A STUDY OF THE STICKINESS OF COST OF GOODS SOLD AND OPERATING COSTS TO CHANGES IN SALES LEVEL IN IRAN

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Abstract:

Increased competition in domestic and foreign markets has made managers to identify their costs structure and behavior better. Cost behavior is a model based on which costs response to changes in level of activity. Having invented stickiness of costs model by Anderson and Janakiraman (2003), managers are able to better predict costs behavior when increases and decreases are occurred in sales. Using above model, this research examines behavior of cost of goods sold as well as general, administrative and selling costs and studies the degree of stickiness of these costs given to decreased sales in past year and the ratio of total assets to sales. Statistical universe of the research is listed companies in Tehran Stock Exchange for a period of 10 years (2001-2010). The results indicate that cost of goods sales isn't sticky to changes in sales however general, administrative and selling costs (SG&A costs) increase by 0.443% when there is 1% increase in sales level while 1% decrease leads to 0.261% reduction. The results also indicate that stickiness degree of SG&A costs is lower in periods previous which decreased sales were occurred and the ratio of total assets to sales as a factor of companies' size does not effect on stickiness degree of these costs.

Key words: *costs sticky, cost of goods sold, general, administrative and selling costs*

1. Introduction

Dramatically changes in manufacturing industries and competition in global markets including technological innovations, development of computer systems have

made companies being able to adapt to new conditions survive and those who do not have such power exit from market competition.

So, in order to adapt to global markets and increase their power to compete with other companies, managers need information but information in annual financial reports is not sufficient for managers' decision making. So, accountants provide more useful information to be affective on managers' decisions by providing variety of information about cost behavior,

Identification of cost structure or behavior refers to how costs response to changes in activity level. In other words, cost behavior is a model based on which a given cost responses to changes in activity level. Having invented stickiness of costs model by Anderson and Janakiraman (2003), managers have become more aware from their costs structure and are able to predict costs behavior when sales decrease and increase.

The main problem in this research is that whether cost of goods sales and general, administrative and selling costs are sticky to changes in sales level? How much is stickiness degree of these costs considering different factors including decreased sales in the past year and the ratio of total assets to sales?

2. Theoretical framework

The concept of relationship between costs and activities was formed in the late 1960's and early 1970's in some of researches studies. Afterwards,

Noreen and Soderstorm (1994) suggested that in terms of activity level, costs are divided into fixed and variable. Variable costs change proportionately with changes in level of activity. So, if costs don't increases proportionately with sales, then it is considered as management poor control by analyzers.

Cooper and Kaplan (1988), also found in their research that existence of different responses of costs is due to managers are more inclined to change costs when activity level increases than decreases. So, it is misleading to consider level of activity but not costs behavior in estimation of costs behavior. Management decision making is a big mistake without considering stickiness of costs. Indeed, a proportion between costs and level of activity doesn't always hold as suggested in traditional costing model. In traditional costing model, costs allocated to product are distorted and the main reason is selecting the same base (product unit level) for allocating all costs to products.

Anderson and Janakiraman (2003) invented the term stickiness of costs to represent asymmetric reaction of cots and their analysis of general, administrative and selling costs supported it. They studied differential slopes of costs and found that increases in costs are more when sales increase than decreases in costs when sales decrease because the slope is smaller when there is decreased level of activity and it is said that costs are sticky.

3. Related literature

Researchers found different results in researches for stickiness of costs however; most of them confirmed stickiness of general, administrative and selling costs.Some of researches related to sticky of costs are:

Subraamaniam and Weidenmier (2003) found that when there are little changes in sales revenue, costs are not sticky however when changes are more than 10%, stickiness of costs is distinguished. They consider stickiness of costs resulting from management considerations and properties. Their assumption is that stickiness of costs is appeared because managers hold contracts to provide resources their violation are costing (due to decreased demand). So, managers may decide to reserve resources used. Thus while company may report decreased income, costs wouldn't decrease in proportion to income reduction.

