The cost stickiness phenomenon in Greek listed firms

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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.
Abstract

Prior literature on cost behavior has already demonstrated the relationship between costs and firms’ activity. Costs increase more with activity increases than they decrease in response to equivalent activity decreases. This sticky cost behavior repudiates the conventional model which accepts that expenses carry on symmetrically for action increments and declines. In this research, we are trying to draw conclusions from a dataset that comprises of Greek listed firms between 2007 and 2014. The assumption is that operating costs fluctuate non symmetrically as the sales revenue fluctuates but in a longer term horizons cost stickiness tends to disappear due to the wide range of information gathered by managers, who learn how to use them properly. In fact, cost stickiness is a situation 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. Another factor that influences the cost stickiness is whether a firm is asset oriented or not. Generally, firm-specific and industry characteristics also impact on levels of cost stickiness. In this research, we investigate how Greek firms react when revenues are changing in relation with assets. The hypotheses that we are forming are rejected or confirmed accordingly.

Keywords; Cost stickiness, Operating Costs, Revenues, Assets, Cost Behavior
1. Introduction

Since businesses started organizing and actively pursuing their economic course, the notion of cost was the subject of continuous study and optimization effort. Traditional studies distinguished two different types of costs and characterized them as fixed or variable on a basis of output’s change. These models distance from the real behavior of costs and their target was to simplify the sizes.

The findings from these surveys seemed fixed, until authors such as Anderson, Banker, & Janakiraman, (2003), have come to show that the behavior of costs may depend upon the level of activity of the company. Balakrishnan, Petersen, & Soderstrom, (2004), have consolidated evidence that the costs are declining with lower dynamics when there is a decrease in production compared with the rise in output at which costs are declining with increasing rates. A decade later Zanella et al. (2015) underline the role of selling, general and administration costs that behave with an inverse intention from the change of activity and he was the first who established the term “cost stickiness”. For the author cost stickiness is the phenomenon that firms tend to face when the output decreases by 1%, the costs decrease by less than 1%. 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 case of Greece as to whether the phenomenon is present and what are the factors that affect the intensity of the cost stickiness.

The necessity for proper management of the cost stickiness is at the discretion of the managers who can and will alter the sources when they see ups and downs in demand. According to Guenther, Riehl, & Rößler (2014) the inability to accomplish the appropriate adjustments of the resources is the main reason for the cost stickiness. The resources they refer to are equipment, personnel or plant. The authors suggest that some cost categories are influenced by changes in activity level (variable or step costs) and that only these costs can be sticky. When the level of activity changes by step, the step costs change as well. These step costs are initially constant and do not change with activity changes. When there is a decrease in activity beyond the step range and when there are no adjustments because of the decrease in activity, the result is cost stickiness. Fixed costs are unchangeable and inflexible over a short period. However, fixed costs can be sticky over a longer time. But these long time frames are
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unusual in researches about cost stickiness. Anderson, Banker, & Janakiraman (2003) stated that managers tend to delay making any change of sources while seeing that there is an upsurge in demand. This strategy helps to avoid losing with an impulsive decision that may save the company's course, to make a tricky change in theirs. Directors might tolerate slack asset costs so as to evade financial results for lessening the more restoring. Banker, Byzalov, & Chen (2013) and Dalla & Perego, (2014) have turned their attention on how cost stickiness may be prone to Employment Protection Legislation that each country applies and how corporate governance, the labor market and cost structure features affect cost stickiness.

Through this academic research in the context of our diplomatic work, we hope to approach the theoretical and practical level of cost stickiness in the Greek companies listed on the Athens Stock Exchange. This will contribute to the debate about if and how cost stickiness works in Greece. In addition this paper will widen the view about how should the managers behave towards this phenomenon by keeping the methods of the past, but adapting them to new, ever-changing conditions.

2. Literature Review and Hypotheses Development

2.1. Motivation

The target of this paper is to decipher whether or not cost stickiness exists in Greek listed companies in a specific time horizon of eight years. The most influential factor for cost stickiness is the market change. Anderson, Banker and Janakiraman(2000) conclude that studying SG&A costs is very important because these costs are the most controversial and affect sales revenue. Balakrishnan & Gruca, (2008) interpreted managers’ decisions as catalytic for cost stickiness of the firms. There have been many papers published about cost stickiness in relation to size and industry Dalla & Perego, (2014), Banker & Chen, (2006) and Cheng, Jiang, & Zeng, (2012). However there is no 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.
2.2. Structure
First of all, in the literature review we will develop the theory that already exists in previous studies on the issues that we are going to contemplate. In the end of the literature review we will bring forward the basic hypotheses, followed by the relevant research tests that will give answers to our query. Finally, the results chapter will provide the findings that will be defined at the last chapter, providing conclusions, limitations and suggestions for further investigation.

2.3. Literature Review and Hypotheses Development
In the first part to this chapter, we will analyze the asymmetric cost behavior in previous studies. Subsequently, we will shed light to the most important factors of cost stickiness, the costs and other factors that affect them. Finally, we will present the hypothesis statement.

2.3.1. Asymmetric Cost Behavior
The majority of earlier academic texts embrace the clear separation between fixed and variable costs. Fixed costs have a stable route, unaffected by the company’s activity, whilst variable costs have a linear relationship with the changes in company’s activity. Back in 1997 Noreen and Soderstrom (1997) did not find any evidence about cost stickiness in their study. According to their evidence from US hospitals, the predictions were more accurate when they assumed that costs are remaining steady. Anderson et. al (2003) were the first who investigate the asymmetric behavior of costs due to either the mitigation or sharpening of the volume. Their research is based on the conviction that selling, general and administrative costs are sticky and they increase linearly when the volume is increased, but they do not decrease the same amount as the volume decreases. 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.

For Balakrishnan, Petersen, and Soderstrom (2004) costs may be classified as “sticky” if the magnitude of their increase associated to an increase in a firm’s economic activity, is greater than the magnitude of their decrease associated with an equivalent decrease in a firm’s economic activity. Relatively large changes in sales revenues interrupt the linear pattern of cost behavior. In some cases, costs exhibit anti-sticky behavior, that is, the cost response to an activity level decrease is greater than in the
case of an activity increase. Subramaniam and Weidenmier (2003) promoted the same findings about cost stickiness phenomenon. Moreover, all the above studies confirmed that the cost stickiness is influenced extremely by the firms’ characteristics and the economic transitions between the years. In 2015 Zanella et. al(2015) stated that selling, general and administrative costs may not align with the change, and this means that when the output decreases by 1%, the costs decrease by less than 1%. Managers’ incentives and motivations are playing a very important role in the cost stickiness procedure. According to Cooper and Kaplan(1998) in a case of reduced demand, it is more likely for them to remain with underutilized resources than break a contract which has been very costly breaking clauses. In that situation revenues will drop but the costs will not fall in the same amount. Itay Kama and Dan Weiss (2013) underline the situation which incurs when managers feel the pressure to meet financial analysts’ forecasts and results, the speed down the appropriate adjustments of slack resources for sales’ decreases. These decisions are intentional in order to smooth the cost stickiness and spring up from the agency-driven incentives. According to Banker and Byzalov(2014), managerial decisions for resource commitments depend on concurrent sales and also prior resource levels, which affect the level of adjustment costs, predictions of future sales, which affect the level of future adjustment costs and agency and behavioral factors, which drive manager’s actual choices and motivation. Many authors enhance the opinion that cost asymmetry is a matter of psychology. Pessimistic (optimistic) provisions of sales decline may lead to reduction (increase) of cost asymmetry. (Banker, Byzalov, Ciftci, and Mashruwala 2014; Banker and Byzalov 2014; Subramaniam and Weidermier 2003; Balakrishnan, Peterson, and Soderstrom 2004).

