Cost Stickiness and Ownership Structure in Greek Companies

Tzillas Ioannis

SCHOOL OF ECONOMICS, BUSINESS ADMINISTRATION & LEGAL STUDIES

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Thessaloniki – Greece
Student Name: Tzillas Ioannis
SID: 1107170019
Supervisor: Dr. Alexandros Sikalidis

I hereby declare that the work submitted is mine and that where I have made use of another’s work, I have attributed the source(s) according to the Regulations set in the Student’s Handbook.

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Abstract

Prior literature on cost and cost behavior has already established the relationship between costs and firms’ activity. The phenomenon where costs increase more with the increase of firms’ activity rather than decreased when there is an equivalent decrease on active have determined as Cost Stickiness. Sticky Costs This sticky cost behavior renounces the classical model which accepts that expenses carry on symmetrically for production volume fluctuations. In this research we are trying to investigate and draw conclusions about cost behavior in Greek listed firms. The dataset is compromised by all Greek listed Firms that are listed in the Athens Stock exchange given the timeframe of ten years from 2008 to 2018. Our assumptions are that cost in Greek listed firms is behave as sticky (operating costs fluctuate non-symmetrically as the sales revenue fluctuates), but in longer time of periods under scrutiny the phenomenon of cost stickiness tend to be smoother or disappear. Following the previous literature, we assume that this is due to the better information managers gather through longer time frames. Additionally, cost stickiness is a phenomenon that is greatly influenced by market fluctuations. When firms sustain larger drops in revenues, the costs are becoming less sticky, helping somehow the progress of the firms. The majority of Greek listed firms faced a high deterioration in revenues during the period under scrutiny thus make us expect that the phenomenon tends to be lower. Finally, we test the sample of firms in terms of the firms’ ownership structure and more specific the connection of family ownership and the phenomenon of cost stickiness. All three hypotheses that we are forming are rejected or confirmed accordingly.

Keywords: Cost behavior, Cost stickiness, Operating Revenues, Operating costs, Ownership Structure

Tzillas Ioannis
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1. Introduction

Cost behavior is one of the most important aspects that have to be altogether comprehensible in order a business exercise effective management accounting. The classical model on cost behavior suggests that costs are distinguished into two different types and characterize them as fixed and variable. According Noreen, (1991), this segmentation is made in the notion that costs change proportionately with changes in the activity driver. However, the classical model and the related studies distance from the real behavior of cost and been carried out with a consignment to be understandable and simplify the sizes.

This notion was called into question when Noreen & Soderstrom (1997) and Cooper & Kaplan (1998) suggested that costs accelerate more with increases in activity than they fall with decreases in activity. Anderson, Banker, & Janakiraman (2003), on their research have come to show that the behavior of costs may depend upon the level of activity. Balakrishnan, Petersen, & Soderstrom (2004), disclosed evidence that when there is a decrease in production compared with the acceleration in output in which costs start to decline with an increasing rate, cost is declining with lower dynamics. Anderson et al. (2003) was the first who characterized a cost as “sticky” and established the term “cost stickiness”. For the author cost stickiness is the phenomenon that a firm face when in a decrease of output by 1% the costs decrease by less than 1%. In addition, the author suggests that selling, general and administrative costs (SG&A) respond differently into changes in activity. Both authors suggest that the level of cost stickiness is influenced by economic conditions and by business characteristics. Zanella et al. (2015) underline the role of (SG&A) costs that behave with an inverse intention from the change of activity. Since then, many studies have been conducted about firms or countries with little emphasis in Greek firms due to small changes. However, it is interesting to study the phenomenon in Greece and what are the factors that affect the intensity, if any, of the cost stickiness.

According Subramaniam and Weidenmier (2003) cost stickiness has been attributed to aspects of managerial behavior where managers have entered into contracts for the
supply of resources but, in the event of a decline in revenues, decide to retain underutilized resources rather than incur the costs of renegotiating the contracts. This inability to accomplish the appropriate adjustment of the resources that been used is according Guenther, Riehl, & Rößler (2014) the generating cause of cost stickiness. Anderson, Banker, & Janakiraman (2003) stated that managers tend to delay making any arrangement in resources while waiting that there is an upsurge in demand.

Through this academic research in the context of our diplomatic work, we hope to shed light on the cost behavior in Greek listed firms during the period of the financial crisis (2008-2018) where firms encounter different problems. There is not enough evidence or research on this topic in this specific country and this research aims to identify the situation by many aspects. Cost management could boost a firm’s profitability something vital in a situation of a depressed market because it can bring, combined with other measures more revenues in a business. There have been many papers published about cost stickiness in relation to size and industry Dalla & Perego, (2014) and Banker & Chen, (2006). However, there is not enough evidence about Greek listed firms. The empirical part of this study will collect data essential for the analyses using models that other authors have already used as well. During this research many issues are going to be clear enough in order to understand the general idea of “sticky” costs in Greek reality were family owned business is the rule and not an exception.

