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# Impact of Macro Economic Factors on Operating Cost Stickiness in the Tehran Stock Exchange

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## ABSTRACT

This research reviewed the impact of macroeconomic factors (industrial production growth, national income, capital market return) on operating cost stickiness for companies listed in the Tehran stock exchange. Using the elimination method, 91 firms were chosen and data was extracted from the firms and the Central Bank library to test the hypothesis. The variables tested used multivariable linear regression. This research has based on annual observations from the years 2007 to 2012. The results showed that there is a meaningful positive relation between industrial production growth and operating cost stickiness and a meaningful positive relation between capital market return and operating cost stickiness. No meaningful relation was found between national income and operating cost stickiness.
**KEYWORDS**: Operating cost stickiness, Industrial production growth, National income, Capital market return

## 1. INTRODUCTION

Macroeconomic factors (industrial production growth, national income, capital market return) play an important role in the global economy. The economic health of a country can be judged by its industrial production, which represents appropriate economic growth for shareholders. Alongside industrial production growth, national income is a crucial tool for macroeconomic factor and is an index to determine if social economic advantages depend on the free market. The effect of a net income for a specified period beyond the capital consumption allowance of a country and capital market return is important for measuring net gain for investors.

Information about the amount of expenditure against changes in sales or sale activity levels help managers make decisions about planning and budgets, pricing of products, determining break-even points, and other managerial decisions. To take action and for planning, managers require data on cost effectiveness using a propensity score, which measures quality spending against possible changes in activity level and macro-economic factors. The propensity score is a model that defines how costs react to a change in the level of activity or to macroeconomic factors.

Some theories assert that costs have an inverse reaction on ascending-descending changes in activity level. This characteristic is called cost stickiness, and it challenges the relation between changes in costs in response to a decrease-increase in activity level. Cooper and Kaplan (1998) asserted that cost stickiness occurs when managers direct a supply of contract costs that is not cost-effective. The managers maybe decide to keep the all resources in the way; while a firm may report a decrease in revenue, costs do not decrease like revenue does. Macroeconomic factors are effective because they make a series of specific decisions against industrial production growth, national income, capital market return that affect cost stickiness. Traditionally, cost models have drawn of the attention of management accountants who decide on and control activity. The data shows that managers are now looking for the most effective elements on cost behavior.

The present study reviewed the impact of industrial production growth, national income, and capital market return on operating costs stickiness of firms as a whole and separately.

### 1.1. LITERATURE REVIEW

The relationship between costs and activity was observed by Solomon and Stabos in the 1960s and 1970s. Subsequently, a number of theories have been advanced. Noreen (1994) stated that costs are either fixed or variable, depending on the level of activity; variable costs change based on a change in the level of activity.

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Estimating cost behavior without considering cost stickiness will produce misleading results. White et al. (1977) stated that the Noreen's theory is unreliable. For example, selling, general and administrative (SGA) expenses form a percent of defined sales for the analysis of financial statements. Mints (1992), however, says that, if there is a disproportionate increase in costs against sales, financial statements will show a weakness in management control. This analysis may be misleading, because if SGA expenses are sticky, as sales increase a proportional increase in costs will occur, but if sales decrease, there will not be a proportional decrease in costs.

Cost models relate cost behavior to accounting science, relating the difference between fixed variable costs to changes in activity level. It is assumed that fixed costs are separate from activity level. In the sub-complex of a traditional model of cost behavior, some theories produce very different results for this model from the change in real costs. The research of Anderson et al. (2003) on 762 firms over a 20-year period showed a 0.55% increase for a 1% increase in SGA expenses, but a 1% decrease for a 0.35% decrease in SGA. They indicate that executive costs will show different reactions from ascending and descending changes in sales revenue. In other words, cost stickiness means a possible increase in costs for an increase in revenue is much more effective than a simultaneous decrease in revenue.

Suberamaniam and Weidenmier (2003) developed the basics of cost stickiness dependence on the cost of items. This stickiness contributes to the dimensions of management behavior. Anderson et al. (2003) and Suberamaniam and Weidenmier (2003) found that this stickiness is connected to the economy. Noreen and Soderstorm(1997) do not share this view and Cooper and Kaplan (1997) believe the behavior of costs results from management characteristics. Their fundamental theory say that cost stickiness results from a series of managerial contracts to increase resources (raw material, human capital, etc.), the violation of which will result in loss (decrease in demand). Managers may decide to retain their resources. Firms may report a decrease in revenue, but the costs will not decrease.