Adjustment costs are another factor that causes inelastic cost behavior. As adjustment costs we define the contracting or psychological costs that emerge during the resource-adjustment process. When adjustments costs are higher, managers are more willing to retain unutilized resources to avoid adjustment costs (Anderson, Banker, and Janakiraman 2003; Calleja, Stelianos, and Thomas 2006; Banker Byzalov and Chen 2013).

Cheng et al (2012) stated that there were plenty of articles about firms’ or countries’ cost stickiness, especially in US and UK. Previous empirical work has been carried
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exclusively with US companies with Caleja et al (2006) who studied US, UK, French and German firms about cost stickiness finding that governments subject to code-law governance systems, such as France and Germany, tend to face more sticky costs. However there is a little evidence about cost stickiness and its administration in the period of crisis in Greece.

Cost stickiness is greater in election years relative to nonelection years, consistent with expectations according to Lee, Pittman and Saffar(2016). In Greece from 2007 to 2014 there were four national elections that played a very important role in shaping cost asymmetry. Cohen, Karatzimas and Naoum (2015) identified that sticky behavior is present in Greek local governments too, where the adjustments of costs of service provision are taking place faster for upward of the activity changes by the managers than downward of the activity changes. Kokotakis, Garefalakis, Mantalis, Zanidakis and Galifianakis (2013) studied how the costs behave on Greek Food, Beverages and Tobacco industry, confirming their inelastic tendency. Moreover this sector has a direct relation to all households. Therefore, the phenomenon of cost stickiness seems to be present in many forms in Greek economy.

2.3.2. Costs and additional factors
The first who investigated Selling, General and Administrative costs were Anderson, Banker, & Janakiraman, (2003). Their ABJ model will be used from future authors until today, in which a combination of SG&A costs and activity level of the firms act as an indicator of how cost stickiness actually works. The authors found that managers’ self interests may cause cost stickiness in periods of unutilized resources and reduction of demand.

Subramaniam & Weidenmier (2003) tried to separate the cost stickiness among different sectors such as manufacturing, merchandising, service firms and financial firms. They conclude that financial firms did not face cost stickiness. However, cost of goods sold (COGS) are only sticky for financial and manufacturing firms; for merchandising firms, this is not the case. Their study showed that cost stickiness is higher at manufacturing firms because they possess largely fixed assets and inventory. On the other hand, merchandising firms have less cost stickiness due to the competitive environment they operate in. Every industry has its own structure, cost
characteristics, property, labor, plant, specific level of inventory, and equipment cost, so cost stickiness differs among the industries.

By using American Standard Industry Classification Test Anderson & Lanen (2009) studied individual industries in order to decipher a possible connection between cost stickiness and firms’ characteristics. As they expected their results disclosed that cost stickiness phenomenon can change form and type, and it depends on the type of industry, country, accounting methods and the possibility of anti-stickiness (reverse phenomenon).

Firms’ characteristics such as asset level, employee level and the reduction of revenues in previous periods are considered as crucial for the forming of cost stickiness. Anderson, Banker and Janakiraman (2003) stated that firms which employee more personnel or possess more assets, tend to demonstrate higher levels of cost stickiness. Calleja, Steliaros & Thomas (2006) used the same study and they added the ratio of interest, the level of debt and return on equity to their testing process. They also underlined that intensity of assets, the number of employees and the amount of debt financing combined with operation in specialized in several markets and businesses may influence cost stickiness.

Selling prices also affect cost stickiness. This is an opinion that Canon (2014) questions. He noticed the managers’ strategy that tends to adjust the selling price the moment that demand changes instead of reducing or increasing capacity. He examined the airline industry in which the example is very clear. He clarified a tradeoff in how managers react to demand’s ups and downs. They take into account not only the demand but also the profit of the additional generated revenue in case of adding more capacities.

Contemporary companies are not just production units. They have a form of social systems, cores that employees, managers and products interact and are obliged to comply with the expectations of their environment and the social values and norms. Companies nowadays try to build policies of commitment not only to customers but also to their personnel. 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. According to Banker, Byzalov and 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. Moreover 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 reputation and status. This occasion contributes to cost stickiness. Shust & Weiss (2014) test the possible influence of reporting methods in cost stickiness. Their study found that financial reporting methods only affect the cost stickiness of reported expenses, whilst costs are not affected. They also tested the impact of depreciation on cost stickiness, because depreciation involves expenses not paid in cash. They find evidence that depreciation increases cost stickiness. Furthermore, they find that operating expenses after the depreciation show significantly more cost stickiness than reported expenses before depreciation. They also suggest that capital investment decisions made in previous periods, which results in depreciation expenses in the current period, may lead to the increase in cost stickiness in the current period. Therefore, reporting choices required by the GAAP affect cost stickiness. The GAAP requires reporting of depreciation accrual, which is one of those methods.

In addition, Shangkun, Dong, & Xiaoli, (2014) investigated whether external auditors play a role in the cost stickiness among listed Chinese’s firms. They find evidence that firms audited by one of the Big Four audit firms show low cost stickiness. 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.

As we can observe cost stickiness may be affected by many different characteristics. However, it is very difficult to use all the above determinants in one research.
To amplify reader’s convenience, in the appendix sessions we demonstrate tables that summarize every research that we used for our literature review in chronological view.

2.4. Hypothesis 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 2007-2014

\[ H_1: \text{Greek listed firms are facing cost stickiness in the period 2007-2014.} \]

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.

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. This forms the second hypothesis:

\[ H_2: \text{Cost stickiness declines for a two period- model in contrast with one-period model.} \]
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Costs may be characterized as sticky when the changes in revenue exceed 15% among years according to Subramaniam and Weidenmier (2003). Although the cost stickiness tend to decline for largest drops in revenues, thus recommending managers to start renegotiating contracts to adjust the levels of resources. At this point, we reach the formation of the third hypothesis, which we will examine by setting small intervals to the revenues’ changes in order to have the differentiation in cost stickiness:

\[ H_3: \text{Cost stickiness depends on Revenues’ intense fluctuations.} \]

Finally, it has been observed that the structure within a firm may affect the levels of cost stickiness. Especially firms with an asset structure composed mainly by assets might be expected to present high levels of cost stickiness. Especially in Greek listed firms where the assets play an important role to their course this assumption may drive us to valuable results. Our last hypothesis is formed as:

\[ H_4: \text{Cost stickiness depends on Firms’ Assets.} \]

In additional to the hypothesis, firm characteristics in combination with the changes in operating activity may cause differences in the outcome of this research. As to prevent this, the determinants, asset intensity will be used as control variables. This will strengthen the outcome and we will be driven to safer results.

Eventually, these four 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 Research Methodology part.