2. Literature Review

2.1 Cost Behavior

Going back into traditional cost behavior models we observe that in the accounting literature costs are been distinguish as fixed and variable with respect to changes in the level of activity. Regarding this notion fixed costs are considered to be independent of the level of activity and variable costs are considered to be linearly and proportionally related with changes in a business’s output. The majority of earlier academic researches embraces the clear separation between fixed and variable costs and embraces the classical theory. Many authors like Miller & Vollman, (1985) and Noreen, (1991) find
no evidence about cost stickiness in their researches. During the next few years archival research has provided very little evidence about the behavior of activity costs in relation to changes in activity levels. Banker & Johnston (1993), with their study of cost drivers in the U.S. Airline industry and Noreen and Soderstrom, (1997), with their study on U.S. hospital service department, disclose both poor evidence about the phenomenon of cost stickiness because of the lack of availability of data related with costs drivers. Anderson et al., (2003), were the first who disclosed evidence about the asymmetric behavior of costs regarding either the mitigation or sharpening of activity demand. Their research is based on the conviction that selling, general and administrative (SG&A) costs are sticky and they increase linearly when the volume is increased, but they do not decrease at the same amount as the volume decreases. In addition, they connected the variable cost with managerial decisions. Cost stickiness occurs when management do not reduce variable costs to the minimum level necessary to support a reduced activity demand. More specifically they found that on average they increase by 0.55% per 1% increase in revenues but decrease only 0.35% per 1% decrease in revenues. Balakrishnan, Petersen, and Soderstrom (2004), characterize costs as “sticky” if the magnitude of their increase associated with an increase in a firm’s core economic activity, is greater than the magnitude of their decrease associated with an equivalent decrease in a firm’s core economic activity. The authors suggest that the linear pattern of cost behavior is interrupted by large changes in sales revenues. In 2015 Zanella et al., (2015) stated that (SG&A) costs may not align with the change, and this means that when the output decreases by 1%, the costs decrease by less than 1%. All the above studies confirmed that the cost stickiness is influenced extremely by the firms’ characteristics and the economic transitions between the years.

2.2 Agency Problems

Agency theory support the view that managers may act in complete alignment with their self-interests and not firm’s interests. An opinion is that managers may hesitate to reduce resources in order not to hurt their status, thus a crucial factor about the cost
behavior is managers and their motives and incentives. Subramaniam & Weidenmier, (2003), confirm and extend the evidence on sticky costs to include the behavior of the cost-of-goods-sold expense. This stickiness has been attributed to aspects of managerial behavior where managers have entered into contracts for the supply of resources but, in the event of a decline in revenues, decide to retain underutilized resources rather than incur the costs of renegotiating the contracts. Cooper & Kaplan, (1998), commenting on manager’s behavior suggest that in a case of a reduced demand of activity, it is more likely for them to remain with underutilized resources (thus, do not decrease variable cost) than break a contract which has been very costly for them. In that situation revenues and costs will not decrease proportionally. Banker & Byzalov, (2014), investigate on the relation of managerial decisions and cost stickiness. They decompose adjustment costs and attribute them to deliberate managerial theory. Two conclusions are been extracted: cost stickiness conditional on a prior sales increase and cost anti-stickiness conditional on a prior sales decrease. These predictions reflect the structure of optimal decisions with adjustment costs and the impact of prior sales changes on managers' expectations about future sales changes. Kama & Weiss, (2013), examine managers’ intention for resources adjustments. Their study focusses on the impact of managers’ incentives to meet earnings targets on resource adjustment and the ensuing cost structures. The findings they extract suggest that managers have agency-driven incentives to adjust resources (reduce the costs when sales fall) and diminish the degree of cost stickiness in order to meet financial analysts’ forecasts and avoid losses. Chen, Lu & Sougiannis, (2011), investigate on the managerial choices in adjusting resources. They focus on decisions by self-interest managers, and they confirm the acknowledgment of existing incentives of managers to smooth the phenomenon of cost stickiness in order to reach earnings targets. Kallapur & Eldenburg, (2005), in their study also connect the phenomenon of cost stickiness with agency problems. Their research focused on Washington State hospital, and the findings suggest that the phenomenon was sharper in hospitals where the majority of the patients where client of one specific insurance company.

2.3 Governance structure & Political Factors
Calleja et al., (2006), in their study analyze a sample of firms from U.S., U.K., France and Germany in order to exclude inference about the phenomenon of cost stickiness. Amongst others, their findings suggest that cost stickiness is attributable to differences in the system of corporate governance and the legal system. In the code-law system of corporate governance, businesses are directed by an alliance of external and internal interest groups. In contrast with UK and the US, the common-law system of corporate governance puts most emphasis on the notion of shareholder maximization and on the role of the stock market as a means of achieving that objective. Their findings suggest that governments subject to code-law governance systems, such as France and Germany, tend to face more sticky costs. Cohen, Karatzimas & Naoum, (2015), confirm the phenomenon of cost stickiness disclosing evidence about cost behavior in Greek local governments, they conclude that local government managers adjust the costs of service provisions (core activity) more quickly than the downward of the activity. Commenting on political factors and cost behavior Lee, Pittman & Saffar, (2016), extract evidence about the phenomenon of cost stickiness in local governments’ service provision activities, and they conclude that it is greater in election years relative to non-election years. Yao & Kening, (2018), on their research on Chinese A-share market from 2008 to 2015 connect the phenomenon of cost stickiness with the level of the risk in Chinese corporations. They define firm’s ownership as the key indicator in the connection of firm’s risk and cost stickiness. The concentration degree of ownership is an important part of corporate governance, which reflects the strength of shareholders to a certain extent. Depending on the ownership structure different methods of the corporate governance are a firm’s reality. That means that the largest shareholders may have different motivations to manage, supervise and constrain, thus cost behavior is affected and as a result firm’s risk is affected.

