticipated that SG&A costs will be sticky on average which leads to the first hypothesis:

\[ H_1: \text{The relative magnitude of an increase in SG&A costs for a 1\% increase in sales revenue is greater than the relative magnitude of a decrease in SG&A costs for a 1\% decline in sales revenue.} \]

We have reviewed evidence concerning the factors that give rise to differential cost stickiness, namely, adjustment costs, management’s optimism/pessimism, and management incentives derived from agency relationships. Asset intensity and employee intensity were used as proxies for adjustment costs and were found to be associated positively with cost stickiness. We here propose that another potential factor that might affect adjustment costs is cost structure. Previous studies (e.g., Subramaniam and
Weidenmier, 2003) report different cost stickiness across different industries which may be attributed to different cost structures among different industries.

We explicitly argue that the presence of a relatively high proportion of committed (fixed) costs in the cost structure of a firm will cause increases in adjustment costs, particularly downward adjustment costs. This may be explained in two ways. Committed resources are hard to adjust downward in the short run. These resources are not sufficiently divisible and can not be disposed of in small quantities at will. Therefore to avoid substantial disposal losses, management may be reluctant to cut such resources in a timely fashion. Thus the larger the portion of committed costs in cost structure, the lower the flexibility with which the firm can change resources to match sales changes. This is a “cost adjustment delay theory” explanation of the driving effect of committed cost on cost stickiness.

An alternative explanation stems from the “deliberate decision theory” referred to above. Here, the delay in the response of committed costs is not just due to the very nature of committed resources which denies timely adjustment, but rather to deliberate economic weighing of downward adjustment and upward adjustment costs. Downward adjustment costs for committed resources are prohibitively high due to the significance of disposal costs which typically exceed the cost of securing required resources in future periods.

Both explanations, the cost adjustment delay theory and deliberate decision theory explanations, lead to the prediction that relatively higher committed cost in the cost structure of a firm is associated with a higher degree of cost stickiness, hence the second hypothesis:

\[ H_2: \text{The higher the relative level of fixed costs in the firm’s cost structure, the higher the cost stickiness degree.} \]

Another factor is the degree of uncertainty managers perceive about future sales. Previous literature (ABJ (2003), Subramaniam and Weidenmier (2003), Banker and Chen (2006), Banker et al. (2010), He et al. (2010) and BBD (2011)) used three surrogate measures for demand uncertainty: GDP, previous period's sales changes and order backlogs. In general, all measures support that when the revenue uncertainty increases, the cost stickiness becomes higher.
We introduce a new basis for the demand uncertainty hypothesis derived from implications of prospect theory (Tversky and Kahneman, 1981). According to prospect theory, people tend to be risk averse as far as losses and risk taker in gain situations. As is established in the literature, downward adjustment costs outweigh upward adjustment costs. Thus, under highly uncertain demand, cutting committed resources in a period of decreased sales and incurring downward adjustment costs results in a sure loss in the current period as opposed to a highly uncertain gain in the future period. In such a setting, managers would be keen to avoid incurring downward adjustment cost and bearing a sure loss, thereby producing cost stickiness.

The present study provides a direct measure for revenue uncertainty which is the firm's revenue coefficient of variation\(^2\). If the manager is sure about the future revenue, whether decrease or increase, he will take the optimal decision to avoid bearing slack resources or loosing sales. But if the firm’s revenue is uncertain, the manager might bear slack resources for any unexpected surge in demand. This issue will be tested in the following hypothesis:

\(H_3: \text{The higher the level of the firm’s revenue uncertainty, the higher its cost stickiness degree.}\)

3. Method

3.1. Sample Description

The population of the study comprises all Egyptian corporations listed on Egyptian stock exchange, except for financial, insurance and pension funds sectors which are excluded because of problems of comparability and as they were excluded in previous literature.

A sample of 60 firms over a 7-year period (2001 - 2007) is randomly drawn from the population, 30 of them are manufacturing firms and the other 30 firms are non-manufacturing firms (containing various sectors: health and pharmaceuticals, storage, utilities, communication, suppliers and retailers, tourism and entertainment). All firms drawn from the population should have been registered in security exchange market for the period 2001 - 2007. Years 2008 and 2009 are not

\(^2\)Coefficient of variation: A measure of spread for a set of data defined as: \(100 \times \text{standard deviation/mean}\). (Everitt and Skrondal (2010)).
included in the sample to avoid the unknown effect of the 2008 financial crisis. Also, more recent years are not included to avoid the potential effect of the Egyptian revolution on companies’ financial performance.