3. Research Methodology

The primary target of this research is to investigate the effect of cost stickiness in Greek listed companies over seven years. Following the beaten track, we are going to use the basic model used by Anderson, Banker, & Janakiraman, (2003) which calculates the firms’ cost stickiness. Continuing, with some variations of the used model, we will lead to conclusions about the differentiation of the phenomenon at specific time intervals, changes in activity as well as the specific characteristics of the firms.
3.1. Cost stickiness

We test for cost stickiness of Greek listed firms using the following model:

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

where \(d\) is a dummy variable that takes the value of 1 when revenue decreases between two years and otherwise is 0.

The use of this regression is totally aligned with previous studies (Anderson et al., 2003; Subramaniam and Weidenmier, 2003). The model compares the variables between current and previous periods using ratios that referred to costs and revenues. In that way we achieve better cross-sectional comparison. Moreover, the ratios are log-transformed in order to obtain a better normal distribution and enhance the economic interpretation. The value of \(d\) is the one that determines the existence of cost stickiness. Since the value of the decrease variable \((d)\) is 0 when revenue increases, \(\beta_1\) measures the increase in percentage terms in costs with a 1% increase in revenue. In the opposite case, when revenue decreases the variable \(d\) is taking the value of 1, and therefore the sum of \(\beta_1\) and \(\beta_2\) measures the decrease, in percentage terms, in costs associated with a 1% decrease in revenue. \(\beta_2 = 0\) means balance between cost fluctuations, while a negative value indicates sticky cost and statistically significance.

By using the same model as Anderson et al.’s (2003) did, we exact the conjecture that cost stickiness depends on market growth: In periods of high-market growth managers believe that the possible decline revenues may not be permanent but they behave different in low economic growth periods. In this case they decide to keep a more conservative behavior towards resources and they don’t reduce them.

We test this conjecture by running the models over 7-year periods of varying market conditions. This period from 2007 to 2014 is very crucial for Greek economy as many firms have difficulty surviving, cutting down resources, reducing exports, tackling new adding taxes and finally facing non-performing loans.
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.

3.2. Cost stickiness and the time horizon
Anderson et al. (2003) discovered that the phenomenon of cost stickiness was not certain when they would use accounting data massively. This is because the managers would receive better decisions and they were more aware of the causes and the existence of the decline of revenues. For that reason the cost stickiness seemed to be smaller to non-existent since the adjustment costs tended to be less than the costs of the unexploited resources.

In order to be aligned with the research of Caleja et al. (2006) we use the same exact test with aggregated data for two year periods, and we imprint the changes in the revenues by extending the time frame of the variables. The value coefficient $\beta_2$ will be the factor which will signify the progress of cost stickiness for the two-period model compared to the one-period model.

3.3. Cost stickiness and changes in the activity
The magnitude of changes in revenues may affect cost stickiness. When revenues’ change exceeds 15%, total costs presented as very sticky. This is in contradiction with cost of goods sold expenses that tend to fall for largest drops of revenues. In that situation, managers undergo the costs of renegotiating contracts to adjust resource levels rather than incur the costs of retaining surplus, unutilized resources.

In order to test the variability in revenues’ changes and the effect on cost stickiness, we use a model which uses four dummy variables:

\[
\log[\text{total operating costs}_{i,t}/\text{total operating costs}_{i,t-1}] = \alpha + \sum_{j=1}^{4} \beta_j d_{j,i,t} \log[\text{revenue}_{i,t}/\text{revenue}_{i,t-1}] + \varepsilon_{i,t}
\]

, where company $i = 1$–193 and year $t = 2007$ to 2014 and $d_j$ is a dummy variable which takes the values: $d_1 = 1$ if the percentage change in revenue lies between $-0.10$ and $0.10$, and is otherwise $0$, $d_2 = 1$ if the percentage change in revenue lies between $-0.50$ and $-0.25$ or between $0.25$ and $0.50$, and is otherwise $0$, $d_3 = 1$ if the percentage
change in revenue lies between −0.25 and 0, and is otherwise 0, \( d_4 = 1 \) if the percentage change in revenue lies between −0.50 and −0.25, and is otherwise 0.

All these dummy variables are operating as safety measures in order to have a comprehensive and wide range of sales variations between years. Coefficients \( \beta_1 \) and \( \beta_2 \) measure the increase in costs following a 1% increase in revenues and each has its corresponding coefficient \( \beta_3 \) and \( \beta_4 \) measuring the sticky cost behavior. The last ones are expected to be negative.

### 3.4. Cost stickiness and specific firm characteristics

Rich bibliographic evidence already confirmed the relationship between specific firms’ characteristics of the phenomenon of cost stickiness. Both Anderson et al. (2003) and Subramaniam and Weidenmier (2003) have provided evidence that associated cost stickiness with firms’ behavior toward assets and employees. Anderson, Banker and Janakiraman (2003) stated in their research that the combination between asset intensity, employee intensity and revenue decrease may lead to the appearance of cost stickiness especially in big firms. Other authors such as Calleja, Steliaros, & Thomas (2006) and Subramaniam & Weidenmier (2003) went with their research one step further, as they studied not only about asset and employee affection to cost stickiness, but also the debt financing and working capital concluding similar conclusions.

Given the fact that we are going to study about Greek listed firms we are going to concentrate on the asset intensity of the firms. The applied model is the same that Anderson, Banker and Janakiraman (2003) used for their study:

\[
\log\left(\frac{\text{Costs}_{i,t}}{\text{Costs}_{i,t-1}}\right) = \alpha + \beta_1 \log\left(\frac{\text{Revenue}_{i,t}}{\text{Revenue}_{i,t-1}}\right) + \beta_2 \text{ Decrease\_Dummy}_{i,t} \log\left(\frac{\text{Revenue}_{i,t}}{\text{Revenue}_{i,t-1}}\right) + \beta_3 \log\left(\frac{\text{Assets}_{i,t}}{\text{Assets}_{i,t-1}}\right) + \beta_4 \log\left(\frac{\text{Assets}_{i,t-1}}{\text{Assets}_{i,t-2}}\right) + \beta_5 \log\left(\frac{\text{Assets}_{i,t-1}}{\text{Assets}_{i,t-2}}\right) + \epsilon_{i,t}
\]

In this regression \( \text{Decrease\_Dummy} \) takes the value of 1 when the revenue in the current period is less than the previous, whilst \( \text{Decrease\_A\_Dummy} \) takes the value of 1 when the total assets in period \( t \) are less than in \( t-1 \).
In this way, we will try to build up a measure, which will shed light, to how Greek listed firms from all sectors evaluate the volume of their total assets and if there is a connection with the cost stickiness.

4. Data collection and Methodology of statistics

The computational part of this research is based on quantitative data gathered from the Amadeus Database and Bloomberg Database. All these are accessible by the IHU VPN Service. The dataset comprises of the financial elements that are emanated from the financial statements of the Greek listed firms to Athens Stock Exchange from all sectors between 2007 and 2014. For comparability purposes we exclude financial firms.