2.4 Cost stickiness in labor

Jaramillo, Schiantarelli & Sembenelli, (1993), on their research on tried to extract evidence in order to connect labor and cost behavior. In particular their findings suggest that business that face increasing demand in their activity level tend to hire more employees than dismissing personnel when they face deterioration in their demand on activity. According to Banker, Byzalov & Chen (2013), managers will be less willing
to fire workers when activity decreases than to hire workers when activity increases if
the firing costs exceed the hiring costs. That is why more workers will be hired when
demand increases than workers will be fired when demand decreases. Therefore, cost
stickiness is directly linked with managerial decisions regarding activity and
employees. When demand decreases, and the resources maintain unaltered, then cost
stickiness can be generated. Goux, Maurin & Pauchet, (2001), estimated a model of
labor demand that accounts for dynamics arising from the relative costs of hiring and
firing workers. They use panel data of 1000 French firms and their estimates suggest
that it is much costlier to lay off workers under Infinite Term Contract than to hire them
and the asymmetry between hiring and layoff costs (cost stickiness phenomenon) is
more important for non-production than for production employees. Guenther, Riehl &
Robler, (2014), mentioned that policies which are avoiding dismissing employees
because doing so may damage their reputation, may lead to cost stickiness. When the
demand is low, it is very difficult for a company to pay for highly qualified employees
just because they work as a team in a very essential way. Hoping that the demand will
restore in the future, managers decide to keep them, and this may cause cost stickiness.

2.5 Other factors affecting cost behavior

Shuts & Weiss, (2014) in their research are testing for a possible connection of the
phenomenon of cost stickiness and the reporting methods a company uses. They
conclude that financial reporting methods only affect the cost stickiness of reported
expenses, whilst costs are not affected. They test about the impact of depreciation on
cost behavior, because depreciation involves expenses not paid in cash. Operating
expenses after depreciation show significantly more cost stickiness than reported
expenses before depreciation. They also provide evidence that depreciation increases
cost stickiness. Reporting choices required by the GAAP affect cost behavior. The
GAAP requires reporting of depreciation accrual, which is one of those methods.
Specifically, they try to extract evidence about the assertion that reported expenses can
serve as an appropriate proxy for estimating the asymmetry of economic costs. Their
findings reject this assertion, indicating that reporting choices influence the estimated
asymmetry level of reported expenses. As a result, reported expenses are significantly
stickier than economic costs. This evidence suggests that reporting standards required
by GAAP affect the phenomenon of cost stickiness. Calleja, Steliaros & Thomas, (2006), used the same study as Anderson et al., (2003) did but they added the ratio of interest, the level of debt and return on equity to their testing process. They also emphasize that firms’ characteristics like the intensity of assets (different firms employ different volume of assets, the amount of the employees, the firm’s investments and the amount of the debt can affect cost behavior. Additionally, factors of the firm’s external environment like the market that the firm operates can influence the phenomenon of cost stickiness. Canon (2014), investigates the hypothesis that selling prices affect cost behavior and as a result cost stickiness. He extracts evidence that managers tend to adjust selling prices the period the demand changes rather than make changes in capacity. In order to investigate this assumption, he examines the airline industry a clear and representative example about his research. He confirmed a tradeoff in how managers react to demand’s changes.

Finally, Shangkun, Dong & Xiaoli, (2014), investigated listed Chinese’s firms in order to question about the role of external auditors and the phenomenon of cost stickiness. They extract evidence that firms that under the audit by one of the Big Four audit firms show lower rates of the cost stickiness phenomenon. Firms that are audited by other audit firms do not show any significance. These results show that the Big Four are more capable of reducing cost stickiness. Which provides evidence of the higher audit quality of these firms?

3. Hypotheses Development

Cost stickiness is a phenomenon that opposes traditional accounting literature that strictly separates fixed and variable costs. It is mainly affected by the changes in demand but can be addressed by timely and valid reactions of managers. However, managers in order to decide properly they are invited to take into account many aspects of the firm: selling price of the products, excess capacity and its revenues or expenses, the asset or employee direction to the firm, to name but a few. Examining the cost stickiness phenomenon in Greece constitutes an attractive challenge for the researchers.
During the period of crisis, the firms that achieved to survive, struggle every day suffering in a very strict corporate environment with repeatable financial responsibilities, poor cash flow in some cases and marginal sales. Cost stickiness’s presence is intense from the local governments to the retail sector which has a direct relationship with households.

The following hypothesis will be used to answer whether or not cost stickiness is present in Greek listed firms during the period 2008-2018.

**H1: Greek listed firms are facing cost stickiness in the period 2008-2018.**

As the competition among companies is becoming tougher and the financial limits are narrowing, managers of Greek firms have to examine every aspect carefully in order to make the right decisions for their companies. Prior literature has provide evidence that confirm the existence of the phenomenon of cost stickiness amongst several countries or market segments. With our first hypothesis we will investigate cost behavior in Greek market through the years of the financial depression between 2008-2018.

**H2: Cost stickiness declines for a two period-model in contrast with one period model.**

The second hypothesis concerns the phenomenon of cost stickiness and time frames. Previous literature on the topic suggest that the phenomenon tends to be low in longer periods of time. Anderson et al. (2003) have stated that as the years go by and the more representative data is gathered, managers are better aware of the moves they have to make to avoid revenue decline. However, at a longer time period the readjustment costs may be lower than the costs of unused assets and thus the effect is mitigated. Our second hypothesis is in what extend costs are sticky if we use the same data in a two-period time frame.
**H3: Cost stickiness depends on Firms’ ownership structure.**

In addition to the hypothesis, firm characteristics in combination with the changes in operating activity may cause differences in the outcome of this research. We define as family owned companies all Greek Listed firms in which a family owns at least 10% of the total share capital. This will strengthen the outcome and we will be driven to safer results. Investigating the third hypothesis we are going to extract evidence about the connection between cost stickiness and family ownership in Greek listed firms. These three hypotheses will lead us to results that may be valuable for Greek companies and we will accept or reject them through different testing procedures that are described below at the Methodology part.