The data are screened for missing observations of either SG&A costs or sales revenue. The total number of remaining observations after removing firms with missing data is 274 company-year observations, representing 55 firms (30 manufacturing firms and 25 non-manufacturing firms). Following BBD (2011), to correct for inflation, sales and SG&A costs are deflated using the GDP deflator. The data are organized as a panel data model and analyzed using the least squares method. The regression is carried out using Eviews version 7.1, Stata version 12, and SPSS version 15.

3.2. Test Model
Following ABJ (2003), the following model is employed for testing the average cost stickiness behavior:

$$\log\left(\frac{SG&A_{i,t}}{SG&A_{i,t-1}}\right) = \beta_0 + \beta_1 D_{i,t} + \beta_2 \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) + \beta_3 \times D_{i,t} \times \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) + \varepsilon_{i,t} (1)$$

Where:

- $SG&A$ refers to selling, general, and administrative costs.
- $Rev$ refers to total revenue.
- $D$ refers to a dummy variable which takes the value of one when revenue decreases between two periods, and 0 otherwise.
- $t$ refers to the period.
- $i$ refers to the firm.
- $\varepsilon$ refers to the error term.

The use of the log model is consistent with previous studies. First, it provides a better comparison among firms in the light of the great diversity of performance and size between them. Second, cross-sectional and pooled estimation is likely to

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3 GDP and GDP deflator data were obtained from The World Bank website: http://www.worldbank.org/
result in heteroscedasticity; the log-linear specification reduces the potential for heteroscedasticity in the estimation.

The dummy variable is equal to one when the revenue of firm \( i \) in time \( t \) is lower than its revenue in time \( t-1 \), zero otherwise. Since the dummy is equal to zero when revenue increases, coefficient \( \beta_2 \) measures the percentage rise in costs with respect to a 1% rise in revenue. Furthermore, the sum of the coefficients \( (\beta_2 + \beta_3) \) measures the percent fall in costs with respect to a 1% drop in revenue. If costs are sticky, costs change relative to an increase in revenue must be greater than their change relative to an equal decrease in revenue. Therefore, hypothesis \( H_1 \) about average stickiness implies that \( \beta_2 > 0 \) and \( \beta_3 < 0 \).

In order to test \( H_2 \), which predicts that the higher the relative level of fixed costs in a firm’s cost structure, the higher the cost stickiness degree). Following Blakrishnan et al. (1996), cost structure is proxied by the ratio of depreciation expense to COGS. Firms in the sample are classified into two groups based on the computed ratio of depreciation expense to COGS. The first group consists of all firms having a depreciation/COGS ratio above the sample median ratio and the second group consists of all firms having a depreciation/COGS ratio below the sample median ratio. If the first group cost stickiness degree is higher than that of the second group cost stickiness degree, \( H_2 \) is accepted.

In order to test \( H_3 \) (The higher the level of a firm’s revenue uncertainty, the higher its cost stickiness degree), once again, the firms in the sample are classified into two groups based on the computed values of the coefficient of variation of each firm’s revenue. Group one includes all firms above the median ratio and group two includes all firms below the median ratio. If group one’s stickiness degree is higher than group two’s stickiness degree, \( H_3 \) is accepted.

4. Results

Figure 2 presents the behavior of both mean \( \log \left( \frac{SG&A_{i,t}}{SG&A_{i,t-1}} \right) \) and mean \( \log \left( \frac{\text{Rev}_{i,t}}{\text{Rev}_{i,t-1}} \right) \) over the six years (2002 to 2007). During sales decrease periods, the mean \( \log \left( \frac{SG&A_{i,t}}{SG&A_{i,t-1}} \right) \)