After being gathered the data get filtered in order to have a sample that can be used for analysis. All these steps diminished our sample. First of all, the cases where the costs were higher than the revenues were deleted from the dataset or when firms had negative revenues across the years (losses). We continue with the implementation of a filter that secures our data from the effects of mergers, acquisitions and divestitures by eliminating the firms that their revenues or costs changed for more than 50% than the previous year. Moreover, we exclude the preceding firm-years where the change in operating costs between two years is higher than 50%. In that way, we achieve the avoidance of non-recurring costs that may be included among the operating costs of the firms. The final and more crucial steps are the elimination of firm-years when the revenues are lower than €7 million and the bottom and top 1% of the observations for both costs and revenues’ cases. This has been done due to the assumption that the firms with lower revenues than this amount have difficulty of facing cost stickiness generally, and the 1% of the extreme values is eliminated for the convenience of the statistical calculations and in order to avoid excessive outliers. We have also removed incomplete data cases or cases that missed data either in revenues or costs because they react in a nonfunctional way for the analysis.
Table 1 presents all the phases that the dataset has been through. The first sample contains 1543 observations but after the application of the filters the remaining observations for the regressions are 970.

Table 1. Sample Selection

<table>
<thead>
<tr>
<th>Description</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Amount</td>
<td>1,543</td>
</tr>
<tr>
<td>Firm- years with losses</td>
<td>121</td>
</tr>
<tr>
<td>Firm-years with more than 50% change in Revenues or Costs</td>
<td>269</td>
</tr>
<tr>
<td>Firm-years with Revenues lower than €7 mln.</td>
<td>83</td>
</tr>
<tr>
<td>Firm-years with 1% extreme values</td>
<td>38</td>
</tr>
<tr>
<td>Incomplete Company Data</td>
<td>62</td>
</tr>
<tr>
<td>Final Sample</td>
<td>970</td>
</tr>
</tbody>
</table>

4.1. Descriptive Statistics

The regressions that we have mentioned we are going to use in our tests were carried out using Stata Program Version 10. Each model has been tested for heteroscedasticity via the program and the variables in the models are initially tested for multi-collinearity. The data used for our research are arranged as a pooled regression model and estimated using Ordinary Least Squares. Before performing the regressions, these assumptions will be tested and the data should be transformed to meet the assumptions, which are: 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.
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...over the time in a very clear way. Table 2 below presents the descriptive statistics of the untransformed variables before starting the regression proceeding:

Table 2. Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Observations</th>
<th>Mean</th>
<th>St. Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm Year</td>
<td>970</td>
<td>2.01</td>
<td>2.28</td>
<td>2.007</td>
<td>2.014</td>
</tr>
<tr>
<td>Revenue</td>
<td>970</td>
<td>2.25</td>
<td>6.34</td>
<td>7.29</td>
<td>8.48</td>
</tr>
<tr>
<td>OpCosts</td>
<td>970</td>
<td>3.16</td>
<td>6.01</td>
<td>1.31</td>
<td>5.61</td>
</tr>
</tbody>
</table>

The data are expressed in billions of €

The statistics show that the median of the total revenues is €2.25 billion while for the operating costs the amount is €3.16 billion. When looking over the statistics, we confirm the importance of the variables that all 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 between different observations 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 stressed in particular, 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, erroneous procedures or more simply areas where a certain theory cannot be valid, here in case of Greek listed companies the amount of outliers is normal because of the fair small sample (193 listed firms throughout 8 years) as well as the time period we chose to examine when fluctuations are intense, unexpected, and greatly change the course of each firm.

5. Empirical Findings

In this chapter, we will analyze the results from our regression analysis. Each test will be explained starting from whether or not costs are sticky in Greek firms and finally explaining if certain characteristics affect the cost stickiness phenomenon.
5.1. Cost Stickiness

Table 3 presents the regression analysis of the first model, the examination of cost stickiness existence in Greek listed firms from 2007 to 2014. The model include the dependent variable \( \log \left[ \frac{\text{total operating costs}_i}{\text{total operating costs}_{i,t-1}} \right] \), independent variable \( \log \left[ \frac{\text{revenue}_i}{\text{revenue}_{i,t-1}} \right] \) and all control variables. The dummy variable \( d_{i,t} \) is the signal to the change in revenue that takes the value of 1 when revenue decreases between two years and otherwise is 0:

Table 3. Regression Analysis Model 1, Cost Stickiness

<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>-0.004(-1.34)</td>
<td>0.57(7.29)</td>
<td>-0.25(-2.19)</td>
<td>0.167</td>
</tr>
</tbody>
</table>

Note: Based on 763 observations. T-statistics are shown in the parentheses

Hypothesis one expects a result that proves the existence of the phenomenon of cost stickiness in Greek listed firms during the examined period. Our model is statistically significant as the p-value is zero. R-squared is around 20% which means that the model explains 20% of the variance. This small amount is due to the dissimilarity of our data. Greek listed firms tend to have great fluctuations in both operating costs and sales revenue that change the landscape of homogeneity for our regressions. However, the independent variable is statistically significant as \( \beta_1 \) and \( \beta_2 \) present two-tail p-values (\( |t| \)) lower than 0.05. \( \beta_1 \) seems to have the most significant impact on the model as its two-tail p-value is zero. Moreover, from the point of view of t-ratio, \( \beta_2 \) is the most important variable as we expected because its t-ratio (-2.19) is the lowest compared to the value of 1.96. The operating costs variable shows that the change in revenue lead to asymmetric cost change. The estimated value of \( \beta_1 = 0.57 \) with a t-ratio of 7.29, imply that total operating costs increase, on average, by around 0.57% per 1% increase in revenue. Across all firms in the sample, \( \beta_2 \) averages -0.25 with a t-ratio of -2.19. That fact leads to the conjecture that when revenue decreases by 1%, total operating costs decrease by around 0.25%. This stresses that changes in total operating costs are neither proportional nor symmetrical to changes in revenue. The value of \( \beta_2 \) determines the existence of cost stickiness and at that point our hypothesis is confirmed because we received a negative value.
Our evidence is very close to those of Anderson, Banker, & Janakiraman (2003) from which we borrowed the used regression. The authors investigated 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. On the contrary, Calleja, Steliaros, & Thomas (2006) who investigated cost stickiness across countries found that operating costs increase on average by 0.97% per 1% increase in revenue. The operating costs decrease only by 0.91% per 1% decrease in revenue. It appears 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.

5.2. Cost stickiness and the time horizon

Table 4 presents the regression analysis of the second model which compares the cost stickiness for a two-period model with a one-period model. The test uses a similar model to the one used in section 1.1 with the dummy variable that takes the value of 1 when current revenues are decreased, compared with 2 years ago and otherwise is 0. With an extension of the time frame of the variables in order to incorporate any change in revenue over two periods:

Table 4. Regression Analysis Model 2, Cost Stickiness over two periods

<table>
<thead>
<tr>
<th>$\alpha$</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.12(1.46)</td>
<td>0.68(19.97)</td>
<td>0.08(1.37)</td>
<td>0.627</td>
</tr>
</tbody>
</table>

Note: Based on 1065 observations. T-statistics are shown in the parentheses.

Our model is statistically significant as the p-value is once again zero. R-squared is higher than the previous one reaching the percentage of 62.27% which means that the model explains 62.27% of the variance. 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. Finally, although the $R^2$ is quite high, there is
only a small number of variables significant, 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 cost stickiness is marginally less pronounced over a two-year period. This finding is a difficult enigma. 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. Furthermore, Anderson, Banker, & Janakiraman (2003) find that stickiness in costs decreases and becomes less pronounced with the aggregation of periods, as longer periods include complete adjustment cycles. In our case, it seems that the cost stickiness is a phenomenon that tends to be faced by managers’ decisions over longer periods and the second hypothesis is confirmed.

