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THE RELATIONSHIP BETWEEN PRODUCTIVITY INDICATORS AND THE NET EARNINGS

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Abstract: *The main objective of this study was to identify the relationship between productivity Indicators and the net earnings. The methodology of the present study in terms of purpose is application and in terms of the research method was case study so that by selecting pharmaceutical industry in Tehran stock exchange as the population, the relationship between the dependent and independent variables was assessed and identified. In this study the dependent variable is the net earnings, and independent variables include labor productivity in terms of number of employees, productivity index of fixed assets, total assets productivity index, productivity index of personnel costs, and indexes of raw materials' inventory. In this study, to analyze the data, descriptive statistics, i.e. mean and standard deviation, and inferential statistics were, i.e. correlation test, was used and to analysis data extracted from the major financial statements of pharmaceutical companies in Tehran stock exchange, SPSS statistical software was used. In this study library method and survey was used to gather data so that investigating records from companies of pharmaceutical industry in a three years period, i.e. 2008-2010, needed information were transferred into specific tables and then were analyzed. Findings show a significant relationship between Indicators of labor productivity in terms of number of employees and net earnings as well as between indicators of capital productivity in fixed assets and net earnings at the significance level of 0.05 there exist. There is a significant relationship between indicators of labor productivity in terms of personnel costs with net earnings at the significance level of 0.10. Also, at the significance level of 0.05, there is no significant relationship between measures of productivity in terms of total assets and net earnings as well as between indexes of raw materials' inventory and net earnings.*

INTRODUCTION

In this study, our mean of the productivity Indicators include labor productivity Indicators, capital productivity Indicators, raw material inventory so that the personnel costs as the independent variable and net earnings as the dependent variable is being considered. In this study, the authors attempted to determine the kind of relationship between aforementioned Indicators. Although, little research

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has been done on the relationship between productivity and financial information, but in the relationship between market share and productivity considerable scientific research have been done.

Agheli (2012) examined the relationship between productivity criteria and financial information based on the financial information. Findings of this study suggest that there is a significant relationship between labor productivity Indicators and operating and net earnings as well as between the capital productivity Indicators with operating profit and net earnings. Also, there is no significant relationship between the whole productivity and operating profit and net earnings.

The performance of companies can be evaluated in different ways. For example, through the productivity of the company and the other by evaluating companies based on annual accounting reports or financial information. On the other hand, assessment based on each of them has its own unique qualities and characteristics, so the relationship between them is an interesting matter for study. The main objective of the financial statements is sending information to the different groups of users who are interested to know about the company's performance and use of financial information on their decisions in accordance with their goals (Kitaeva, 2002, p. 7).

Banker and Johnson (1994) by employing the airline industry as an empirical application reached the conclusion that there is positive correlation between profitability and productivity (Saeedi and Alaghi, 2011).

Holman (1998) based on a study on the airline industry reached the conclusion that there is a negative or reverse significant relationship between the operational costs and efficiency criteria (Saeedy and Alaghi, 2011).

Kitaeva (2002) during his research on the relationship between measurements of productivity and financial information on the airline industry studied 35 airlines from 25 countries for the time period of 1991 to 1999. He also concluded that is negative significant relationship between operational costs and performance measures.

Holman *et al.* (2002) based on thier study on the airline industry reached the conclusion that between the efficiency of market share and productivity benchmarks a positive relationship, and between productivity benchmarks and operational costs a negative relationship there exist (Saeedy and Alaghi, 2011).

From the viewpoint of investor, productivity is equal to the concept of return on investment. Thus, earnings are considered as efficacy. Relatively high productivity guarantees higher profits for companies, while lower productivity would lead to relatively lower earnings. Generally, decline in profitability, productivity or price cover reduces earnings. Decrease in productivity indicates the necessity of further analysis of corrective action (Taheri, 2004, 126).

Earnings of a company to a great extent depend on its productivity in the long term. Therefore a company should be required to coincidentally consider both the productivity and cost improvements, if it wants to be beneficial (Tangen, 2003, p. 43).

RESEARCH HYPOTHESES

Every research as the present one, usually, is based on a series of question and researches that researcher attempt to test them. Present study will test the following five hypotheses:

Hypothesis 1: there is a significant relationship between labor productivity in terms of number employees with the net earnings.

Hypothesis 2: there is a significant relationship labor productivity in terms of personnel expenses with the net earnings.

Hypothesis 3: there is a significant relationship between capital productivity in terms of fixed assets with the net earnings.

Hypothesis 4: there is a significant relationship between the productivity of capital in terms of total assets with the net earnings.

Hypothesis 5: there is a significant relationship between productivity of raw material inventory with the net earnings.