Other research on the difference in intensity of cost stickiness indifferent sections of an organization clearly shows that intensity is related to the core sections. Calleja (2005) analyzed cost stickiness using data from companies in the US, Britain, France and Germany. His results showed that an increase of 1% in sales, increased operating costs 97%, and a decrease 1% in sales decreased operating costs 91%. He also found that the intensity of cost stickiness in France and Germany was higher than in the US and Britain.

Mark (2003) focused on costs stickiness for California Airways. He used monthly data from June 1988 to December 2003 at 61 offices of California Airways and has found that stickiness was substantial for operating costs, but not for wage costs. In addition, wage costs showed a faster reaction to a decrease in activity to an increase. Banker and Chen (2003) predicted a rate of return on investment that reflects the sticky behavior of costs. They compared this model with three non-sticky behaviors and found that their model was more sensitive to predicting a return on investment.

Anderson and Lenin (2003) pinpointed a difference in intensity difference in cost stickiness between industries and a similar difference between operating costs, such as marketing, research, development, and wages. Namazi and Davanipour (2009) researched the real behavior of cost stickiness in the Tehran stock exchange. They found that the intensity of cost stickiness decreased as income decreased and that this intensity was higher in companies having more total assets against sales.

Poorzamani and Bakhtiary (2012) investigated the impact of the inflation rate, and short-term and long-term interest rates on operating cost stickiness (OCS) in the Tehran stock exchange. They found that there is a meaningful negative relation between inflation rate and operating cost stickiness, a meaningful positive relation between short-term interest rates and OCS, but no meaningful relation between long-term interest rates and OCS.

Shafeyi and Mohammadzadeh (2009) compared the behavior of cost stickiness in Iranian firms with that of companies in the US, Britain, France and Germany. They replaced the traditional model with cost stickiness, resulting a relation between activity level changes and sales levels. The results showed a 1% increase in SGA expenses resulted from a 0.43% growth in the level of sales.

## 2. Research Hypotheses

The main hypothesis of this study is that macro-economic factors affect operating cost stickiness. There are three secondary hypotheses. The first is that industrial production growth affects OCS. The second is that national income affects OCS. The third is that capital market return affects OCS.

## 3. Research Model and Variables

This model used multi-variable linear regression.

$$\boldsymbol{log}\left[\frac{Total\ operating\ cost\ _{i,t}}{Total\ operating\ cost\ _{i,t-1}}\right]=\alpha+\beta_1\boldsymbol{log}\left[\frac{revenve\ _{i,t}}{revenve\ _{i,t-1}}\right]+$$
$$\beta_2 d_{i,t}\boldsymbol{log}\left[\frac{revenve_{i,t}}{revenve_{i,t-1}}\right]+\beta_3 d_{i,t}\boldsymbol{log}\left[\frac{revenve_{i,t}}{revenve_{i,t-1}}\right]\times industrial\ production\ growth\ +\beta_4 d_{i,t}\boldsymbol{log}\left[\frac{revenve_{i,t}}{revenve_{i,t-1}}\right]\times$$
$$national\ income+\ \beta_5 d_{i,t}\boldsymbol{log}\left[\frac{revenve_{i,t}}{revenve_{i,t-1}}\right]\times capital\ market\ returns+\varepsilon_{i,t}$$
(1)

*3.1. Total operating cost*

This cost is calculated from income statements of companies on the Tehran stock exchange and OCS as the dependent variable is computed using a dummy variable as follows: when the revenue from sales decreases for two periods, the dummy variable has a value of 1 or zero. If it is zero, revenue has increased and B1% of the costs increase, producing an 1% increase in revenue. If the dummy variable has a value of 1, revenue has decreased, and B1%,…….B5% of costs decrease, producing a 1% decrease in revenue.

*3.2. Revenue*

Revenue is an independent variable produced from the income statement of companies on the Tehran stock exchange.

*3.3.(di,t)*

The dummy variable for sales has a value of 1 if the sales revenue decreases for two periods, otherwise it is zero. This time, revenue increases and B1% of costs increase, producing a 1% increase in revenue; as revenue decreases, B1%,…….B5% of costs decrease, producing a 1% decrease in revenue.

*3.4. Industrial production growth*

Industrial production is the output of factories, mines and companies, and industrial production growth represents appropriate economic growth for shareholders. It is an independent variable that is multiplied by the dummy variable; its data is obtained from the Central Bank library.