5.3. Cost Stickiness and change in the activity

The third hypothesis predicts that the cost stickiness depends on the intense fluctuations of sales revenue. In order to examine this assumption, we add up intervals operating as limits within which the changes are made. More specifically we add dummy variables which take the following prices: \( d_1 = 1 \) if the percentage change in revenue lies between \(-0.10\) and 0.10, and is otherwise 0, \( d_2 = 1 \) if the percentage change in revenue lies between \(-0.50\) and \(-0.25\) or between 0.25 and 0.50, and is otherwise 0, \( d_3 = 1 \) if the percentage change in revenue lies between \(-0.25\) and 0, and is otherwise 0, \( d_4 = 1 \) if the percentage change in revenue lies between \(-0.50\) and \(-0.25\), and is otherwise 0. The results are presented in Table 4 below:

Table 4. Regression Analysis Model 3, Cost Stickiness and changes in the activity

<table>
<thead>
<tr>
<th></th>
<th>Changes (&lt;\pm10%&gt;) -25%</th>
<th>Changes (\pm50%&gt;\pm25%)</th>
<th>( \alpha )</th>
<th>( \beta_1 )</th>
<th>( \beta_2 )</th>
<th>( \beta_3 )</th>
<th>( \beta_4 )</th>
<th>R(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes (&lt;\pm10%&gt;) -25%</td>
<td>0.55(4.60)</td>
<td>-0.14(-0.8)</td>
<td>0.54(5.86)</td>
<td>-0.25(-2.06)</td>
<td>0.169</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changes (\pm50%&gt;\pm25%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Based on 763 observations. T-statistics are shown in the parentheses.
Since the p-value has zero value the model is statistically significant. R-squared continues to be significantly low and the model explains 17% of the variance. At 5% confidence $\beta_3$ and $\beta_4$ are the most important with negative t-values while the variables $\beta_1$, $\beta_2$ and $\beta_4$ have the most significant impact for the model. Even though the change in the size of the coefficients is small, $\beta_1$ and $\beta_2$ depicts the response of costs to positive changes in the revenues which is increased. $\beta_3$ and $\beta_4$ are all negative as we expected. We observe that a drop of 10% in revenues sustains a reduction in cost stickiness by around two percentage points. Because these changes are slightly different from our first model we decided to take a step further and we try to investigate levels of stickiness for more extreme changes in revenue. We split the data assuming changes in revenues for more or less than 25% and 50%. In that case $\beta_4$ drops to -0.25.

These findings shed light on what is the impact of revenue changes on costs. Therefore, when fluctuations are small to marginal, the phenomenon proves to be intense. In cases where activity is moving at moderate levels of fluctuation, businesses seem to be vigilant having the necessary resources to cope with the events and without changing their cost strategy. On the contrary, large and extreme revenue cuts are likely to bring about reductions in cost stickiness, which means that in some cases it is more expensive to keep the surplus stock than to renegotiate it. Finally, the third hypothesis is accepted as the changes in revenues affect the cost stickiness of Greek listed firms.

5.4. Cost stickiness and specific firm characteristics.

Our last hypothesis predicts that cost stickiness may depend on specific firm characteristics such as the assets that they possess. In order to test this assumption we are opted to a model similar to Anderson, Banker and Janakiraman (2003). This model includes two dummy variables that take the value of 1 when the revenue in the current period is less than the previous, and a second that takes the value of 1 when the total assets in the current period are less than the previous. Table 5 demonstrates the results:
As well as all the previous models, so it is also characterized as statistically significant because of the zero p-value. The model has low R-squared which explains 18.71% of the variance. Of course in this model, we elaborated additional data, referred to the assets that Greek listed firms declared during the examined period. It seems that the additional data suffered the same characteristics as the previous ones with great outliers that come from the intense fluctuations. Among the coefficients $\beta_4$ is the most important at a level of 5% confidence, whilst $\beta_1$ has significant impact on the model. However, the remaining coefficients are significant too as their values are getting close to zero.

Based on these results, the fourth hypothesis is rejected. The correlation between the assets and the operating cost is extremely low as the coefficients are taking values very close to zero. Although Calleja et al (2013) did support the notion that cost stickiness is associated with asset intensity, in our case this is not an assumption. In our regression costs are changing by 0.52% when the Revenue variable is changing by 1%. The asset variable indicates that a high intensity of assets leads to higher stickiness in costs. The explanation of this is that the costs are being retained because of surplus resources and the level of resources after renegotiations (Dalla & Perego, 2014). Through bibliographical evidence, Anderson, Banker and Janakiraman (2003) had identified a positive correlation between asset intensity and cost stickiness while Chen, Lu, & Sougiannis (2012) stressed that employee intensity which is another important factor has no correlation with cost stickiness. This disagreement may be caused due to the different sample that the authors used to their research. Therefore the same authors combine the asset intensity with the employees and state the notion that firms with high asset intensity had a greater percentage of temporary employees. Subramaniam & Weidenmier (2003) show that high stickiness in SG&A costs is the result of high asset intensity.

<table>
<thead>
<tr>
<th>$\alpha$</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
<th>$\beta_3$</th>
<th>$\beta_4$</th>
<th>$\beta_5$</th>
<th>$\beta_6$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.005(-1.36)</td>
<td>0.52(6.37)</td>
<td>-0.25(-2.24)</td>
<td>0.02(2.92)</td>
<td>-0.04(-2.69)</td>
<td>0.03(1.17)</td>
<td>0.14(1.76)</td>
<td>0.1871</td>
</tr>
</tbody>
</table>

Note: Based on 762 observations. T-statistics are shown in the parentheses.
In our case, even if the model is significant the asset intensity show little to no correlation with the costs. The values of $\beta_5$ and $\beta_6$, which are directly connected with the amount of assets has values of 0.03 and 0.14 respectively, which are not only positive but also hide and disintegrate us from the desirable result, the correlation between cost stickiness and asset intensity. However, all the other coefficients are statistically significant and they get negative values as well. These coefficients are directly connected to the decline of revenues and offer us information about similar cases. This negative correlation may be caused since simply assets are not the catalytic factor that affects managers in decisions they have to take so that they can cope with cost stickiness for their firms. 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 assets that each company declares on its balance sheet in relation to cost stickiness and we urge the managers to search and study other elements that can provide solutions to the problems they face.

6. Conclusions

6.1. Summary of main findings

In order to strengthen reader’s convenience and for a clear clarification of the research’s results, a summary table is included. Table 6 below, presents an overview of the results:

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>$H_1$</td>
<td>Results are significant. Hypothesis is accepted</td>
</tr>
<tr>
<td>$H_2$</td>
<td>Results are significant. Hypothesis is accepted</td>
</tr>
<tr>
<td>$H_3$</td>
<td>Results are significant. Hypothesis is accepted</td>
</tr>
<tr>
<td>$H_4$</td>
<td>Results are insignificant and not in the hypothesized direction</td>
</tr>
</tbody>
</table>

Hypothesis one is confirmed after we investigated the relationship between operating costs and revenues for the Greek listed firms. When the revenue decreased by 1% the operating costs decreased by less than 1% (0.25%) and this is the notion of cost stickiness. Our findings at this point are aligned with previous studies such as Anderson, Banker, & Janakiraman (2003), Weidenmier & Subramaniam (2003) and
Chen, Lu, & Sougiannis (2012). Cost stickiness seems to be normalized when we review periods that compare current results with two years back. Managers have more information and they find essential ways to overcome the cutting back on the resources and the appropriate adjustments.