\[^4\text{According to the traditional cost behavior model, relative upward and downward changes in costs will be equal, i.e. symmetric, which means that } \beta_2 = 0.\]
curve is higher than the mean \( \log \left( \frac{\text{Rev}_{i,t}}{\text{Rev}_{i,t-1}} \right) \) curve, whereas during sales increase periods the mean \( \log \left( \frac{\text{SG&A}_{i,t}}{\text{SG&A}_{i,t-1}} \right) \) curve is lower than the mean \( \log \left( \frac{\text{Rev}_{i,t}}{\text{Rev}_{i,t-1}} \right) \) curve and moves steeper upward. Comparing the mean \( \log \left( \frac{\text{SG&A}_{i,t}}{\text{SG&A}_{i,t-1}} \right) \) curve slope in both sales increasing and decreasing periods, it is observed that the slope of the mean \( \log \left( \frac{\text{SG&A}_{i,t}}{\text{SG&A}_{i,t-1}} \right) \) curve in revenue increasing periods is higher than that in revenue decreasing periods, which reflects the stickiness of SG&A costs.

The model is estimated using ordinary least squares (OLS). Extreme observations are eliminated from the estimation by excluding observations that disturb normality of residuals. Breusch-Pagan/Cook-Weisberg test [1979] test indicated that heteroskedas-ticity was not a problem for the log-linear model. The Variance Inflation Factor (VIF) quantifies the severity of multicollinearity in OLS regression analysis. Applying Kutner et al. (2004) cutoff (VIF<10), multicollinearity is not a problem. Serial correlation is evaluated in the data using the Durbin-Watson [1951] test statistic and the Wooldridge serial correlation test (2003). Both tests indicate that it is not necessary to correct for serial correlation in the data.

4.1. Descriptive statistics

Detailed descriptive statistics for the test sample are presented in Table 1. Inflation is corrected using GDP deflator as the large differences between means of sales revenue and deflated sales revenue and between SG&A costs and deflated SG&A costs indicate that inflation is an important variable which should be controlled for.

4.2. The average stickiness behavior \( (H_I) \)

The average cost stickiness \( (H_I) \) is tested first using the ABJ (2003) basic model of cost stickiness. The results are reported in Table 2. A strong explanatory power of the model (adjusted \( R^2 = 0.77 \)) is observed, which means that 77% of the variation in log
(SG&A) is accounted for by the variables in the right hand side of the model. The estimated values of $\beta_1$ and $\beta_2$ of 0.906 and -0.63, respectively (both significant at 0.000) indicate that SG&A costs increase on average by about 0.91% when revenue increases by 1% and decrease by about 0.28% ($= 0.91 - 0.63$) for a revenue decrease of an equal magnitude. The effect is clearly highly significant ($p = 0.000$). Hence, on the average, the firms in the sample exhibit SG&A costs stickiness in the period 2001-2007, and thus $H1$ is strongly supported.

Insert Table 2 about here

Importantly, our results also show that SG&A stickiness in Egyptian firms is substantially higher than its counterpart in American firms tested in the ABJ (2003) study (increased by 0.55% for a 1% increase in revenue and decreased by 0.35% for a 1% sales decrease). In ABJ (2003) model, $\beta_2$ with a negative sign is considered the measure for cost stickiness degree. In the present study, $\beta_2 = -0.63$ for Egyptian firms, whereas its counterpart in ABJ (2003) is only -0.20, which means that SG&A stickiness in Egyptian firms is stronger than its counterpart in American firms tested in the ABJ (2003) study. Reasons for this difference may be that Egyptian managers do not have the same flexibility to make decisions to adjust resources quickly. Adjusting resources imposes some costs resulting from breaking contracts, laying-off workers, and downsizing operations which may also result in loss of productivity and loyalty of remaining employees.

If the model is estimated without the interaction variable for revenue decreasing periods, i.e. the traditional cost behavior model, $\beta_1$ would be 0.769. This would represent the variation of SG&A costs with revenue changes that would be measured if no allowance were made for asymmetry in the change in costs with revenue increases and revenue decreases.

The cost stickiness of Cost of Goods Sold (COGS) and operating costs (SG&A + COST) is also tested. Both are found to be sticky. COGS and operating costs increase on average by 1.00% and 0.95%, respectively when revenue increases by 1% and decrease by 0.89% and 0.72%, respectively for a revenue decrease of an equal magnitude.

4.3. The cost structure effect ($H_2$)
Balakrishnan et al. (2011) showed that the presence of fixed costs could lead to asymmetry behavior of costs in response to
changes in revenue. By using simulated data for different cost structures, they concluded that a firm-specific cost structure could be an important omitted variable in analyzing cost stickiness. BBD (2011) stated that the assumptions Balakrishnan et al. (2011) depended on to drive the simulated data were not realistic.