*3.5. National income*

Revenues of businesses and segments of the economy that produce goods and services in society is called the national income. It is an independent variable that is multiplied by the dummy variable; its data is obtained from the Central Bank library.

*3.6. Capital market return*

A capital market is that in which securities are exchanged; capital market return is income that investors gain. It is an independent variable that is multiplied by the dummy variable; its data is obtained from the Central Bank library.

## 4. RESEARCH METHODOLOGY

Statistics in this research include those for all companies on the Tehran stock exchange from 2007 to 2012. They were selected because of the ease of availability of financial statements for these companies and their being members of the stock exchange. The total number of companies on the exchange is for more than30 industrial groups for a total of 440 companies.

This research has used a sampling method defining a series of standards of elimination to ultimately choose 91 firms from the Tehran stock exchange. Those that were selected had the following qualities:

- They are companies for which data is available.
- Their fiscal year ends in the month of March.
- They were accepted to the bourse before 2005.
- They are not investment brokers or banks.
- They do not operate under long-term delay when dealing.

*4.1 Analysis of data*

The goal of this research is applied, the procedure is descriptive, and the time span is post-event. This research used a multi-variable linear regression model to test the hypotheses and used a panel data model using Spss and Eviews software. The F test was used to test the hypotheses and the accuracy of the data. It defined the kind of test (fixed or accidental effects) based on the Hasman test with attention to the kind of model against an average model. To produce better results, the F exam was used and to investigate the variables and their correlation, the Pearson correlation coefficient was used. To investigate the normal form of the dependent variable contribution, the Jarque-

Bera test was used. The theory of remnant variance similarity is described by Breusch–Pagan and remnant independence is described by Durbin-Watson.

## 5. RESEARCH RESULTS

### *5.1. Results of descriptive statistics*

Table 1 shows that the average log of operating costs for the selected companies compared to the last year was 0.0638; its minimum was -0.4951 and maximum was 0.8486. The average log of sales revenue of the selected companies compared to the last year was 0.0569, with a minimum of -0.6235 and a maximum of0.5184. The statistics indicate that the average industrial production growth was -1.180 for 2007 to 2012, with a minimum of -7.70 and a maximum of 5 (descending). The statistics also indicate that the average national income was 414142 in 2007 to 2012, with a minimum of 115684 and a maximum of 674565 and that the average capital market return was 0.160, with a minimum of 0 and a maximum of 1.

Table 1. Descriptive statistics for research variables.

| Variables | observations | Mean | Std.dev | min | max | skewness | kurtosis |
|---|---|---|---|---|---|---|---|
| Operating costs | 449 | 0/0637 | 0/1454 | -0/4951 | 0/8486 | 0/940 | 8/438 |
| Sales revenue | 449 | 0/0569 | 0/1203 | -0/6235 | 0/5184 | - 0/826 | 9/088 |
| Dummy | 455 | 0/7758 | 0/4174 | 0 | 1 | 0/083 | 1/894 |
| Industrial production growth | 455 | -1/180 | 4/2761 | -7/70 | 5 | - 0/069 | 1/998 |
| National income | 455 | 414142 | 204295 | 115684 | 674565 | - 0/246 | 1/579 |
| Capital market return | 455 | 0/160 | 0/4174 | 0 | 1 | -1/322 | 2/749 |

### *5.2. Normal test of research dependent variable*

The least squares method was used to estimate the model parameters. In this method, a normal distribution was assumed for the dependent variable and it was tested using the Jarque-Bera model. The results show that the operating cost variable does not have a normal distribution ($N_0$). The Johnson transfer function was used to normalize the data. After normalization, the results of Jarque-Bera show that the operating cost variable has a normal distribution.

Chart 1. Results of normal exam of dependent variable.

