Validation of a Multiple Linear Regression Model

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Abstract: *In this paper, we present a model of multiple linear regressions for the margin trade.*

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1. Introduction

In the current economy, it has become imperative to have a professional management of the firms. The relationship between inventory management and organizational performance is fairly debated. Overall it is accepted that good management of inventories influences the performance of the organization. However, all stocks were not analyzed in detail.
It is proposed to establish a framework for analyzing the influence of the inventories on the performance of organization. Beside the method MRP, that is another method to control the inventory [1] and the method ABC, that is a method of control for inventories [2], we can control inventories even at a summary level using a model of relation between a dependent variable and others dependent variables, a model that we will propose below.

2. The proposal of a multiple linear regression model

It is known that the performance of the organization is primarily measured in financial terms. For example, the index Gartner, according to [3], has about 10 years old when calculating and aims to make a ranking of the top 25 supply chain companies, ranking focuses on idea-driven application, has two main components, namely 50% based on the opinion of two panels of voters and 50% on financial metrics such as: ROA (return on assets), inventory turnover and income growth.
We analyze the impact of inventories on the performance of the organization financially. Inventory turnover defined, shows how well managed stocks are, where big is said to be good. But this opinion should be relaxed because of the possibility to rotate inventories less so to have a lower value of this indicator and simultaneously to have a gross margin greater unlike the version in which you have an inventory turnover greater and gross margin small. The inventory turnover is different on sectors, industries, within the branches, may be different from companies operating in the field. In order to obtain a regression function, seek to highlight the inventory turnover in conjunction with inventory growth rate, rate margin / cost of goods sold and commercial margin was calculated. It is tried to show that the commercial margin is a function of inventory turnover, inventory growth rate, rate margin / cost of goods sold, based on data analyzed company operating in industrial processing branch.
Commercial margin is the rate of financial performance and inventories turnover is a metric important to inventory, supply activity; it can be global or types of stocks; rate margin / cost of goods sold is the ratio between margin and cost of goods sold, also an important metric of supply, the rate of growth inventory is relevant to the situation of inventory and succeed in modeling of commercial margin based on inventory turnover, rate margin / cost of goods sold and inventory growth rates demonstrate the influence of supply on performance.
All three dependent variables make sense to influence the commercial margin.
It is proposed as a model for determining the rate of commercial margin, a model where the dependent variable is the rate of commercial margin and as independent variables: inventory turnover, rate margin / cost of goods sold, inventory growth rate.

$y=\alpha 0+\alpha_1 X_1+\alpha_2 X_2+\alpha_3 X_3+\varepsilon$[4]

• y is the dependent variable (explained endogenous outcome) and the rate of commercial margin
• x is the vector of independent variables (explanatory exogenous), the size 1×p, in this case
X_1-inventory turnover,
X_2-rate margin/cost of goods sold
X_3- inventory growth rate,
• α is the vector coefficients of size p × 1, the model parameters,
• ε is a variable interpreted as an error.

3. Validation of the model

In this paper we try to analyze the influence of the inventories on the performance of the financial statements of the company. We chose to analyze the data of a company; for confidentiality reasons we noted the enterprise CA = analyzed.
We chose its data from the 2009-2013 periods to extract conclusion in as well founded. To see the influence of inventories we show a table with primary data, Table 1.

TABLE 1: Primary data

Lei-absolute value	2009	2010	2011	2012	2013
Turnover	69,115,487	62,304,542	71,453,534	70,673,051	98,376,866
Cost of goods sold	50,459,012	49,149,779	57,989,330	56,272,156	76,688,403
Commercial margin	18,656,475	13,154,763	13,464,204	14,400,894	21,688,463
Inventory	5,801,992	8,900,550	10,759,210	11,433,702	11,159,340
Average of inventory	7,353,042	7,351,271	9,829,880	11,096,456	11,296,521
Inventory growth rate	0.65	1.53	1.21	1.06	0.98
Rata margin/cost of goods sold	0.37	0.27	0.23	0.26	0.28
Rata of commercial MARGIN	0.27	0.21	0.19	0.20	0.22
Inventory turnover	6.86	6.69	5.90	5.07	6.79
Inventories for year 2008=8904091					

Company performance is the commercial margin rate calculated by the formula

$$\text{Rate of commercial margin} = \frac{\text{Commercial margin}}{\text{Turnover}} \quad (1),[5]$$

Commercial margin rate is also a dependent variable explained by some inventory rate:

$$\text{Rate increase in inventories} = \frac{\text{Inventory curent year}}{\text{Inventory previous year}} \quad (2),$$

$$\text{Rate margin on cost of goods sold} = \frac{\text{Commercial margin}}{\text{Cost of goods sold}} \quad (3),$$

$$\text{Inventory turnover} = \frac{\text{Cost of goods sold}}{\text{Average value of inventory}} \quad (4), [6]$$

In order to determine a linear regression model the commercial margin rate based on inventory turnover, rate margin / cost of goods sold, inventory growth rate, these data are presented in Table 2.