Medeiro and Costa (2004) studied the relationship between general, administrative and selling costs and sales revenue through multivariable regression relationship Using data of 198 Brazilian companies in a 7-year period (1986-2003), the results accepted the main hypothesis and claimed general, administrative and selling costs of companies of statistical universal as sticky. The results also indicate that 10% increase in sales revenue may increase general, administrative and selling costs by 5.90%. However, 10% reduction in sales revenue may decrease general, administrative and selling costs only by 3.20%.

Balakrishnan et al. (2004) found that if a company operates in high capacity, managers may not decrease their resources immediately responding to decreased sales because it may be temporary. However, when a company operates in high capacity increased sales may increase resources. Thus, assuming high capacity, response to decreased activity is smaller than that to similar increase in level of activity and stickiness of costs occurs.

A research performed by Kallapur and Eldenburg (2004) indicates that increase rate of variable cost to total costs is more in hospitals having more patients. This research also indicates that in addition to technological changes, costs behavior is affected by managerial decision makings. Indeed this research studies the effect of number of patients on variable cot of hospital.

Steliaros, Thomas and Calleja (2006) studied the difference in stickiness of costs among countries and related it to difference in operation of labor markets and governance structure.

Benker and Chen (2006), considered the effectiveness of sticky costs on company value.

Dan Weiss (2010) studied stickiness degree of costs to predict profit and found that stickiness of costs make profit prediction less accurate.

Ghaemi and Nematolahi (2006) studied costs in detail and found that cost of goods sales and general, administrative and selling costs have stickiness separately to changes in sales.

The present research studies stickiness of costs and its degree considering factors of decreased sales in past year and the ratio of total assets to sales. In addition, the results are offered by individual industry for above costs along with adjusting inflation effects separately.

4. Research methodology

The present research can be classified as implicational; its local scope is companies listed in Tehran Stock Exchange during 2001- 2010. As in testing hypotheses, two past years selling data was required to determine some variables, data was gathered since 1999 but the period for the test is ten years, 2001-2010.

4.1. Research hypotheses

This research aims at studying the relationship between stickiness of cots (cost of goods sold, SG& A costs) and sales level and determining stickiness degree of costs considering factors of sales reduction in the past year and the ratio of total assets to sales in order to managers become more aware from their costs behavior and use them in adjusting their budgets.

Following hypotheses are postulated for stickiness of costs:

H_1: cost of goods sold is sticky to changes in sales level.

H_2: general, administrative and selling costs are sticky to changes in sales level.

Following hypotheses are suggested for degree of stickiness of cost of goods sales and general, administrative and selling costs:

H_3: the degree of stickiness of cost of goods sales is lower in periods before which sales reduction occurred.

H_4: the degree of stickiness of general, administrative and selling costs is lower in periods before which sale reduction occurred.

Following hypotheses are suggested for the degree of stickiness related to companies' size:

H_5: the degree of stickiness of cost of goods sales to changes in sales is higher in companies their ratio of total assets to sales is bigger.

H_6: the degree of stickiness of general, administrative and selling costs to changes in sales is higher in companies their ratio of total assets to sales is bigger.

4.2. Statistical universe and sample

Statistical universe of this research includes all companies listed in Tehran stock exchange market. So companies met following conditions were selected as statistical sample:

(1) Sample companies are from manufacturing industry.

(2) They have listed in Tehran Stock Exchange since 2001.

(3) Data related to their cost of goods sold and general, administrative and selling costs and income are available from 2001 to 2010 annually.

Having performed sampling process, the number of companies was reduced to 150 from 21 different industries.

4.3. Data collection method

To calculate research variables, financial statements data of companies listed in Tehran exchange market was used including balance sheet, cost benefit in the form of compact disks and website www.seo.ir and package software Novin RahAvard.

Data gathered was analyzed using statistical tests and multiple- regression was statistical method used for testing hypotheses.

4.4. Methods for analyzing information and testing hypotheses

Considering stickiness of costs model suggested by Anderson et al. (2003), H1 and H2 can be tested by substituting Cost variable for Cogs and SG&A.

$$\text{Log}\left[\frac{Cost_{i,t}}{Cost_{i,t-1}}\right]=\beta 0+\beta 1\text{Log}\left[\frac{Sales_{i,t}}{Sales_{i,t-1}}\right]+\beta 2*Di,t*\text{Log}\left[\frac{Sales_{i,t}}{Sales_{i,t-1}}\right]+\varepsilon i,t$$

Costi,t= cost of company i in the period t

Costi,t-1= cost of company i in the period t-1

Salesi,t= net sales of company i in the period t

Salesi, t-1= net sales of company I in the period t-1

Di,t= if Salesi,t-1>Salei,t, then its value is one otherwise is zero.