**4. Methodology**

The main target of the thesis is to investigate and extract conclusions about the phenomenon of cost stickiness in Greek listed firms over the last eight years. In order evidence about our hypothesis be extracted, the log model of Anderson, Banker, & Janakiraman (2003) will be used.

**4.1 Cost stickiness**

In order to investigate in what extend costs in Greek listed firms behave as ‘’sticky’’ costs we use the following model:

\[
\log \left[ \frac{\text{total operating costs}_{i,t}}{\text{total operating costs}_{i,t-1}} \right] = \alpha + \beta_1 \log \left[ \frac{\text{revenue}_{i,t}}{\text{revenue}_{i,t-1}} \right] + \beta_2 \times d_{i,t} \log \left[ \frac{\text{revenue}_{i,t}}{\text{revenue}_{i,t-1}} \right] + \varepsilon_{i,t}
\]
where variable (d) is a dummy variable that takes the value of 1 when the revenue decreases between two periods and the value of 0 otherwise.

The log model has been used in previous studies that tried to investigate cost behavior (Anderson et al., 2003) and Calleja et al., (2006). Running the regression model, we compare variables between current and previous periods. In order to better cross-sectional comparison been achieved we use ratios that are referred to operating costs and revenues through different periods. Log transformed ratios are used in order to obtain a better distribution and enhance the economic interpretation. The value of the dummy variable (d) is the one that can characterize the cost behavior as sticky and confirms the existence of cost stickiness. When the value of the variable (d) is 1 when revenue decreases, the sum of (β1) and (β2) measures the decrease in percentage terms, in costs following a 1% decrease in revenue. Otherwise, when the value of the variable (d) take the value of (0) when the revenue increases, (β1) measures the increase in percentage terms in costs with a 1% increase in revenue. Taking into consideration the traditional cost behavior model (β2) would be equal to 0 since the changes in costs should be equal and (β1) should be equal to 1, reflecting the proportional changes. If the costs are sticky (β2) should be negative and statistically significant.

Anderson et al., (2003) in their research find that the level of the phenomenon increases in periods of high market growth, and during those periods’ managers consider declines in revenues as being more transitory than the periods of low economic growths, thus keep a more conservative behavior and they don’t decrease them. Additionally, Calleja et al., (2006) provide evidence that the phenomenon of cost stickiness is more likely to be observed when firms sustain larger drops in revenue. In the present research we test those findings by running the regression model over two 5-year periods of varying market conditions. The period of the Greek crisis from 2008-2018 many firms faced many difficulties and high decreases in revenues that drove to cutting down resources, reducing exports, tackling new adding taxes and finally facing non-performing loans. Finally, in order to implement the model, we use the sales revenue as the most precise approach than sales volume. For costs, we used total operating costs, as they are actively involved in the determination of the cost stickiness phenomenon.
4.2 Cost stickiness and time horizon

In order to investigate the phenomenon of cost stickiness concerning the time horizon we are going to run the same regression model that Calleja et al., (2006) used in their research but we are going to extend the time frame of the variables in order to incorporate revenue changes aggregated over two periods. Furthermore, we imprint the fluctuations of the revenue by extending the time frame of the variables. If the value and significance of the variable (β2) declines for the two-period model compared to the one-period model, then we can conclude that the phenomenon declines with time. Calleja et al., (2006) investigates and confirms the findings of Anderson et al. (2003), who suggest that the phenomenon of coast stickiness declines over time. Using big accounting data measured over aggregated time periods they extract evidence that confirmed their assumption. Previous literature suggests that is because the fact that over the long-term managers have more information and become more certain about the cause of revenue deterioration. Over longer time period adjustment costs of reducing resources becomes smoother thus cost stickiness is likely to be less.

4.3 Cost stickiness and specific firm’s ownership structure

Our last hypothesis suggests that cost stickiness may depend on specific firm characteristics such as the ownership structure. In order to investigate this assumption, we adopted a model similar to Anderson et al. (2003). This model includes two dummy variables: The first one takes the value of 1 when the revenue in the current period is less than the previous and the value of 0 otherwise. The second one takes the value of 1 when a firm in our sample characterized as family owned company.

\[
\log \left[ \frac{\text{total operating costs } i,t}{\text{total operating costs } i,t-1} \right] = \alpha + \beta_1 \log \left[ \frac{\text{revenue } i,t}{\text{revenue } i,t-1} \right] + \beta_2 \times d_{i,t} \log \left[ \frac{\text{revenue } i,t}{\text{revenue } i,t-1} \right] + \beta_3 \times f_{i,t} \log \left[ \frac{\text{revenue } i,t}{\text{revenue } i,t-1} \right]
\]

, where \((d_{i,t})\) is a dummy variable that takes the value of 1 when revenue decreases and is 0 otherwise and \((f_{i,t})\) takes the value of 1 when the company is family owned and the value of 0 otherwise.
As mentioned before Anderson et al. (2003) connected the phenomenon of cost stickiness with firm’s employees and asset intensity. Calleja et al., (2006) continues the previous literature on the topic and provides evidence that cost stickiness is related with other firm’s special characteristics. We are going to test the effect of ownership structure in cost behavior in Greek Listed Firms. Greek firm’s ownership differs because of the high concentration of family members in ownership structure compared with other firms listed in other stock exchanges around the globe.

4.4 Data collection

In order to proceed into the computational part of this research we exported data from the Amadeus Database and Thomson Eikon Database. Data were available through the International Hellenic University VPN Services. The dataset comprises of the financial elements that extracted of the financial statements of Greek Listed Firms of the Athens Stock Exchange from all sectors between 2008 and 2018. For comparability purposes we exclude financial firms.