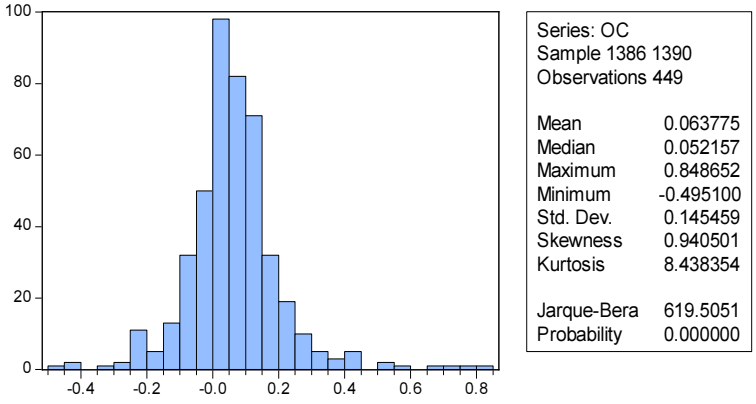
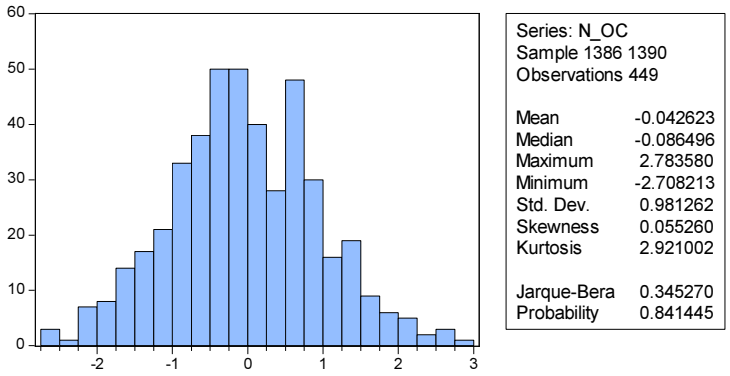


Chart 2. Results of exam after a normalization.




*5.3. Test of first secondary research hypothesis*

The first secondary hypothesis postulates the impact of industrial production growth on OCS with results as follows:

- $H_0$: industrial production growth has no impact on operating cost stickiness.
- $H_1$: industrial production growth has an impact on operating cost stickiness.

The results of Model 1 are as follows:

- Jarque-Bera: remnants are not normal at the 95% confidence level (ignore because of central limit theorem).
- Breusch-Pagan: no similarity of variance and the problem is the lack of variance similarity. The great least squares (GLS) model was used to remove this problem.
- Durbin-Watson: the remnants are independent.
- Ramsey: the model is correct.

Using the results of the test of chaw and the classic regression of statistic averages, Model 1 was estimated using combined data.

$$\log\left[\frac{Total\ Operation\ Cost_{i,t}}{Total\ Operation\ Cost_{i,t-1}}\right] = \alpha + \beta_1 \log\left[\frac{revenue_{i,t}}{revenue_{i,t-1}}\right] + \beta_2 d_{i,t} \times \log\left[\frac{revenue_{i,t}}{revenue_{i,t-1}}\right] + \beta_3 d_{i,t} \times \log\left[\frac{revenue_{i,t}}{revenue_{i,t-1}}\right] \times Industrial\ \ production\ growth + \varepsilon_{i,t} \quad (2)$$

The probability of the *t*-statistic for the variable coefficient "sales revenue× sales dummy variable× industrial production growth" is less than 0.05 (0.0246). There is a meaningful relation at the 95% confidence level. The first secondary hypothesis is accepted: industrial production growth affects OCS. A positive variable coefficient (0.1152) indicates a direct relation between inflation and OCS.

Table 2.Test results for first secondary hypothesis.

| **Dependent variables: operating cost<br>Observation:448 firm-year** | | | |
|---|---|---|---|
| **Variable** | coefficient | t-statistic | P-Value |
| **Fixed component** | -0/2130 | 4/036 | 0/0001 |
| **Sales revenue** | 0/6437 | 2/372 | 0/0181 |
| **sales revenue×Dummy variable** | 1/8338 | 3/884 | 0/0001 |
| **sales revenue ×Dummy variable industrial production growth×** | 0/1152 | 2/254 | 0/0246 |
| **Determination coefficient** | | 0/1877 | |
| $F$<br>$(P-Value)$ | | 35/449<br>( 0/0000) | |

*5.4. Test of the second secondary hypothesis*

The second secondary hypothesis postulates the impact of national income on the operating costs stickiness and the results are as follows:

- $H_0$: national income has no impact on operating cost stickiness.
- $H_1$: national income has an impact on operating cost stickiness.

The results of Model 2 are as follows:

- Jarque-Bera: remnants are not normal at 95% confidence level (ignore because of central limit theorem)
- Breusch-Pagan: no similarity of variance and the problem is the lack of variance similarity. The great least squares (GLS) model was used to remove this problem.
- Durbin-Watson: the remnants are independent.
- Ramsey: the model is correct.