Since Di,t value is zero when sales increase, so β1 denotes increase percentage in costs because of 1% increase in sales level. Also since variable coefficient Di,t is equal to one when sales reduce, so β1+β2 indicates reduction percentage in costs because of 1% decrease in sales. If costs are sticky, increase percentage of costs in periods of sales increase should be more than reduction percentage of costs in periods of sales decrease. In other words there should be β1>0 and β2<0.

In the below model, changes in the degree of stickiness of costs are studied in periods before which sales reduction occurred. H3 and H4 are tested by substituting Cost variable for Cogs and SG&A.

$$\text{Log}\left[\frac{Cost_{i,t}}{Cost_{i,t-1}}\right]=\beta 0+\beta 1\text{Log}\left[\frac{Sales_{i,t}}{Sales_{i,t-1}}\right]+\beta 2*Di,t*\text{Log}\left[\frac{Sales_{i,t}}{Sales_{i,t-1}}\right]+\beta 3*Di,t*SDi,t*\text{Log}\left[\frac{Sales_{i,t}}{Sales_{I,t-1}}\right]+\varepsilon I,t$$

New variables with respect to past models means:

Di,t= if Salesi,t-1> Salesi,t , its value is 1 otherwise is zero.

SDi,t=if there were sales reduction before periods of sales reduction, its value is 1, otherwise is zero.

In this model, coefficient β1 denotes increase percentage in costs because of 1% increase in sales level and β1+β2+β3 indicates costs reduction percentage because of 1% decrease in sales level. Negative sign of coefficient β2 implies stickiness of costs and positive sign of β3 implies reduced degree of stickiness in periods before which reduced sales occurred.

In the below model, the effect of the ratio of total assets of companies to net sales on degree of stickiness of costs are studied. H5 and H6 are tested by substituting Costs variable for Cogs and SG&A.

$$\text{Log}\left[\frac{Cost_{i,t}}{Cost_{i,t-1}}\right] = \beta 0 + \beta 1 \text{Log}\left[\frac{Sales_{i,t}}{Sales_{i,t-1}}\right] + \beta 2 * Di,t * \text{Log}\left[\frac{Sales_{i,t}}{Sales_{i,t-1}}\right] + \beta 3 * Di,t * \text{Log}\left[\frac{Sales_{i,t}}{Sales_{i,t-1}}\right] * \text{Log}\left[\frac{Assets\ i,t}{Sales\ i,t}\right] + \varepsilon I,t$$

New variable with respect to past models means.

Assetsi,t= total assets of company i in the period t

Where β1 denotes increase percentage in costs due to 1% increase in sales level and β1+β2+β3 indicates percentage decrease in costs because of 1% decrease in sales level. Negative sign of β2 implies stickiness of costs. Also negative sign of β3 indicates increased degree of stickiness of companies their ratio of total assets to net sales is bigger.

5. Research findings

5.1. Descriptive statistics

To perform research operation, after eliminating year-companies their data haven't been audited during research period, main variables were calculated for all sample member companies (1484 year-companies). Descriptive statistics results are shown in Table 1.

Table 1: Descriptive statistics of variables

Variables	Minimum	Maximum	Mean	SD
Sales i,t	278	83,610,826	1,009,017	4,621,728
Sales i,t-1	278	64,304,941	856,178	3,879,504
$\text{Log}\left[\frac{Sales_{i,t}}{Sales_{i,t-1}}\right]$	(2.5298)	2.6389	0.0558	0.1646
Cogs i,t	207	69,717,889	798,674	3,902,845
Cogs i,t-1	207	56,043,668	673,004	3,280,023
$\text{Log}\left[\frac{Cogs_{i,t}}{Cogs_{i,t-1}}\right]$	(2.5880)	2.6717	0.0612	0.1603
SG&A i,t	346	3,669,547	54,894	240,030
SG&A i,t-1	346	3,426,248	47,512	217,504
$\text{Log}\left[\frac{SG\&A\ i,t}{SG\&A_{i,t-1}}\right]$	(0.7189)	1	0.0614	0.1390
Assets i,t	498	73,406,804	1,284,240	5,027,673
$\text{Log}\left[\frac{Assets\ i,t}{Sales\ i,t}\right]$	(2.8538)	2.6704	0.1257	0.2607