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 their surplus resources. Hypothesis four offered us insignificant results and disintegrated the common sense that the assets affect cost stickiness. In Greek companies, the fluctuations of revenues continue to influence only the operating costs and are independent of how many assets they possess. This finding opposes the results of prior literature (Subramaniam & Weidenmier (2003), Anderson, Banker and Janakiraman (2003).

6.2. Conclusion and Discussion
The main research question of this study is whether or not cost stickiness is present in Greek listed companies during the period from 2007 to 2014 which is confirmed. Greek listed companies suffer this phenomenon possibly without knowing where it comes from, the extent of its influence and whether it is manageable. This paper 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 in balance with prior literature concerning cost stickiness. Total operating costs increase, on average, by around 0.57% per 1% increase in revenue, whilst total operating costs decrease by around 0.25% when revenue decreases by 1%. This finding confirms Anderson, Banker, & Janakiraman (2003) who first investigate thoroughly the cost stickiness and support the notion that cost stickiness is a reaction to revenue changes by producing exact same results as ours. To measure this, empirical models that include ratios of total operating costs and sales revenue are introduced. The results give a good insight into many possibilities to handle cost stickiness.

Based on the second hypothesis we tried to investigate what is happening when we extend the examined period using exactly the same data. Using various filters in our computing program, we were optimistically led to the result that costs are less sticky
The cost stickiness phenomenon in Greek listed firms

when longer-time periods are considered. A strong, possible factor that may affect this reduction is the amount of information that managers tend to have over a longer timeframe. In that way they are more ready to make adjustments as the ratio of the expense of cutting back resources relative to the incremental cost of retaining surplus resources becomes smaller.

Setting our sample to extreme revenue declines, we drove into our third hypothesis. Our results suggest that when fluctuations are small to marginal, the cost stickiness proves to be intense. In cases where activity is moving at moderate levels of fluctuation, businesses seem to be vigilant having the necessary resources to cope with the events and without changing their cost strategy. On the contrary, large and extreme revenue cuts are likely to bring about reductions in cost stickiness, which means that in some cases it is more expensive to keep the surplus stock than to renegotiate it. In our case 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. In our research we shed light in the side concerned the asset structure of the firms. Aligned with Dalla & Perego (2014) findings, cost stickiness of the firms seems to be affected to a minimum level from the asset intensity. In general we can conclude that having a high level of assets leads to less cost stickiness. However in our analysis and through the regression models that we have used all coefficients went close to zero, meaning that the influence is marginal. The reason for this has not yet been investigated and needs to be further researched. Possible reasons may be the corporate governance and how managers behave towards assets, the systems of code-law governance and or the rigorous external scrutiny.

This study is subject to many limitations as many other studies do concerning cost stickiness. First of all, the reader should bear in mind that this research is based on sales revenue for the estimation of the activity magnitude which means that the findings must be handled with every reservation. Sales Revenues were used as the most representative, cross-section sample through the different databases, even though revenues are affected by many factors such as changes in prices or the managers’ decisions. We chose to elaborate with a narrow time horizon of seven
The cost stickiness phenomenon in Greek listed firms

years, whilst on all the other researches the time horizon is at least 20 years. However, the time horizon is contemporary and approaches today’s data in a very close way.

Another limitation is the use of multiple different databases. This means that the dataset of this study was dependent on the overlap of different databases. One last limitation is the fact that the sample consists only from Greek companies for a specific time horizon. Greek economy is changing infinitely and if we try to investigate the current period the results definitely will be different.

The results from this research can be an area of application for the managers. Adhering 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. It is the opportunity to assess internal and external stability, whether each company is being hurt and how flexible it can be. 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. This may not really mean lessening the supply of assets, which may not be conceivable or doable. Elective ways may incorporate focusing on the promoting perspective to support request or moving unutilized assets to elective exercises. 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. Considering cost stickiness at the arranging and control stages and offering leeway for those elements that reason cost stickiness will yield better execution and performance, and at last upgrade investor wealth.

Further investigation could be carrying out on what are other factors that affect cost stickiness in Greek companies. Moreover, due to the fact that the size of the Greek companies is relatively small, it would be very helpful to conduct research not only on listed companies but also on family businesses, which are at the core of the Greek
The cost stickiness phenomenon in Greek listed firms economy. Obviously, the results of such surveys could easily be communicated to the managers of the companies, thus assisting in a robust course for any business free of sticky conditions that do not help them grow as much as they can.
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7. Bibliography


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8. Appendix

Regression Analysis

In this appendix the results of the regression of models are exhibit in a more detailed overview. The descriptive statistics, the model summary and the coefficients are presented. For the convenience of the statistical calculations and in order to be more accurate, below we demonstrate all the steps that we take in order to have our results via Stata Program. Explanations about the names of the variables used are following:

1. “First”: \( \log \left( \frac{\text{total operating costs}_{i,t}}{\text{total operating costs}_{i,t-1}} \right) \)

2. “Second”: \( \log \left( \frac{\text{revenue}_{i,t}}{\text{revenue}_{i,t-1}} \right) \)

3. “Third”: \( \log \left( \frac{\text{Revenue}_{i,t-1}}{\text{Revenue}_{i,t-2}} \right) \)

4. “Fourth”: \( \log \left( \frac{\text{Assets}_{i,t}}{\text{Assets}_{i,t-1}} \right) + \)

All the \( \beta \)'s are taking the values of dummies at each table.

Test 1, Regression Analysis Model 1, Cost stickiness

Table 1. Regression Analysis Results

<table>
<thead>
<tr>
<th>Linear regression</th>
<th>Number of obs = 762</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F( 2, 760) = 64.64</td>
</tr>
<tr>
<td></td>
<td>Prob &gt; F = 0.0000</td>
</tr>
<tr>
<td></td>
<td>R-squared = 0.1570</td>
</tr>
<tr>
<td></td>
<td>ROO 1 MSE = .0876</td>
</tr>
</tbody>
</table>

|            | Coef.     | Robust std. Err. | t     | P>|t| | 95% conf. interval |
|------------|-----------|------------------|-------|------|-------------------|
| First      |           |                  |       |      |                   |
| Second     | .579212   | .07943           | 7.29  | 0.000| .4232838 to .7351403 |
| dummy      | -.2583757 | .1178198         | -2.19 | 0.029| -.4896685 to -.0270848 |
| cons       | -.0048259 | .0036017         | -1.34 | 0.181| -.0118964 to .0022446 |
Scatter Plot 1. Cost Stickiness