One contribution of the present study is testing for the effect of the relative weight of fixed costs in cost structure on the cost stickiness degree using real data. The ratio of depreciation to COGS is used, which is employed by Balakrishnan et al. (1996) in a different context, as a measure of the relative extent of committed costs (fixed costs).

The sample is classified into two groups; one contains firms with relatively high committed costs and the other contains firms with relatively low committed costs. Results are presented in Table 3 and Table 4. Table 3 shows the results of firms with higher committed costs, the estimated value of $\beta_1$ of 0.855 ($p = 0.000$) indicates that SG&A costs increase on average by about 0.86% when revenue increases by 1%, and decrease on average by 0.23% ($\beta_1 = 0.86 + \beta_2 = -0.63$) when revenue decreases by 1%. Table 4 shows the results for firms with lower fixed costs portion in cost structure. In firms with lower fixed cost proportion, SG&A costs exhibit weaker cost stickiness behavior as $|\beta_2| = 0.486$ is lower than its counterpart in the other group (0.633). That leads to acceptance of $H_2$, that the presence of higher fixed costs proportion in the cost structure leads to a higher cost stickiness degree.

| Insert Table 3 about here |
| Insert Table 4 about here |

**4.4. Demand uncertainty effect ($H_3$)**

As reported by ABJ (2003) that when there is uncertainty about future demand, managers may intentionally delay reductions of committed resources. Uncertainty about future demand is measured in previous literature by the direction of previous periods change in sales. Also they depend on other indicators like GDP and order backlog to reflect the uncertainty of future demand.

Another contribution of the present study is that it applies a direct measure for revenue uncertainty using firm’s revenue
coefficient of variation\(^5\). The higher the coefficient of variation the higher the uncertainty about future revenue. Using the coefficient of variation numbers, the sample is classified into two groups; group one with above median coefficient of variation and group two with below median coefficient of variation.

Results of the two groups are presented in Table 5 and Table 6. For firms with a higher coefficient of variation (higher uncertainty about future demand) cost stickiness behavior is observed. The estimated value of \(\beta_2\) of 0.835 (\(p = 0.000\)) indicates that SG&A costs increase on average by about 0.84% when revenue increases by 1%, and decrease on average by 0.04% (\(\beta_2 = 0.84 + \beta_3 = -0.80\)) for a revenue decrease of an equal magnitude.

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\text{Table 5} \\
\hline
\text{Table 6} \\
\hline
\]

Compared to the high stickiness degree appearing in the group with higher uncertainty about future demand, stickiness in the other group which represents firms with lower uncertainty about future revenue cannot be confirmed. Although \(R^2\) is high (0.81), \(\beta_3\) which is the cost stickiness parameter is insignificant. The conclusion is that uncertainty is the main reason of cost stickiness. When the degree of uncertainty is high the manager may delay the cutting of committed resources until he becomes more certain about the permanence of such decline. Another justification as reported by Banker et al. (2014) is that firms facing higher demand uncertainty have a more rigid short-run cost structure with relatively higher fixed and lower variable costs and as \(H_2\) predicts that the presence of higher fixed cost proportion in cost structure may lead to higher degree of cost stickiness.

5. Limitations and future research

5.1. Limitations

The results of the present study and their interpretations are subject to several limitations. First, the analysis of accounting data underlies several restrictions. As brought up by Anderson and Lanen (2009), the change in accounting sales, however, do not necessarily have to indicate a corresponding change in sales activity. The reported sales number may also be influenced by

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\(^5\) When standard deviation is used, results do not support the hypothesis.
changing accounting rules concerning revenue recognition or price adjustments. The price of a product or a service may be affected by changes in demand of that product or service, or changes in money’s purchasing power parity (inflation). An attempt is made to control for inflation factor by restating all figures by the GDP price index (using year 2001 as the base year).

Second, another limitation is the sample size. Collecting data in Egyptian business environment in general, the presence of financial crisis (2008) and Egyptian revolution (2011) all result in short time series. Although an attempt is made to make the sample size as large as possible, it is still small compared to other research in this field. A third limitation is that Cannon (2011) provides some evidence that costs appear sticky relative to revenue as management likely cuts output prices to a greater degree as demand falls than it raises prices as demand grows. Finally, an important limitation concerns the calculation of SG&A figure in Egyptian firms’ financial statements. Firms do not follow the same rules for calculating and disclosing this amount, thus its calculation may be subject to some unintentional and unknown bias.