Values of Assets, SG&At-1, SG&A, CoGSt-1, CoGS, Sellst-1, and Sells are in million Rial.

5.2. The results of testing hypotheses

As seen in the Table 2, the results of testing H_1 imply that cost of goods sold is not sticky to changes in sales level however the results of testing H2 indicate stickiness of general, administrative and selling costs so that by 1% increase in sales level, there is 0.443% increase in general, administrative and selling costs and by 1% decrease, there is 0.261%(0.443-0.182) reduction. So, H_1 and H_2 are accepted.

The results of testing H3 indicate that sale reduction in past year does not lead to decreased degree of stickiness of cost of sale goods, so H3 is rejected. However, the results of testing H4 indicate that sale reduction in past year leads to decreased degree of stickiness of general, administrative and selling costs by 0.145%. So, H4 is accepted. In H5 and H6, the ratio of total assets to sales was tested on degree of sickliness of cost of goods sold and general, administrative and selling costs and the results indicated that the ratio of total assets to sales has no effect on the degree of stickiness of costs. So, H_5 and H_6 are rejected.

Table 2: The results of testing hypotheses

Hypothesis	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson	Acceptance condition for hypothesis	Results
	Dependent Variable	β 0	β 1	β 2	β 3		
H_1	0.954	0.911	0.911	0.0367	1.692	B1>0, B2<0	Rejected
	Cogs	0.009*	0.920*	0.008	-----		
H_2	0.490	0.240	0.239	0.0917	1.939	B1>0, B2<0	Confirmed
	SG&A	0.033*	0.443*	(0.182)*	-----		
H_3	0.952	0.906	0.906	0.0370	1.687	B1 , B3>0, B2<0	Rejected
	Cogs	0.008*	0.928*	(0.009)	(0.086)		
H_4	0.498	00248	0.246	0.0919	1.953	B1 , B3>0, B2<0	Confirmed
	SG&A	0.034*	0.439*	(0.199)*	0.145*		
H_5	0.966	0.933	0.933	0.0369	1.683	B1>0 , B2,B3<0	Rejected
	Cogs	0.008*	0.927*	(0.033)	0.046*		
H_6	0.491	0.241	0.239	0.0918	1.938	B1>0 , B2,B3<0	Rejected
	SG&A	0.032*	0.447*	(0.219)*	0.018		

(*) is significant in level of 5%.

5.3. Testing hypotheses by industry

Industries of similar activity were classified in the same class and others in "other industries" class and statistical tests were studied on these industries. The results of statistical tests by industry are shown in Table 3 and are of similar results to total industries. The difference is that in H2 test, stickiness of general, administrative and selling costs are supported only in mine extraction, automobile and electric apparatuses and parts and other industries. However, in H4 test, reduced sales in past year leads to reduced degree of stickiness only in mine extraction and other industries and the respective hypothesis is accepted.