Set of Commands 1. Cost stickiness

* Cost stickiness
* Copyright 2017 by Styliani Kouroumani
* Creating a log file to store output
log using stata_output.txt, text replace
clear all
set more off
* Change directory to folder with data files
cd C:/thesisstata
* Reading Stata (.dta) file
use all, clear
*Preparing Data
rename var1 CompanyName
rename var2 FirmYear
destring var3, ignore(".") generate(Revenue)
destring var4, ignore(".") generate(OpCosts)
drop var3 var4
drop if FirmYear==.
* Summarizing the data
describe
summarize
*panel data creation
gen firmid=group(CompanyName)
gen timeid=group(FirmYear)
tsset firmid timeid
*Sampling our data
gen dummy=0
replace dummy=1 if (Revenue-OpCosts)>0
replace dummy=0 if f.dummy==0
drop if dummy==0
gen dummy1 = (((Revenue-l.Revenue)*100)/l.Revenue)
replace dummy=0 if (dummy1>50 | dummy1<-50) & dummy1!=.
replace dummy1 = (((OpCosts-l.OpCosts)*100)/l.OpCosts)
replace dummy=0 if (dummy1>50 | dummy1<-50) & dummy1!=.
replace dummy=0 if f.dummy==0
drop if dummy==0
drop dummy dummy1
drop if Revenue<7000000
drop if Revenue==. & OpCosts==.
*second analysis
_pctile Revenue, p(1 99)
ret li
drop if Revenue<r(r1)
drop if Revenue>r(r2)
_pctile OpCosts, p(1 99)
ret li
drop if OpCosts<r(r1)
drop if OpCosts>r(r2)
*Cost stickiness
describe
summarize
gen First=log(OpCosts/l.OpCosts)/log(10)
gen Second = log(Revenue/l.Revenue)/log(10)
gen dummy = 1 if Revenue<l.Revenue
replace dummy=dummy*Second
*keep First Second dummy
drop if First==.
replace dummy=0 if dummy==.
* Defining global variables
global ylist First
global xlist Second dummy
* Using global variables
summarize $ylist $xlist
graph twoway scatter First Second
reg $ylist $xlist, robust

Test 2, Regression Analysis Model 2, Cost stickiness over two periods

Table 2. Regression Analysis Results

|        | Coef.  | Robust Std. Err. | t     | P>|t|  | [95% Conf. Interval] |
|--------|--------|------------------|-------|------|-----------------------|
| First  | Second | .6857924         | .0243433 | 19.97 | 0.000 | .618409 - .7531898 |
|        | dummy  | .0048142         | .00620593 | 1.37  | 0.172 | -0.010986 - .022382 |
|        | _cons  | .0124498         | .0085013 | 1.46  | 0.143 | -.0062313 - .031153 |

Set of Commands 2. Cost Stickiness over two periods

* Cost stickiness
* Copyright 2017 by Styliani Kouroumani
* Creating a log file to store output
*log using stata_output.txt, text replace
clear all
set more off
* Change directory to folder with data files
cd C:/thesisstata
* Reading Stata (.dta) file
use all,clear
*Preparing Data
rename var1 CompanyName
rename var2 FirmYear
desstring var3,ignore(".") generate(Revenue)
desstring var4,ignore(".") generate(OpCosts)
drop var3 var4
drop if FirmYear==.
* Summarizing the data
describe
summarize
*panel data creation
egen firmid=group(CompanyName)
egen timeid=group(FirmYear)
tsset firmid timeid
*Sampling our data
gen dummy=0
replace dummy=1 if (Revenue-OpCosts)>0
replace dummy=0 if f.dummy==0
drop if dummy==0
gen dummy1 = (((Revenue-l.Revenue)*100)/l.Revenue)
replace dummy=0 if (dummy1>50 | dummy1<-50) & dummy1!=.
replace dummy1 = (((OpCosts-l.OpCosts)*100)/l.OpCosts)
replace dummy=0 if (dummy1>50 | dummy1<-50) & dummy1!=.
*replace dummy=0 if f.dummy==0
drop if dummy==0
drop dummy dummy1
drop if Revenue<7000000
drop if Revenue==. & OpCosts==

*second analysis
_pctile Revenue, p(1 99)
ret li
drop if Revenue<r(r1)
drop if Revenue>r(r2)
_pctile OpCosts, p(1 99)
ret li
drop if OpCosts<r(r1)
drop if OpCosts>r(r2)
The cost stickiness phenomenon in Greek listed firms

Test 3, Regression Analysis Model 3, Cost stickiness and changes in activity

Table 3. Regression Analysis Results

|                      | Coef. | Robust Std. Err. | t     | P>|t|   | [95% Conf. Interval] |
|----------------------|-------|------------------|-------|-------|----------------------|
| dummy                | .5330337 | .120247        | 4.60  | 0.000 | .316977 - .7890904    |
| dummy1               | .5466732 | .0932945       | 5.86  | 0.000 | .3635269 - .7298194  |
| dummy2               | -.1421776 | .1783511       | -0.80 | 0.426 | -.4922983 - .2079431 |
| dummy3               | -.2544748 | .1237214       | -2.06 | 0.040 | -.4973521 - -.0115975|
| _cons                | -.0023576 | .0039884      | -0.64 | 0.522 | -.0103872 - .0005272 |

Set of Commands 3. Cost Stickiness and changes in activity

* Cost stickiness
* Copyright 2017 by Styliani Kouroumani

* Creating a log file to store output
* log using stata_output.txt, text replace

clear all
set more off

* Change directory to folder with data files
    cd C:/thesisstata
* Reading Stata (.dta) file
    use all, clear
* Preparing Data
    rename var1 CompanyName
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    destring var3, ignore(".") generate(Revenue)
    destring var4, ignore(".") generate(OpCosts)
    drop var3 var4
    drop if FirmYear==.
* Sampling our data
    gen dummy=0
    replace dummy=1 if (Revenue-OpCosts)>0
    replace dummy=0 if f.dummy==0
    drop if dummy==0
    gen dummy1 = (((Revenue-l.Revenue)*100)/l.Revenue)
    replace dummy=0 if (dummy1>50 | dummy1<-50) & dummy!=.
    replace dummy1 = (((OpCosts-l.OpCosts)*100)/l.OpCosts)
    replace dummy=0 if (dummy1>50 | dummy1<-50) & dummy!=.
    replace dummy=0 if f.dummy==0
    drop if dummy==0
The cost stickiness phenomenon in Greek listed firms

drop dummy dummy1  
drop if Revenue<7000000  
drop if Revenue==. & OpCosts==.  
*second analysis  
_pctile Revenue, p(1 99)  
ret li  
drop if Revenue<r(r1)  
drop if Revenue>r(r2)  
_pctile OpCosts, p(1 99)  
ret li  
drop if OpCosts<r(r1)  
drop if OpCosts>r(r2)  
*Cost stickiness  
describe  
summarize  
gen First=log(OpCosts/l.OpCosts)/log(10)  
gen Second = log(Revenue/l.Revenue)/log(10)  
gen PerRev=((Revenue/l.Revenue)-1)  
gen dummy=1 if PerRev>-0.25 & PerRev<0.25  
gen dummy1=1 if (PerRev>-0.5 & PerRev<-0.25) | (PerRev>0.25 & PerRev<0.5)  
gen dummy2=1 if PerRev>-0.25 & PerRev<0  
gen dummy3=1 if (PerRev>-0.5 & PerRev<-0.25)  
replace dummy=dummy*Second  
replace dummy1=dummy1*Second  
replace dummy2=dummy2*Second  
replace dummy3=dummy3*Second  
keep First Second dummy dummy1 dummy2 dummy3  
drop if First==.  
replace dummy=0 if dummy==.  
replace dummy1=0 if dummy1==.  
replace dummy2=0 if dummy2==.  
replace dummy3=0 if dummy3==.  