The data filtered in order to create a sample that can be used for analysis. The process of filtering the data diminished the sample size. The steps we followed to filter the data are can be briefly described in the following steps. First of all, we exclude from the dataset firms with negative (loses) revenues across the years. We continue with excluding observations where operating costs were higher than revenues. In order to secure our sample from the effect of M&As and divestitures we exclude data referring to firms with changes in costs and revenues for more than 50% of the previous year. Additionally, we exclude firm-years where the change in total operating costs was higher than 50% between two consecutive year periods.

Excluding those observation of our data, we achieve the avoidance of non-recurring costs that may be included amongst the operating costs of the firms. We also removed observations that data were missed either in costs or revenues because they are not functional for our analysis. Adopting the assumption that firms with lower revenues than €7 million is not likely to face problems with the phenomenon of cost stickiness generally we proceed to the final step of our filtering. The final step of our filtering was the elimination of firm years when revenues were lower than €7 million and, on the top, /bottom of 1% of the sample for both costs and revenues observations. After the
implementation of those filters into the dataset the total number of observations decreased from 1710 to 761 observations.

5. Results

5.1 Descriptive Statistics

The regression models we used during our hypothesis testing were carried out using Stata Program Version… Each model has been tested for heteroscedasticity via the Stata Program and the variables were tested for multi-collinearity. The data used for our research purposes were arranged as a Pooled Regression Model and estimated using the Ordinary Least Squares (OLS) method. Before performing the regressions, we took into consideration the following assumptions: continuous dependent variables, independent variable consists of two or more measures, independence of observations, adequate sample size, no univariate or multivariate outliers, multivariate normality, linear relationship between dependent- and independent variables, there is homogeneity of variance, and there is no multicollinearity. Moreover, the data should take the form of panel data. Panel data combine small amounts of observations with a large number of cross-sectional units and help us to observe the differences between the firm years. All the assumptions tested, and dataset transformed to meet those assumptions.

Table 1 below presents the descriptive statistics of the untransformed variables before the beginning if testing hypothesis process.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Observations</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>1710</td>
<td>2.21</td>
<td>1.17</td>
<td>-1</td>
<td>10.3</td>
</tr>
<tr>
<td>OpCosts</td>
<td>1710</td>
<td>4.25</td>
<td>1.64</td>
<td>0</td>
<td>10.2</td>
</tr>
</tbody>
</table>

(Figures in billions €)

Regarding Table 2 statistics show that the Median (Mean) of Total Operating Costs is €4.25 billion and the Median of Operating revenues is €… billion. Progressing in the
analysis of the statistics we confirm the importance of the testing variables. They both have high standard deviations compared to their means, which indicates that there is a high fluctuation of the value to the variables and could be a mediator for the analysis. These fluctuations within the sample can be controlled with the proper control variables. Although, we have filtered out our dataset in order to have a manageable sample for our calculations, it should be mentioned, that our sample suffers from many values that are far from the majority, the so-called outliers. This means that many data points are far from the sample mean. Even though in most cases the existence of outliers suggests faulty data, into the situation of Greek listed companies the number of outliers is normal because of the small sample size (190 listed firms throughout 8 years) as well as the time period we chose to contact our research when fluctuations are unexpected, intense and great changes occurred in firms during this period.

5.2 Empirical Findings

In this chapter, the results from our regression analysis are analyzed. Each of the three tests are explained starting from hypothesis H1 (whether or not costs in Greek listed firms characterized as sticky, continuing with hypothesis H2 (sticky costs and time horizon) and finally explaining if ownership structure affects the cost stickiness phenomenon

5.2.1 Cost Stickiness

Table 2 presents the regression analysis of our first model. It’s percent the examination of the existence of cost Stickiness in Greek listed firms between 2008 and 2018. The regression model consists of the dependent variable log [total operating costs \( i,t \) /total operating costs \( i,t-1 \) ], the independent variable is log [ revenue \( i,t \) /revenue \( i,t-1 \) ] and all control variables. The dummy variable \( di,t \) is the signal to the change in revenue that takes the value of 1 when revenue decreases between two consecutive years and the value of 0:
Table 2
Regression Analysis for the first Model, 1, Cost Stickiness
Based on 431 observations

<table>
<thead>
<tr>
<th></th>
<th>β1</th>
<th>β2</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>α</td>
<td>0.94(24.7)</td>
<td>-0.12(-1.98)</td>
<td>0.88</td>
</tr>
</tbody>
</table>

After the regression analysis provide evidence about the existence of the phenomenon of cost stickiness in Greek listed firms during the examined period (2008-2018). Our model is statistically significant as the p-value is zero. R-squared is around 88% which means that the model explained 88% of the variance. This high value of the R-squared means that the data fit the model almost perfectly. Highlighting the independent variable, we observe that is statistically significant as the coefficients (β1) and (β2) present two- tail p-values (\(|t|\)) lower than 0.05. The coefficient (β1) has the most significant impact on the model as its p-value has the value of zero. Moreover, from the point of view of t-ratio, (β2) is the most important variable as we expected because its t-ratio (-1.98) lower compared to the value of (1.96). The variable \[\log\left(\frac{\text{total operating costs}_{i,t}}{\text{total operating costs}_{i,t-1}}\right)\] shows that the change in revenue is not proportional to the change of operating costs. The estimated value of (β1) =0.94 with a t-ratio of (24.7), imply that total operating costs increase, on average, by around 0.94% per 1% increase in revenue. Across all firms in the sample, (β2) averages (-0.12) with a t-ratio of (-1.98). That fact leads to the conclusion that when revenue decreases by 1%, total operating costs decrease by around (0.12). This stresses that changes in total operating costs are neither proportional nor symmetrical to changes in revenue. The value of (β2) determines the existence of cost stickiness and at that point our hypothesis is confirmed because we received a negative value.