METHODOLOGY

The present study is of the type of application and is based on the actual previous data. The research is a field, correlational and descriptive one and considering the nature of research's data that are based on previous information, to examine research's hypotheses the statistical regression method was used, which aims to find and measure the relationship between the variables. Subject territory is also in the field of proofing and is entitled investigating the relationship between productivity measures with the net earnings in companies listed in Tehran Stock Exchange. The statistical population of the study includes all firms in the pharmaceutical industry that during 2008 to 2010 have been active in the Tehran Stock Exchange.

1. The firm before the year 2008 should be accepted in Tehran Stock Exchange.
2. Financial year must end at 29 March, in Persian Esfand.
3. In the period under review, no change or stop in the fiscal period is allowed.

The total number of companies listed in Tehran Stock Exchange is now 425 companies than amongst them the pharmaceutical industry was selected as the

statistical population. According to the Tadbir software of stock, number of these companies is 30 companies.

The total number of listed companies in Tehran Stock Exchange:	425
industries other than the pharmaceutical industries:	-395
The number of companies that in the time domain has gone out of stock:	-3
The number of companies that due to the negative added value moved out of population:	0
Total number of companies in the studied population:	27

FINDINGS

The following table shows the central indictors, e.g. mean and median, and dispersion measures, e.g. standard deviation, and kurtosis and skewness, for different variables. The larger value of mean than the value of median indicates the existence of big points in the data, since the average would be affected by these values. In this case, the data distribution is skew to the right. For example, for variables net earnings, investment in property and investment in fixed assets the distribution of data is skew to the right. However, in some cases, the distribution is skew to the left. The distribution of none of variable is skew to the left and if the mean and median values of variables are close to each other, then the data distribution is symmetric. This characteristic is of great important, because symmetry is one of the properties of the normal distribution, which will be discussed in the next section. Logarithm of the dependent variable, i.e. the logarithm of net earnings, with skewness and kurtosis of 0.18 and -0.55, respectively, is very similar to the normal distribution (skewness and kurtosis of the normal distribution are equal to zero).

Table 4.1
Describing Data

Variables	*Observations*	*Outlier observations*	*Mean*	*Median*	*SD*	*Skewness*	*Kurtosis*	*Minimum*	*Maximum*
Net earnings	81	0	162198	95834	189291	2.17	4.49	11195	897950
Logarithm of net earnings	80	1	11.44	11.41	1.02	0.18	-0.55	9.32	13.71
Raw material inventory	81	0	2.67	2.06	1.71	1.43	1.42	0.44	8.04
Capital in terms of assets	81	0	0.59	0.29	0.92	3.20	9.96	0.03	4.70
Capital in terms of fixed assets	81	0	3.20	1.67	4.05	2.28	4.47	0.06	17.60
Labor in terms of personnel expenses	81	0	8.71	7.70	5.28	0.58	-0.50	0.09	21.67
Workforce in terms of number of employees	81	0	477.98	421.71	238.48	0.99	0.99	146	1322

Investigating the normality of the distribution of the dependent variable

One of the assumptions of normal regression model is the assumption that residuals are of normal distribution, which in turn indicates the validity of the regression tests. Afterwards, using Kolmogorov-Smirnov test, normality of the distribution of the dependent variables were studied, because normality of the dependent variables results in the normal distribution of the residuals, i.e. the differences of estimated values of the real ones. Then, it is needed to check the normality of the dependent variable prior to the estimation of parameters and if the normality condition is not satisfied, we should seek for a suitable way to normalize them, e.g. conversion. The null hypothesis and the alternative one are as follows:

$$\begin{cases} H_0: \text{ Data for the dependent variable are normal,} \\ H_1: \text{ Data for the dependent variable are not normal.} \end{cases}$$

Table 4.2
Normal parameters

Variables	*Normal parameters.*			*Max. difference*			*Kolmo-gorov – Smirnov's*	
	Number	*Mean*	*SD*	*Absolute value*	*Positive*	*Negative*	*Z value*	*Probability*
Net earnings	81	162198	189291	0.21	0.20	-0.21	1.91	0.00
Logarithm of net earnings	80	11.44	1.02	0.12	0.12	-0.07	1.05	0.22

The Probability of net earnings is less than 0.05, i.e. equal to 00.0, thus, the null hypothesis is rejected for this variable. In other words, distribution of this variable is not normal, but the probability for the logarithm of the net earnings is equal to 0.22 and greater than 0.05, thus, the null hypothesis is not rejected for this variable. In other words, it means that the distribution of the logarithm of this variable is normal.