* Defining global variables  
global ylist First  
global xlist dummy dummy1 dummy2 dummy3  

* Using global variables  
summarize $ylist $xlist  
reg $ylist $xlist, robust  

Test 4, Regression Analysis Model 4, Cost stickiness and specific firm characteristics  

Table 4. Regression Analysis Results
Scatter plot 2. Cost Stickiness and Assets

Set of Commands 4. Cost Stickiness and specific firm characteristics

* Cost stickiness
* Copyright 2017 by Styliani Kouroumani

* Creating a log file to store output
* log using stata_output.txt, text replace

clear all
set more off

* Change directory to folder with data files
cd C:/thesisstata

* Reading Stata (.dta) file
use allassets,clear

*Preparing Data
rename var1 CompanyName
rename var2 FirmYear
destring var3,ignore(".") generate(Revenue)
destring var4,ignore(".") generate(OpCosts)
destring var5,ignore(".") generate(Assets)
drop var3 var4 var5
drop if FirmYear==.

drop if Revenue<7000000

drop if Revenue==. & OpCosts==.

* Summarizing the data
describe
summarize

*panel data creation
egen firmid=group(CompanyName)
egen timeid=group(FirmYear)
tset firmid timeid

*Sampling our data
gen dummy=0
replace dummy=1 if ( Revenue-OpCosts)>0
replace dummy=0 if f.dummy==0
drop if dummy==0
gen dummy1 = (((Revenue-l.Revenue)*100)/l.Revenue)
replace dummy1=0 if (dummy1>50 | dummy1<-50) & dummy1!=.
replace dummy1 = (((OpCosts-l.OpCosts)*100)/l.OpCosts)
replace dummy1=0 if (dummy1>50 | dummy1<-50) & dummy1!=.
drop if dummy1==0

drop dummy dummy1

drop if Revenue<7000000

drop if Revenue==. & OpCosts==.

*second analysis
_pctile Revenue, p(1 99)
ret li
drop if Revenue<r(r1)
drop if Revenue>r(r2)
_pctile OpCosts, p(1 99)
ret li
drop if OpCosts<r(r1)
drop if OpCosts>r(r2)

*Cost stickiness
describe
summarize
gen First=log(OpCosts/l.OpCosts)/log(10)
gen Second = log(Revenue/l.Revenue)/log(10)
gen Third = log(Revenue[_n-1]/Revenue[_n-2])/log(10)
gen Fourth = log(Assets/l.Assets)/log(10)
gen dummy = 1 if Revenue<l.Revenue
gen dummy1 = 1 if Revenue[_n-1]<Revenue[_n-2]
gen dummy2 = 1 if Assets<l.Assets
replace dummy=dummy*Second
replace dummy1=dummy1*Third
The cost stickiness phenomenon in Greek listed firms

replace dummy2=dummy2*Fourth

keep First Second Third Fourth dummy dummy1 dummy2
drop if First==.
replace dummy=0 if dummy==.
replace dummy1=0 if dummy1==.
replace dummy2=0 if dummy2==.

* Defining global variables
  global ylist First
global xlist Second dummy Third dummy1 Fourth dummy2

* Using global variables
summarize $ylist $xlist
graph twoway scatter First Second
reg $ylist $xlist
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year</th>
<th>Topic Research</th>
<th>Importance for topic</th>
<th>Sample Data</th>
<th>Sample Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooper, R., &amp; Kaplan, 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 such as H&amp;P, P&amp;G etc.</td>
<td>(-)</td>
</tr>
<tr>
<td>Balakrishnan R., Petersen M. J., Soderstrom N.</td>
<td>2004</td>
<td>Relationship between cost stickiness and firm’s activity</td>
<td>How “sticky” costs rely on activity</td>
<td>Therapy clinics</td>
<td>2004</td>
</tr>
<tr>
<td>Calleja, K., Steliaros, M., &amp; Thomas, D. C.</td>
<td>2006</td>
<td>Examination of costs about stickiness, time horizon, firm characteristics &amp; change in operating activity</td>
<td>Comparison of cost stickiness in code-law governance countries and in Greece</td>
<td>UK, US, French and German listed firms</td>
<td>1988-2004</td>
</tr>
<tr>
<td>Anderson, S. W., &amp; Lanen, W. N.</td>
<td>2009</td>
<td>Cost management of cost stickiness</td>
<td>Connection between cost stickiness and firm characteristics</td>
<td>(-)</td>
<td>(-)</td>
</tr>
<tr>
<td>Kama I., Weiss D.</td>
<td>2013</td>
<td>Intentional decisions of managers in order to meet forecasts, influence asymmetric cost behavior</td>
<td>Resource adjustments by managers according to their incentives affect cost stickiness</td>
<td>Public firms</td>
<td>1979-2006</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Year</td>
<td>Study Title</td>
<td>Findings</td>
<td>Sample Size</td>
<td>Time Period</td>
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<td>-----------------------------------------------</td>
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<td>----------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Kokotakis V., Garefalakis A., Mantalis G., Zanidakis N., Galifianakis G.</td>
<td>2013</td>
<td>Examination of cost behavior in Greek retail food and tobacco sector</td>
<td>Presence of cost stickiness in many aspects of Greek economy</td>
<td>438 limited companies</td>
<td>2001-2012</td>
</tr>
<tr>
<td>Banker, R. D., Byzalov, D., Ciftci, M., &amp; Mashruwala, R.</td>
<td>2014</td>
<td>Cost asymmetry dependance on prior sales increase/decrease</td>
<td>Adjustment costs affected by non-current sales, that increase cost stickiness</td>
<td>18,066 firms</td>
<td>1979-2009</td>
</tr>
<tr>
<td>Cannon, J. N.</td>
<td>2014</td>
<td>Examiners determinants of sticky costs</td>
<td>Selling price versus capacity adjustments in order to face stickiness</td>
<td>US Air Transportation Companies</td>
<td>(-)</td>
</tr>
<tr>
<td>Guenther, T. W., Riehl, A., &amp; Rößler, R.</td>
<td>2014</td>
<td>Examiners causes and occurrences of cost stickiness</td>
<td>How dismissing employees affect cost stickiness</td>
<td>(-)</td>
<td>(-)</td>
</tr>
<tr>
<td>Shangkun, L., Dong, C., &amp; Xiaoli, H.</td>
<td>2014</td>
<td>External audit and cost stickiness</td>
<td>How external auditors manipulate cost stickiness of the firms</td>
<td>Chinese listed companies</td>
<td>2002-2010</td>
</tr>
<tr>
<td>Shust, E., &amp; Weiss, D.</td>
<td>2014</td>
<td>Asymmetric cost behavior and sticky costs</td>
<td>Influence of reporting methods in cost stickiness</td>
<td>(-)</td>
<td>(-)</td>
</tr>
<tr>
<td>Zanella, F., Oyelere, P., &amp; Hossain, S.</td>
<td>2015</td>
<td>Existence of &quot;sticky&quot; costs in the UAE. Adjustments between operating revenues and costs</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>
<tr>
<td>S Cohen, S Karatzimas, VC Naoum</td>
<td>2015</td>
<td>The sticky cost phenomenon at the Local Government in Greece</td>
<td>Quck adjustments of costs by the managers</td>
<td>Greek municipalities</td>
<td>2002-2008</td>
</tr>
</tbody>
</table>