The results of our research are aligned with the evidence of Calleja et al., (2006) whose research on cost stickiness contacted across code- law countries. They found that operating costs increase on average by 0.97% per 1% increase in revenue but on the contrary operating costs decrease only by 0.91% per 1% decrease in revenue. Their conclusion is that French and German firms show higher cost stickiness than US and UK firms and in general that there is a linear relationship between changes in operating costs and revenues. According to these authors, this is due to the differences in
corporate governance policies. Additionally, Anderson, Banker, & Janakiraman (2003) from which we borrowed the used regression model contacted a research on 7,629 firms from the period 1979 to 1998. They found evidence that for every 1% increase of revenue, SG&A costs increase by 0.55%, but only decrease by 0.35% per 1% decrease in revenue. Weidenmier & Subramaniam (2003) and Chen, Lu, & Sougiannis (2012) confirm the cost stickiness of costs by using the ABJ model of Anderson et al., (2003)

5.2.2 Cost stickiness and time horizon (two-period model)

Table 3 presents the regression analysis of our second model. The results arise from the regression analysis which contrasts the cost behavior (stickiness) of a two-period model with the cost behavior of one-period model. In order to test the second hypothesis, we use the same model that we use to test cost stickiness in section 4.2. The only difference is that the dummy variable takes the value of 1 when revenues are decreased compared with the revenues of 2 period before and the value of 0 otherwise. We make this change in time frame of the variables in order to incorporate time into cost behavior:

**Table 3**
Regression Analysis for the Second Model, 2, Cost Stickiness and time horizon.
Based on 431 observations
T-statistics are shown in the parentheses
Prob > F = 0.0000

<table>
<thead>
<tr>
<th></th>
<th>( \alpha )</th>
<th>( \beta_1 )</th>
<th>( \beta_2 )</th>
<th>( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.14(-1.32)</td>
<td>0.56 (22.7)</td>
<td>0.09(-1.49)</td>
<td>0.89</td>
</tr>
</tbody>
</table>

The second model is used in order to test for the phenomenon of cost stickiness over time. The model is statistically significant as the p-value is zero. R-squared is higher than compared to one-period regression model reaching the percentage of almost 90% which means that the model explains 90% of the variance. This high value of the R-squared means that the data fit the model almost perfectly. At the level of 5% confidence (\( \beta_1 \)) is the only variable that has some significant impact on the model. Unfortunately, the outcome is not robust on account of the t-statistics and the variable
(\(\beta_2\)) is statistically insignificant. Although the R-Squared is very high, the only variable that is statistically significant is the variable (\(\beta_1\)), indicating that this small number of independent variables explains relatively a lot of variation of the dependent variable. (\(\beta_2\)) has a positive value which means that the phenomenon of cost stickiness is less intense compared to the one-period model. Prior literature on the topic suggests that over longer time of periods, managers have more information about and can adjust their behavior in order to assess more carefully the decline of revenues and act accordingly adjusting their resources. Over a longer period, the ratio of the expense of cutting back resources is smoothing relative to the incremental cost of retaining surplus resources and becomes smaller. Anderson, Banker, & Janakiraman (2003) find that stickiness in costs decreases and becomes less intense with the aggregation of periods, as longer periods include complete adjustment cycles. Analyzing our results and following the previous literature on the topic the phenomenon of cost stickiness seems to be marginally lower in a higher timeframe, thus we are going to accept our second hypothesis.

5.2.3 Cost Stickiness and family ownership

Table 4 presents the regression analysis of our third model. It’s percent the examination of the existence of cost stickiness in Greek listed firms between 2008 and 2018 regarding its ownership structure. The regression model consists of the dependent variable log [total operating costs \(i,t\) /total operating costs \(i,t-1\)], the independent variable is log [ revenue \(i,t\) /revenue \(i,t-1\)] and all control variables.

Table 4
Regression Analysis for the Second Model, 3, Cost Stickiness and Family ownership.
Based on 301 observations
T-statistics are shown in the parentheses
Prob > F = 0.0000

<table>
<thead>
<tr>
<th>(\alpha)</th>
<th>(\beta_1)</th>
<th>(\beta_2)</th>
<th>(\beta_3)</th>
<th>(R^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.07(-1.99)</td>
<td>0.94(17.28)</td>
<td>-0.17(-2.38)</td>
<td>0.05(0.32)</td>
<td>0.89</td>
</tr>
</tbody>
</table>
The third model is used in order to test the connection between the phenomenon of cost stickiness and the ownership structure of Greek Listed Firms. Same as the previous models our third model is statistically significant because the p-value of the model takes the value of (0) zero. R-squared is also high as the previous two models 89% and that means that the model explains almost perfectly the variance. High R-squared in all previous models is something expected because of the filtering of the data sample. In the third model we elaborated one additional variable that incorporated the family ownership of Greek listed Firms.

Analyzing the coefficients ($\beta_1$) has the greater effect on the model. Regarding the other coefficients ($\beta_2$) is statistically significant even if its value is close to zero. The coefficient ($\beta_3$) of the control variable of ownership structure is statistically insignificant. According to the results of the regression analysis we cannot accept the third hypothesis. Correlation between ownership structure is very low as the coefficient take values close to zero. In our regression costs are changing by 0.94% when the Revenue variable is changing by 1% but there is no evidence of how the ownership structure affects the phenomenon of cost stickiness.

Possibly in the case of Greek companies, other features such as, employees, debt financing, and working capital may function as drivers for further investigation by managers. However, with the above analysis, we have rejected the influence of the family ownership that each company cost behavior. Cost stickiness is a reality in Greek listed firms and we prompt the managers to search and study other elements that can provide solutions to the problems they face.