5.2. Future research

Although there have been numerous publications since ABJ (2003) which have documented drivers and characteristics of cost stickiness, the phenomenon is not fully understood yet and further research seems desirable. The current study represents a first effort for providing evidence on the cost stickiness behavior in the Egyptian business environment. However, limitations and other issues that are not examined in the current study provide opportunities for future research.

One promising direction for future research is to explore how managers achieve the optimal resources management in the presence of adjustment costs. Second, how to evaluate managers’ performance and how to build appropriate incentive systems in the presence of cost stickiness. Another question which needs to be answered is how to evaluate firm performance in the presence of cost stickiness. Setting budgets and plans should not follow the traditional model of cost behavior; instead it should consider the cost stickiness behavior of several costs.

Further research also can explore additional factors that affect cost stickiness behavior for each single industry, to deepen the understanding of cost stickiness behavior. Finally, laboratory experiments may provide an additional promising avenue for future research.
6. Conclusion

This study documents the prevalence of sticky cost behavior in SG&A costs in Egyptian firms. The empirical evidence lends strong support to the notion that costs arise as a result of deliberate resources commitment decisions made by forward looking managers in the presence of adjustment costs. In contrast to the traditional cost behavior model (i.e. of symmetrical behavior), the sticky cost behavior model depends on the comparison between two types of adjustment costs that creates a new dynamic relationship between costs and revenue. First, the prevalence of sticky cost behavior in general is tested then the effects of cost structure and demand uncertainty on cost stickiness are examined, both found to be highly significant.

Firms in the sample are classified into two groups according to the relative weight of the fixed costs component (high vs. low) in their cost structure. The results show that firms with higher relative fixed costs component in cost structure show higher stickiness than remaining firms.

Revenue uncertainty is the second factor and the results show that the higher the revenue uncertainty the higher the cost stickiness degree a firm exhibits. To capture revenue uncertainty, the coefficient of variation of firm’s revenue is used as a surrogate measure. In firms with higher coefficient of variation of revenue cost stickiness behavior is witnessed, but not otherwise.

The current study has several limitations such as those reported in the preceding section. Understanding the cost stickiness behavior may improve the incentive systems in a way that makes bearing unfavorable cost variance in contracting volume periods does not necessarily mean inefficient managers’ performance. On the other hand, managers should consider cost stickiness in putting future budgets and plans. The cost stickiness phenomenon provides promising issues for future research such as exploring additional factors that affect cost stickiness and introduce more descriptive proxies for variables examined, and finally, showing how the managers achieve the optimal resources management in the presence of cost stickiness.
References


Cannon, J. N. 2011. *Evaluating determinants of sticky costs and operations based earnings prediction models using air transportation industry data and validation of verifiable detail as a source of credibility in customer retention strategy disclosure.* A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Business Administration, Utah University.


Appendix

Figure 1: Cost Stickiness: Asymmetric SG&A - Sales Relationship

Source: Homburg and Nasev (2008), p.27.

Figure 2: The mean $\log \left( \frac{SG&A_{t,t}}{SG&A_{t,t-1}} \right)$ and the mean $\log \left( \frac{Rev_{t,t}}{Rev_{t,t-1}} \right)$ curves