Table 3: The results of testing hypotheses by industry

H	Coefficients	Building Materials	Building Materials	Pharma and Chemical	Food and Beverages	Mining	Automotive electrical parts and equipment	Other industries	Acceptance condition for hypothesis
H_1	B0	0.008*	0.008*	0.008*	0.012*	0.005*	0.004	0.017*	B1>0, B2<0
	B1	0.927*	0.927*	0.976*	0.860*	1.003*	0.984*	0.769*	
	B2	0.028	0.028	(0.013)	(0.004)	0.017	(0.080)	0.114	
	AR2	0.917	0.917	0.959	0.914	0.991	0.887	0.752	
H_2	B0	0.024*	0.024*	0.020*	0.028*	0.040*	0.053*	0.055*	B1>0, B2<0
	B1	0.528*	0.528*	0.516*	0.368*	0.229*	0.439*	0.296*	
	B2	(0.500)*	(0.500)*	(0.321)*	(0.258)*	0.055	0.445*	0.601*	
	AR2	0.151	0.151	0.270	0.157	0.398	0.201	0.346	
H_3	B0	0.007*	0.007*	0.008*	0.009*	0.002	0.007*	0.016*	B1,B3>0, B2<0
	B1	0.939*	0.939*	0.980*	0.876*	1.007*	0.953*	0.778*	
	B2	(0.018)	(0.018)	(0.060)	0.003	0.011	(0.090)	0.170	
	B3	(0.107)	(0.107)	0.065	(0.327)*	0.286)*	0.252*	(0.372)*	
H_4	B0	0.022*	0.022*	0.020*	0.031*	0.039*	0.053*	0.053*	B1,B3>0, B2<0
	B1	0.513*	0.513*	0.516*	0.354*	0.230*	0.439*	0.306*	
	B2	(0.572)*	(0.572)*	(0.321)*	(0.301)*	0.056	0.456*	0.664*	
	B3	0.585*	0.585*	0.000	0.409*	(0.060)	(0.049)	(0.423)	
H_5	AR2	0.237	0.237	0.268	0.209	0.395	0.199	0.352	B1>0, B2,B3<0
	B0	0.009*	0.009*	0.008*	0.009*	0.004	0.006*		
	B1	0.923*	0.923*	0.978*	0.874*	1.005*	0.956*	0.798*	
	B2	0.069	0.069	(0.039)	(0.108)	(0.023)	(0.071)	(0.504)*	
H_6	B3	(0.060)	(0.060)	0.031	0.072*	0.016	0.117	0.574*	B1>0, B2,B3<0
	AR2	0.917	0.917	0.959	0915	0.990	0.877	0.760	

	B0	0.017	0.017	0.019*	0.039*	0.036*	0.051*	0.049*	
	B1	0.544*	0.544*	0.521*	0.315*	0.236*	0.453*	0.331*	

(*) is significant in level of 5%

5.4. Testing hypotheses by adjusting prices index

Consumed services and goods prices index were used to study the effect of inflation on the test results in order to adjust data so that data gathered were homogenized to prices index in 2010. Then statistical tests were performed on adjusted data and the results are shown in Table 4.

As shown in Table 4, only H_2 and H_4 are accepted. This implies that 1% change in sales level leads to 0.477% increase in general, administrative and selling costs and by 1% decrease in sales level, there are 0.313%(0.477-0.164) decrease. Also, sales reduction in past year leads to decreased degree of stickiness by 0.118%.

Table 4: The results of testing hypotheses

Hypothesis	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson	Acceptance condition for hypothesis	Results
	Dependent Variable	β 0	β 1	β 2	β 3		
H_1	0.953	0.908	0.908	0.0365	1.700	B1>0, B2<0	Rejected
	Cogs	0.003*	0.943*	(0.027)	-----		
H_2	0.506	0.256	0.255	0.0922	1.902	B1>0, B2<0	Confirmed
	SG&A	(0.004)	0.477*	(0.164)*	----		
H_3	0.950	0.903	0.903	0.0364	1.700	B1 , B3>0, B2<0	Rejected
	Cogs	0.002	0.946*	(0.053)*	0.025		
H_4	0.524	0.274	0.273	0.0929	1.922	B1 , B3>0, B2<0	Confirmed
	SG&A	(0.001)	0.465*	(0.169)*	0.118*		
H_5	0.972	0.945	0.945	0.0363	1.686	B1>0 , B2,B3<0	Rejected
	Cogs	0.000	0.987*	(0.111)*	0.055*		
H_6	0.506	0.256	0.255	0.0922	1.902	B1>0 , B2,B3<0	Rejected
	SG&A	(0.004)	0.476*	(0.161)*	(0.002)		

(*) is significant in the level 5%

6. Conclusion

This research was performed in a sample separated by industry and prices index was adjusted to eliminate inflation effect and it was found that cost of goods sold

is not consistent with model stickiness of costs model. However, general, administrative and selling costs are sticky to changes in sales level so that throughout the sample, 1% increases in sales lead to 0.443% increase and 1% decreases result in 0.261% decrease. Decreased sales in past year doesn't lead to reduced degree of stickiness of cost of goods sales but decreases degree of stickiness of general, administrative and selling costs by 0.145%. On the other hand, it was found that the ratio of total assets to sales didn't effect on stickiness degree of costs.