6. Conclusions and Discussion

6.1 Summary of Findings

Hypothesis been made:

Hypothesis 1: Greek listed firms face the phenomenon of cost stickiness during the period of the financial crisis.

Hypothesis 2: Cost stickiness decline over longer time periods

Hypothesis 3: Cost stickiness is affected by a firm’s ownership structure.

Results:

H1: Results are significant. Hypothesis is accepted
H2: Results are significant. Hypothesis is accepted
H3: Results are insignificant. Hypothesis is rejected

Our first hypothesis is confirmed after we investigated cost behavior in our sample of firms. More specifically we investigated the relationship between operating costs and operating revenues for all Greek listed firms between 2008 and 2018. Our results saw that when the revenue decreased by 1% the operating costs decreased by less than 1% (0.12%) and this is definition literature grant to cost stickiness. Our results are aligned with previous research on cost behavior as Anderson, et all (2003), Weidenmier & Subramaniam (2003) and Calleja et al., (2006). The phenomenon of cost stickiness seems to be normalized when we investigate in a longer time-period (current results compared with two years back). Aligned with the previous literature we accept the notion that in the long-term managers possess better information and they find ways to make the appropriate adjustments and overcome the cutting of the resources. In cases where the activity fluctuates among specific negative or positive percentages, the changes are slightly or marginal different from our first model. This finding indicates the awakening of the managers who should decide properly about them surplus resources. This finding opposes the results of prior literature (Subramaniam & Weidenmier (2003), Anderson, Banker and Janakiraman (2003). The main research topic of this study is whether or not costs behave as sticky in Greek Listed Companies from 2008 to 2018, which is confirmed. Cost stickiness is a reality in Greek Listed Firms through the time frame of the depression. Although, Greek firms seem to a=be adapted and try to find solutions to the phenomenon, which we are going to discuss in our second hypothesis. Our study used data from Greek listed companies only to gain a well-lifted view of this paralyzed economy that operates as a case study in many studies. The results of this research are aligned with prior literature concerning the phenomenon of cost stickiness. Total operating costs increase, on average, by around 0.94% per 1% increase in revenue, whilst total operating costs decrease by around 0.12% when revenue decreases by 1%. Our findings align with Calleja et al., (2006) who provide evidence using a sample of US, UK, French and German Firms that operating costs are sticky in response to changes in revenues. Operating costs increase on, on average, by 0.97% per 1% increase in revenue, but decrease by only 0.91% per 1% decrease in revenues. In addition, Anderson, Banker, & Janakiraman (2003) who
first investigate the sticky cost behavior and support the notion that cost stickiness is a reaction to revenue changes by producing extract similar results as ours. We used the same model in order to extract our empirical findings. Discussing our second hypothesis (cost stickiness and time horizon) we investigate cost behavior on longer timeframe base using the same data. The findings we extract after our research are aligned with the research of Calleja et al., (2006) where the value of (β2) declines for their two-period model. According to them Cost Stickiness is less preannounced for firms when periods are aggregated. The broad pattern suggests that over longer adjustment periods, managers have more information in their possession and can assess more carefully the nature and permanence of the decline and act accordingly. Over a longer timeframe, the ratio of the expense of cutting back resources relative to the incremental cost of retaining surplus resources becomes smaller, making adjustments to the level of resources a more viable course of action.

Using various filters in our computing program, we were optimistically led to the result that costs are less sticky when longer-time periods are considered. In our model the variable (β2) is marginally positive 0.09. In that way they are readier to adjust as the ratio of the expense of cutting back resources relative to the incremental cost of retaining surplus resources becomes smaller.

In our Study Greek firms react linearly to these assumptions and the cost stickiness fluctuates as the revenues fluctuate, too. Stickiness is a feature of certain industries, certain firm characteristics, and market wide conditions. We try to shed light in the side concerned ownership structure of the firms and more specific family ownership in Greek Listed Firms. However, in our analysis and through the regression models that we have used the dummy variable that affects cost stickiness is statistically insignificant. The coefficient is close to zero 0.05, meaning that the influence is marginal. The reason for this has not yet been investigated and needs to be further researched. A possible reason for that fact is that the majority of Greek Listed firms is family owned and as a fact they all face the phenomenon of cost stickiness independently of their ownership structure. This study is subject to many limitations as many other studies do concerning cost stickiness. To begin with, our dataset is compromised by data, collected by various databases. We downloaded data from both Amadeus and Thomson Eikon databases, thus there is a limitation on the dataset, data
are dependent on the overlap of different databases. Secondly, in our research we use sales revenue in order to estimate the volume of the firm’s activity thus the reader should bear in mind that our findings must be handled with skepticism. Sales Revenues were used as the most representative can be affected by many different factors such as prices or managers decisions. A third limitation is the time horizon we use in order to contact our research as well as the sample size. Compared with other researches that usually use a higher timeframe we used a narrow time horizon of 10 years. In addition, the number of Greek Listed Firms 190 is narrow compared to other research in other countries. Our final limitation is the current situation that Greek economy is facing with grate fluctuations and changes in every aspect of its operations. Greek economy is changing rapidly and if we try to investigate the current period regarding the previous 10-year period we examined the results will be different.