- Mean Log (SG&A)  - Mean Log (revenue)
<table>
<thead>
<tr>
<th></th>
<th>Revenue</th>
<th>Deflated Revenue</th>
<th>SG&amp;A Expenses</th>
<th>Deflated SG&amp;A Expenses</th>
<th>SG&amp;A Expenses as a Percentage of Revenue&lt;sup&gt;6&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>461187</td>
<td>134986</td>
<td>47128</td>
<td>14554</td>
<td>0.130</td>
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<tr>
<td><strong>Mode</strong></td>
<td>2581</td>
<td>10</td>
<td>40</td>
<td>6</td>
<td>0.004</td>
</tr>
<tr>
<td><strong>Std. Dev.</strong></td>
<td>1058703</td>
<td>297397</td>
<td>153349</td>
<td>45552</td>
<td>0.431</td>
</tr>
<tr>
<td><strong>Skewness</strong></td>
<td>0.004</td>
<td>0.004</td>
<td>0.007</td>
<td>0.006</td>
<td>12.453</td>
</tr>
<tr>
<td><strong>Kurtosis</strong></td>
<td>0.022</td>
<td>0.188</td>
<td>0.054</td>
<td>0.035</td>
<td>164.83</td>
</tr>
<tr>
<td><strong>Quartiles:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower</td>
<td>33345</td>
<td>10124</td>
<td>2743</td>
<td>771</td>
<td>0.039</td>
</tr>
<tr>
<td>Median</td>
<td>129382</td>
<td>39133</td>
<td>8015</td>
<td>2342</td>
<td>0.083</td>
</tr>
<tr>
<td>Upper</td>
<td>310191</td>
<td>93643</td>
<td>21892</td>
<td>6785</td>
<td>0.127</td>
</tr>
</tbody>
</table>

<sup>6</sup> This column without omission of the (‘000)
The estimation model follows ABJ (2003):

\[
\log \left( \frac{SG\&A_{i,t}}{SG\&A_{i,t-1}} \right) = \beta_0 + \beta_1 D_{i,t} + \beta_2 \log \left( \frac{Rev_{i,t}}{Rev_{i,t-1}} \right) + \beta_3 D_{i,t} \\
\times \log \left( \frac{Rev_{i,t}}{Rev_{i,t-1}} \right) + \epsilon_{i,t} \quad (1)
\]

### Table 2

<table>
<thead>
<tr>
<th>Estimator</th>
<th>Variable</th>
<th>Coeff.</th>
<th>Std. Error</th>
<th>t-test</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\hat{\beta}_0)</td>
<td>C</td>
<td>-0.012</td>
<td>0.057</td>
<td>-0.217</td>
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<tr>
<td>(\hat{\beta}_1)</td>
<td>DUMMY</td>
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<td>0.000</td>
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<tr>
<td>(\hat{\beta}_2)</td>
<td>LOG(REV)</td>
<td>0.906</td>
<td>0.087</td>
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<td>0.000</td>
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<tr>
<td>(\hat{\beta}_3)</td>
<td>DUMMY*LOG(REV)</td>
<td>-0.633</td>
<td>0.104</td>
<td>-6.093</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Summary Statistics

<p>| | | | | |</p>
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<tr>
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<tbody>
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<td>R-squared</td>
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<td>Prob (F-Statistic)</td>
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<tr>
<td>Durbin-Watson test</td>
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### Table 3

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<th>Std. Error</th>
<th>t-test</th>
<th>Prob.</th>
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<tr>
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<td>DUMMY</td>
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<td>-3.591</td>
<td>0.001</td>
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<tr>
<td>(\hat{\beta}_2)</td>
<td>LOG(REV)</td>
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<td>0.124</td>
<td>6.871</td>
<td>0.000</td>
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<td>(\hat{\beta}_3)</td>
<td>DUMMY*LOG(REV)</td>
<td>-0.633</td>
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Summary Statistics

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<td>R-squared</td>
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### Table 4
**Results of testing H2 (lower fixed costs proportion)**

<table>
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<th>Estimator</th>
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<th>Std. Error</th>
<th>t-test</th>
<th>Prob.</th>
</tr>
</thead>
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<tr>
<td>$\beta_0$</td>
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<td>0.096</td>
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<td>$\beta_1$</td>
<td>DUMMY</td>
<td>-0.121</td>
<td>0.110</td>
<td>-1.101</td>
<td>0.273</td>
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<tr>
<td>$\beta_2$</td>
<td>LOG(REV)</td>
<td>1.041</td>
<td>0.152</td>
<td>6.870</td>
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<td>$\beta_3$</td>
<td>DUMMY*LOG(REV)</td>
<td>-0.486</td>
<td>0.191</td>
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</table>

**Summary Statistics**

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<td>F-Statistic</td>
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<td>Durbin-Watson test</td>
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### Table 5
**Results of testing H3 (higher demand uncertainty)**