Using the results of the test of chaw and the classic regression of statistic averages, Model 2was estimated using combined data.

$$\log\left[\frac{Total\ Operation\ Cost_{i,t}}{Total\ Operation\ Cost_{i,t-1}}\right] = \alpha + \beta_1 \log\left[\frac{revenue_{i,t}}{revenue_{i,t-1}}\right] + \beta_2 d_{i,t} \times \log\left[\frac{revenue_{i,t}}{revenue_{i,t-1}}\right] + \beta_3 d_{i,t} \times \log\left[\frac{revenue_{i,t}}{revenue_{i,t-1}}\right] \times National\ income + \varepsilon_{i,t} \quad (3)$$

The probability of the *t*-statistic to the variable coefficient "sales revenue× sales dummy variable× national income" is greater than 0.05. There is no meaningful relation at the 95% confidence level between this variable and OCS. The second secondary hypothesis is rejected and national income has no impact on OCS.

Table 3. Test results of second secondary hypothesis.

| **Dependent variables: operating cost<br>Observation:448 firm-year** | | | |
|---|---|---|---|
| **Variable** | coefficient | t statistic | P-Value |
| **Fixed component** | -0/2265 | -5/613 | 0/0000 |
| **Sales revenue** | 0/5668 | 1/361 | 0/1740 |
| **sales revenue×Dummy variable** | 1/9176 | 2/298 | 0/0220 |
| **sales revenue× national income×Dummy variable** | 0/00001 | 0/208 | 0/8348 |
| **Determination coefficient** | 0/1632 | | |
| $F$<br>$(P-Value)$ | 30/067<br>(0/0000) | | |

*5.5. Test of third secondary hypothesis*

The third secondary hypothesis postulates the impact of capital market return on OCS as follows:

- $H_0$: capital market return has no impact on operating cost stickiness.
- $H_1$: capital market return has an impact on operating cost stickiness.

The results of Model 2 are as follows:

- Jarque-Bera: remnants are not normal at 95% confidence level (ignore because of central limit theorem)
- Breusch-Pagan: no similarity of variance and the problem is the lack of variance similarity. The great least squares (GLS) model was used to remove this problem.
- Durbin-Watson: the remnants are independent.
- Ramsey: the model is correct.

Using the results of the test of Chaw and the classic regression of statistic averages, Model 3was estimated using combined data.

$$\log\left[\frac{Total\ Operation\ Cost_{i,t}}{Total\ Operation\ Cost_{i,t-1}}\right] = \alpha + \beta_1 \log\left[\frac{revenue_{i,t}}{revenue_{i,t-1}}\right] + \beta_2 d_{i,t} \times \log\left[\frac{revenue_{i,t}}{revenue_{i,t-1}}\right] + \beta_3 d_{i,t} \times \log\left[\frac{revenue_{i,t}}{revenue_{i,t-1}}\right] \times Capital\ market\ return + \varepsilon_{i,t} \quad (4)$$

The probability the *t*-statistic for the variable coefficient "sales revenue× sales dummy variable× capital market return" is less than 0.05 (0.0111). There is a meaningful relation at the 95% confidence level. The third secondary

hypothesis is accepted; capital market return affects OCS. A positive variable coefficient (0.0124) indicates that there is a direct relation between capital market return and OCS.

Table 4. Test results of the third secondary hypothesis.

| Dependent variables: operating cost<br>Observation:448 firm-year | | | |
|---|---|---|---|
| **variable** | coefficient | t-statistic | P-Value |
| **Fixed component** | -0/2214 | -5/565 | 0/0000 |
| **Sales revenue** | 0/6029 | 1/500 | 0/1343 |
| **sales revenue×Dummy variable** | 1/8837 | 3/647 | 0/0003 |
| **sales revenue×capital market return×Dummy variable** | 0/0124 | 2/551 | 0/0111 |
| **Determination coefficient** | 0/1733 | | |
| $F$<br>$(P-Value)$ | 32/238<br>(0/000) | | |

*5.6. Test of main hypothesis*

This hypothesis and its statistical hypothesis is as follows:

- $H_0$: macroeconomic factors have no impact on operating cost stickiness.
- $H_1$: macroeconomic factors have an impact on operating cost stickiness.