Persevering to traditional methods, there is a strong chance of overestimating or underestimating cost behavior over the course of business fluctuations. An understanding of the sticky cost behavior can help to better control and plan the company. The natural tendency of managers is to plight firms with resources responding to current or future growth. However, cost stickiness may be the motivation that they need in order to be more flexible. Careful planning can mitigate sticky cost behavior. To stay away from or limit the impacts of sticky cost conduct, administrators should have the capacity to recognize and oversee unused limit and assets. As far as the control concerns, cost stickiness conceivably misshapes standard costing frameworks, fluctuation examination, and remuneration plans. Assessing singular execution against a benchmark which, for impeccably normal reasons, does not flex not surprisingly as a result of alteration costs related with earlier duties, is unmistakably unjust. Further investigation could be currying out on what are other factors that affect the phenomenon of cost sickness. After Analyzing the Greek Market and due to the fact, the small size of Greek companies a further research could be carrying out not only in Public Firms but also in private firms that are the biggest part of the Greek economy. The result of our research could be communicated on Greek firms’ managers or in our case owners, thus assisting in a robust course for any business free of sticky conditions that do not help them grow as much as they can.


Kama, I., & Weiss, D. (2010). *Do managers' deliberate decisions induce sticky costs?* Tel Aviv University, Faculty of Management, The Leon Recanati Graduate School of Business Administration.


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**Appendix**

**A. Literature Summary**

Table A1: Summary of prior research on Cost Behavior
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year</th>
<th>Research Matter</th>
<th>Importance of Topic</th>
<th>Sample Data</th>
<th>Sample Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miller, J. G, Vollmann, T. E</td>
<td>1985</td>
<td>Manufacturing strategies in Large manufacturers in Western Europe, North America and Japan</td>
<td>Find no evidence on cost stickiness</td>
<td>1,000 Large manufacturers in Western Europe, North America and Japan</td>
<td>1983-1985</td>
</tr>
<tr>
<td>Balakrishnan R, Petersen M. J, Soderstrom N.</td>
<td>2004</td>
<td>Capacity Utilization and cost stickiness</td>
<td>How &quot;sticky&quot; costs connect with firm’s activity</td>
<td>Therapy Clinics</td>
<td>2004</td>
</tr>
<tr>
<td>Zanella, F, Oyelere, P, Hossain, S.</td>
<td>2015</td>
<td>Existence of &quot;sticky&quot; costs in the UAE Adjustments between</td>
<td>SG&amp;A costs may not align with the change in revenues</td>
<td>105 publicly listed companies in the UAE</td>
<td>2002-2011</td>
</tr>
</tbody>
</table>
Table A2: Summary of prior research on Cost Stickiness and Agency Problems

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year</th>
<th>Research Matter</th>
<th>Importance of Topic</th>
<th>Sample Data</th>
<th>Sample Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooper, R.</td>
<td>1998</td>
<td>Investigation on how managers' decisions affect cost stickiness</td>
<td>Cost stickiness is sensitive due to Managerial decisions</td>
<td>Research on leading companies worldwide</td>
<td></td>
</tr>
<tr>
<td>Kaplan, R.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subramaniam, C.</td>
<td>2003</td>
<td>Exploring behavior of cost in different ranges of sales</td>
<td>Costs become sticky in revenue changes</td>
<td>Manufacturing Merchandising and financial firms</td>
<td>1979-2000</td>
</tr>
<tr>
<td>Weidenmier, M. L.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kallapur, S.</td>
<td>2005</td>
<td>Hospital reimbursement and cost stickiness in Washington State Hospitals</td>
<td>Change in cost behavior is attributable to Medicare's change in reimbursement.</td>
<td>831 departments in 59 Washington State hospitals</td>
<td>1977–1994</td>
</tr>
<tr>
<td>Eldenburg, L.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kama I.</td>
<td>2013</td>
<td>Incentive that lead managers into earning management in order to meet</td>
<td>Resource adjustments by managers according to their incentives</td>
<td>All public firms covered by Compustat and CRSP during</td>
<td>1979-2006</td>
</tr>
<tr>
<td>Weiss D.</td>
<td></td>
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<td></td>
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</tbody>
</table>
Table A3: Summary of prior research on Cost stickiness in Labor

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year</th>
<th>Research Matter</th>
<th>Importance of Topic</th>
<th>Sample Data</th>
<th>Sample Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jaramillo, F.</td>
<td>1993</td>
<td>Asymmetric Equilibrium Adjustment between Employment and Economic Growth</td>
<td>Direct connection between cost stickiness and employees hiring/firing</td>
<td>(-)</td>
<td>(-)</td>
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<tr>
<td>Schiantarelli, F.</td>
<td></td>
<td></td>
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<td>Sembenelli, A.</td>
<td></td>
<td></td>
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<tr>
<td>Goux, D.</td>
<td>2001</td>
<td>Fixed-term contracts and the dynamics of Labor demand</td>
<td>Connect the type of employee contracts (indefinite/fixed-term) with cost stickiness</td>
<td>1000 French Firms</td>
<td>1988-1992</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Year</td>
<td>Research Matter</td>
<td>Importance of Topic</td>
<td>Sample Data</td>
<td>Sample Years</td>
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</tbody>
</table>

Table A4: Summary of prior research on other factors affecting cost stickiness
<table>
<thead>
<tr>
<th>Change in operating activity</th>
<th>How external auditors affect cost stickiness of the firms</th>
<th>Selling price versus capacity adjustments in order to face stickiness</th>
<th>Influence of reporting methods in cost stickiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shangkun, L. Dong, C. Xiaoli, H. 2014</td>
<td>External Auditors and cost behavior</td>
<td>Chinese Listed Companies</td>
<td>2002-2010</td>
</tr>
<tr>
<td>Cannon, J. N. 2014</td>
<td>Examines determinants of cost stickiness</td>
<td>US Air Transportation Companies</td>
<td>(-)</td>
</tr>
<tr>
<td>Shust, E. Weiss, D. 2014</td>
<td>Asymmetric cost behavior and sticky costs</td>
<td></td>
<td>(-)</td>
</tr>
</tbody>
</table>