TABLE 2: The rate of inventory turnover depending on commercial margin, rate margin / cost of goods sold and inventory growth rate in 2009-2013 for the company analyzed

Year	Rate of commercial margin	Inventory turnover	Rate margin/Cost of goods sold	Inventory growth rate
2009	0.27	6.86	0.37	0.65
2010	0.21	6.69	0.27	1.53
2011	0.19	5.90	0.23	1.21
2012	0.20	5.07	0.26	1.06
2013	0.22	6.79	0.28	0.98

After analyzing the data in Data Analysis, Analysis Tools, regression function following data were found, as shown in Table 3.

TABLE 3: Regression model

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999621
R Square	0.999243
Adjusted R Square	0.996971
Standard Error	0.001702
Observations	5

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0.003821	0.001274	439.8718	0.035032
Residual	1	2.9E-06	2.9E-06		
Total	4	0.003824			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.049989	0.010323	4.84257	0.129641	-0.08117	0.181152	-0.08117	0.181152
X Variable 1	0.000324	0.001631	0.198454	0.875281	-0.0204	0.021045	-0.0204	0.021045
X Variable 2	0.588665	0.034965	16.83584	0.037769	0.144392	1.032937	0.144392	1.032937
X Variable 3	0.000855	0.004631	0.184565	0.88381	-0.05799	0.059695	-0.05799	0.059695

RESIDUAL OUTPUT

Observation	*Predicted Y*	*Residuals*	*Standard Residuals*
1	0.270417	-0.00048	-0.56971
2	0.211018	0.000119	0.139677
3	0.18961	-0.00118	-1.38302
4	0.203186	0.000581	0.68339
5	0.219502	0.000961	1.129666

PROBABILITY OUTPUT

Percentile	*Y*
10	0.188433
30	0.203768
50	0.211137
70	0.220463
90	0.269932

Analyzing the data shows that there is a strong link between variables, pointer Multiple R = 0.999621, it is close to the maximum possible one, and according R Square = 0.999243 variance variable rate commercial margin is explained by the three independent variables- inventory turnover, rate margin / cost of goods sold and inventory growth rate in the proportion of 99.9243%, which translates into the fact that the three independent variables strongly influence trading margin rate. Interpretation of the F is required to validate the regression model, [4]; there are 2 assumptions:

H_0: $\alpha_1 = \alpha_2 = \alpha_3 = 0$
H_1: there is at least one nonzero coefficient αi.

This test refers to all independent variables (H_0 does not refer to the term free), considering that the whole significance of this test verifies regressions.
Significance F - sided probability is critical and the resulting value is lower than the materiality threshold set, then the null hypothesis in favor of the alternative hypothesis; Statistics F test is obtained as a ratio of the average of squared deviations from the average of squared deviations from regression and residue, calculated with the appropriate degrees of freedom.
If the test F has a high value and the value corresponding Significance F statistics is low (less than 0.05), the independent variables explain the variation in the dependent variable and vice versa. In this case the value of F is 439.8718 (is large), and the Significance F is 0.035032, is less than 0.05 materiality. It follows that the null hypothesis in favor of the alternative hypothesis H1, the model is valid. The values of these coefficients are:
$\alpha_0 = 0.049989$ (free term)
$\alpha_1 = 0.000324$
$\alpha_2 = 0.588665$
$\alpha_3 = 0.00085$
It follows that the dependent variable variation of the three independent variables takes the form of multiple linear regression equations of the form

$$\mathbf{y=0.049989 + 0.000324x_1 + 0.588665x_2 + 0.000855x_3}$$

In terms of the regression equation graphically expressed in Figure 1 it is of the following form:

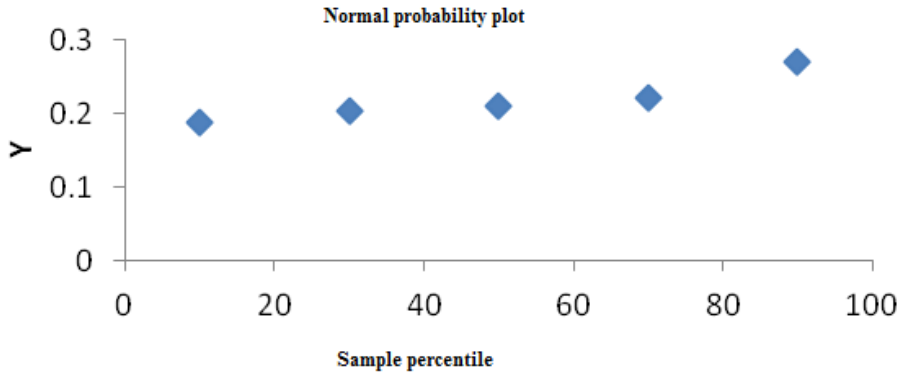

Fig. 1. The graphical representation of the equation, normal probability

This means that the group has a normal probability.
We have the possibility that the data available in the future to make a forecast for values of commercial margin rate, thanks to the regression function above. This verifies the multiple linear regression model of the form

$$\mathbf{y = \alpha_0+\alpha_1x_1+\alpha_2x_2+\alpha_3x_3+\varepsilon}$$

Conclusions

In this paper we have established a strong link between the rate of performance, margin rate commercial and three dependent variables - inventory turnover, rate margin / cost of goods sold, inventory growth rate - setting a model for the future of the dependent variable according to three independent variables. We can observe that this model can be performed by the supply system, as a part of the enterprise, that it is a rational system, that it has a goal to obtain profit, [7].

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