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<th>Std. Error</th>
<th>t-test</th>
<th>Prob.</th>
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<tbody>
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<td>$\beta_0$</td>
<td>C</td>
<td>0.036</td>
<td>0.110</td>
<td>0.323</td>
<td>0.748</td>
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<tr>
<td>$\beta_1$</td>
<td>DUMMY</td>
<td>-0.456</td>
<td>0.122</td>
<td>-3.734</td>
<td>0.000</td>
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<tr>
<td>$\beta_2$</td>
<td>LOG(REV)</td>
<td>0.835</td>
<td>0.174</td>
<td>4.797</td>
<td>0.000</td>
</tr>
<tr>
<td>$\beta_3$</td>
<td>DUMMY*LOG(REV)</td>
<td>-0.803</td>
<td>0.188</td>
<td>-4.265</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Summary Statistics**

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<td>F-statistic</td>
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<td>Adjusted R-squared</td>
<td>0.608</td>
<td>Prob (F-statistic)</td>
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<td>Durbin-Watson stat</td>
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### Table 6
**Results of testing H4 (lower demand uncertainty)**

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<th>Estimator</th>
<th>Variable</th>
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<th>Std. Error</th>
<th>t-test</th>
<th>Prob.</th>
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<tbody>
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<td>$\beta_0$</td>
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<td>$\beta_1$</td>
<td>DUMMY</td>
<td>-0.104</td>
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<td>$\beta_2$</td>
<td>LOG(REV)</td>
<td>0.891</td>
<td>0.108</td>
<td>8.224</td>
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<td>DUMMY*LOG(REV)</td>
<td>-0.066</td>
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**Summary Statistics**

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<tbody>
<tr>
<td>R-squared</td>
<td>0.810</td>
<td>F-statistic</td>
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<td>Adjusted R-squared</td>
<td>0.805</td>
<td>Prob (F-statistic)</td>
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<td></td>
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<tr>
<td>Durbin-Watson stat</td>
<td>1.835</td>
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</tbody>
</table>
اختبار إمبريقي لتاثير هيكل التكلفة وعدم تأكد الطلب
على لزوجة المصروفات البيعية والإدارية

أحمد عبد العزيز عبد الحميد*
محمد السعيد أبوالعز**

ملخص بالعربية
توجد نظرية ودليل إمبريقي على أن العديد من التكاليف لا تستجيب بطريقة متماثلة
لارتفاع وانخفاض النشاط المحرك لها على عكس نموذج التكلفة التقليدي. بمعنى
أكثر تحديدًا، وجد أن معدل زيادة في التكاليف الناتج عن زيادة النشاط أكبر من
معدل الانخفاض في التكاليف الناتج عن إنخفاض النشاط بنفس المقدار، وهذا ما
يسمى بسلوك لزوجة التكلفة. سلوك لزوجة التكلفة له أسس اقتصادية، سيكولوجية،
أخرى معتمدة على نظرية الوكالة. تم تجميع العديد من الأدلة التي تدعم سلوك
لزوجة التكلفة بصورة عامة، وتأثرها بتكليف تعديل مستوى النشاط، وتتفاوت وتشاوم
الإدارة تجاه المبيعات المستقبلية، وبحوافز الإدارة في إطار نظرية الوكالة. ويعتبر هذا
البحث إضافة للأبحاث القائمة حيث يختر تأثير هيكل التكلفة وتأثير عدم التأكد
المرتبط بالطلب على لزوجة التكلفة. عينة الدراسة مكونة من 55 شركة للفترة من
عام 2001 إلى 2007. كلا الفرضيتين (تأثير هيكل التكلفة وتأثير عدم التأكد
المرتبط بالطلب) تم قبولهما معنوية إحصائية مرتفعة. تم قبول فرضية اقتران لزوجة
التكلفة بارتفاع نسبة التكاليف الثابتة في هيكل التكلفة. تم أيضًا تأكيد فرضية عدم
تأكد الطلب، فكانت التكاليف عالية اللزوجة عندما كان عدم تأكد الكلب مرتفعًا، أما
في حالة انخفاض عدم تأكد الطلب لم تكن لزوجة التكلفة معنوية إحصاءياً.

كلمات مفتاحية
سلوك التكلفة، لزوجة التكلفة، هيكل التكلفة، عدم التأكد المرتبط بالطلب.

* مدرس مساعد بكلية التجارة جامعة الزقازيق
** أستاذ المحاسبة بكلية التجارة جامعة الزقازيق