The results of the statistical assumption of the total model are as follows:

- Jarque-Bera: remnants are not normal at 95% confidence level (ignore because of central limit theorem)
- Breusch-Pagan: no similarity of variance and the problem is the lack of variance similarity. The great least squares (GLS) model was used to remove this problem.
- Durbin-Watson: the remnants are independent.
- Ramsey: the model is correct.

Using the results of the test of chaw and the classic regression model, this case was estimated using combined data.

$$\log\left[\frac{Total\ Operation\ Cost_{i,t}}{Total\ Operation\ Cost_{i,t-1}}\right]=\alpha+\beta_1\log\left[\frac{revenue_{i,t}}{revenue_{i,t-1}}\right]+\beta_2 d_{i,t}\times\log\left[\frac{revenue_{i,t}}{revenue_{i,t-1}}\right]$$
$$+\beta_3 d_{i,t}\times\log\left[\frac{revenue_{i,t}}{revenue_{i,t-1}}\right]\times Industrial\ \ production\ growth$$
$$+\beta_4 d_{i,t}\times\log\left[\frac{revenue_{i,t}}{revenue_{i,t-1}}\right]\times Capital\ market\ return+\varepsilon_{i,t} \quad (5)$$

Table 5. Test results of main hypothesis.

| Dependent variables: operating cost<br>Observation:448 firm-year | | | |
|---|---|---|---|
| **Variable** | Coefficient | t Statistic | P-Value |
| **Fixed component** | -0/2138 | -4/481 | 0/0000 |
| **Sales revenue** | 0/7994 | 2/834 | 0/0048 |
| **sales revenue ×Dummy variable** | 1/9745 | 2/803 | 0/0053 |
| **industrial production growth×sales revenue ×Dummy variable** | 0/1024 | 2/621 | 0/0091 |
| **capital market return×sales revenue ×Dummy variable** | 0/0092 | 3/073 | 0/0023 |
| ***AR(1)*** | -0/2461 | -11/258 | 0/0000 |
| **Determination coefficient** | 0/1602 | | |
| $F$<br>$(P-Value)$ | 14/546<br>(0/000) | | |

The probability of the *t*-statistic for the variable coefficient "sales revenue× sales dummy variable× industrial production growth" is less than 0.05(0.0091). There is a meaningful relation at the 95% confidence level between

industrial production growth and OCS. A positive coefficient of this variable (0.1024) indicates that there is a direct relation between industrial production growth and OCS. Based on the total model, an increase of 1 in industrial production growth will increase OCS to 0.1024. The probability of the *t*-statistic for the variable coefficient "sales revenue× sales dummy variable× capital market return" is less than 0.05(0.0023); there is a meaningful relation at the 95% confidence level between capital market return and OCS. A positive coefficient for this variable (0.0092) indicates a direct relation exists between capital market return and OCS. Based on an increase 1 of the main model for capital market return, increases OCS 0.0092. This indicates that the main research hypothesis has been accepted.

## 6. Conclusion

This research has examined the relationship between macroeconomic factors and found that industrial production growth has a direct effect on OCS. An increase in industrial production growth increases OCS. The results show that capital market return has a direct relation to OCS of active companies in the Iranian market. An increase in the capital market return increased OCS. The results also show that there is no meaningful relation between national income and OCS.

Table 6. Results

| variable | Sig.level | Quantity of (t) | statistic | coefficient | results |
|---|---|---|---|---|---|
| Industrial production growth | 0/0246 | 2/254 | t | 0/1152 | confirmed |
| National income | 0/8348 | 0/208 | t | 0/00001 | rejected |
| Capital market return | 0/0111 | 2/551 | t | 0/0124 | confirmed |

The results of this study are similar to those of Calleja et al. (2005) and supplement the findings of Namazi and Dawanipour (2009). Calleja et al. analyzed operating cost stickiness in the US, Britain, France, and Germany and found that operating cost stickiness exists in all of them, with a greater incidence in France and Germany.

Since the results show that both industrial production growth and capital market return affect OCS, it is suggested that managers, when planning and budgeting their operating costs, factor in cost stickiness and the impact of industrial production growth and capital market return. Also, in recognition of the results showing the effect of macroeconomic factors (industrial production growth and capital market return) on OCS in active companies in the Iranian market and because of recent changes in economic policy, it is suggested that policy-makers pay more attention to maintaining the stability of the country's economy. Companies should add OCS to their statements, so that investors can easily analyze them. Is suggested that cost stickiness be introduced to academics and the capital market, so that accountants and investors understand this important factor.

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