Following reasons can provide stickiness in general, administrative and selling costs:

1. Considering employment contracts of fixed forces in administrative departments and managerial forces in these sectors, managers aren't inclined to fire such staff when there are decreased activity volume and income so while decreased activity, general, administrative and selling costs may decease less so these costs are stickier.
2. Due to economic instability, there is a possibility that effective factors on reduced activities of company will be eliminated in near future so managers do not reduce their resources and reserve unused capacity so cost of unused capacity leads to sticky behavior in general, administrative and selling costs.
3. Due to personal considerations, managers may not want to reduce respective resources which effect on sticky behavior of general, administrative and selling costs by reducing company activities volume. As an example, managers may be unwilling to fire their coworkers the size of their company or organization as it may effect on their status in the company.

Research limitations are:

1. As data offered about cost of goods sales and general, administrative and selling costs were stated as general figures by companies and didn't divided into fixed and variable, analyzing stickiness of cost separated by fixed and variable wasn't possible.
2. General, administrative and selling costs are stated in financial statements as a general figure and only some companies offer these costs separately as general and administrative costs and distribution and sales costs. So, considering the period (2001-2010), more expanded data was not available to perform statistical tests for each cost separately.

Suggestions for future researches

1. Since there weren't sufficient data during research period to divide general, administrative and selling costs into general and administrative costs, and distribution and sales costs, it is suggested that in future studies stickiness of costs would be studied separately given to additional research years and increased data.
2. Evidences show that stickiness of costs is concerned to management informed decisions to adjust capacity level of production and market demand. Closer consideration of management decision making patterns (such as wise decision making, satisfactory rationalism and increasing pattern) and their effects on stickiness of costs is an important step to study cost behavior as better as possible in future researches.

7. References

Anderson, M. and Janakiraman, S. (2003), "Are selling, general, and administrative costs "sticky?", Journal of Accounting Research, vol. 41, pp. 47-63.

Balakrishnan, R., Petersen, M. and Soderstrom, N. (2004), "Does capacity utilization affect the "stickiness" of cost?" Journal of Accounting, Auditing & Finance, Vol.19, No.3, pp.283-299.

Banker, R. and Chen, L. (2006)," Labor market characteristics and cross-country differences in cost stickiness", Working paper, Georgia State University.

Cooper, Robin and Robert S. Kaplan (1988), "How Cost Accounting Distorts Product Costs," Management Accounting, Vol. 69, No. 10, pp. 20-27.

Dan Weiss. (2010), "Cost Behavior and Analysts' Earnings Forecasts", The Accounting Review, Vol. 85, No.4, pp. 1441-1471.

Ghaemi, M H and Nematollahi, M. (2006), "study the behavior of distribution and sales costs, general and administrative costs and goods sales costs in manufacturing companies listed in Tehran Stock Exchange.", Accounting studies seasonal, No.16, pp. 89-71.

Kallapur, S and Eldenburg L (2005), "Uncertainty, real options, and cost behavior: Evidence from Washington state hospitals", Journal of Accounting Research, Vol. 43, No. 5, pp. 735-752.

Medeiros, O. and Costa .R,P.S. (2004), "Cost Stickiness in Brazilian Firms.", http://ssrn.com/abstract=632365.

Noreen, E. and Soderstrom, N. (1994), "Are Overhead Costs Strictly Proportional to activity? Evidence from hospital departments.", Journal of Accounting and Economics vol. 17, No 1-2, pp. 255-278.

Steliaros, M., Thomas, D. and Calleja, K. (2006), "A note on cost stickiness: Some international comparisons.", Management Accounting Research, vol. 17, No.1, pp. 127-40.

Subramaniam, C. and Weidenmier, M. (2003), "Additional Evidence on the Sticky Behaviour of Costs.", Working Paper ,Texas Christian University.