Examining the correlation coefficient between variables

To prove the linearity of the relationship, the correlation test, i.e. Pearson's correlation coefficient, was used, as this criterion measures the linear correlation of two variables. In the following correlation matrix, the amount of Pearson's correlation coefficient between the dependent and independent variables are calculated. The amount of the correlation of variables is written in terms of the null and the alternative hypotheses as follows:

$$\begin{cases} H_0: \rho_{XY} = 0 \\ H_1: \rho_{XY} \neq 0 \end{cases}$$

Pearson's correlation matrix is calculated in the table below and its main results are as follows:

Table 4.3
Logarithm of the net earnings

The independent variables	*Logarithm of the net earnings*		
	Amount of correlation	*Probability*	*Quantity*
Raw material inventory	-0.12	0.29	80
Capital in terms of assets	-0.10	0.36	80
Capital in terms of fixed assets	0.46	0.00	80
Labor in terms of number personnel expenses	0.20	0.07	80
Workforce in terms of number of employees	0.66	0.00	80

The correlations between the logarithm of the net earnings and variables raw material inventory, capital in terms of assets, capital in terms of fixed assets, labor in terms of personnel expenses and workforce in terms of the number of employees are equal to -0.12, -0.10, 0.46, 0.20 and 0.66, respectively. Accordingly, the relationship of the logarithm of the net earnings with variables raw material inventory and capital in terms of assets is not significant, but its relationship with other variables are positively significant.

Also, Spearman's correlation coefficient that measures nonlinear correlation is also computed and its results are presented and discussed in the following table:

Table 4.4
Net earnings

The independent variables	*Net earnings*		
	Correlation coefficient	*Probability*	*Quantity*
Raw material inventory	-0.04	0.69	81
Capital assets are	-0.15	0.17	81
Investment in fixed assets	0.29	0.01	81
Labor in personnel expenses	0.21	0.06	81
Workforce in terms of number of employees	0.66	0.00	81

The correlation between the net earnings and raw material inventory is -0.04 that indicates the insignificance of the correlation. Also, the correlation between the net earnings and variables capital in terms of assets, capital in terms of fixed assets, labor in terms of personnel expenses, and workforce in terms of the number of employees are equal to -0.15, 0.29, 0.21 and 0.66, respectively. Accordingly, the relationship of the net earnings and capital in terms of assets is not significant, but its relationship at the significance level of 90 with other variables is positively significant.

3.4. Multiple Regression Model

Using multiple regression models the model is estimated. In this model, the analysis of parameters is done by controlling other variables, so the results in the situation are more pure for the dependent variable. It should be noted that in this analysis, first the significant of the model using ANOVA as the main question was considered and answered so that in cases where the F statistic is less than 0.05 then the model is considered as significant. Then, using the determination coefficient the intensity of correlation was studied. In the third stage, if the case of the significance of the model parameters would be estimated. This stage would be possible using the table of coefficients and t-statistics and finally the signs of appropriateness of estimation's conditions or in other words the presuppositions of the regression model were addressed. The main presuppositions and the analysis and the control of them are as follows:

1. Checking normality test using Kolmogorov-Smirnov test,
2. Checking the lack of the presence of autocorrelation between residuals using Durbin-Watson test,
3. Checking the lack of the presence of multicollinearity between independent variables using VIF.

In the following we have described this method, i.e. model estimation through Forced and Stepwise method.

The model is given as follows:

$$LnY_{it} = \beta_0 \ + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + \varepsilon_{it}$$

In this model, the null and the alternative hypotheses are as follows:

$$\begin{cases} H_0 : \beta_1 = \beta_2 = ... = \beta_5 \\ H_1 : \beta_i \neq 0 \quad i = 1, 2, ..., 5 \end{cases}$$

$$\begin{cases} H_0 : \text{ there is no significant model,} \\ H_1 : \text{ there is no significant model.} \end{cases}$$

Regression analysis results are given in the following table:

Table 4.4
The significance Level

Source of variations	*The sum of squares*	*Degrees of freedom*	*The mean square*	*F statistics*	*Significance Level*
Regression	41.85	5	8.37	15.57	0.00
Residual	39.78	74	0.54		
Total	81.63	79			

The significance level for F statistics is equal to 0.000. Given this value is less than 0.05, the null hypothesis at the confidence level of 95%, i.e. at the confidence level of 95% there is a significant model.

Table 5.4

Multiple correlation	*Coefficient of determination*	*Adjusted coefficient of determination*	*SD*	*Durbin-Watson*
0.72	0.51	0.48	0.73	1.81

The coefficient of determination is equal to 0.51. In other words, about 51% of the variability of the dependent variable can be explained by the independent and controlled variable. The value of the Durbin-Watson statistics is equal to 1.81. Values close to 2 indicates the lack of autocorrelation of residuals, which is one the regression assumptions.

To estimate the coefficients, the following hypotheses can be tested using the t-partial statistics. The null and the alternative hypotheses for the intercept or the constant value are as follows:

$$\begin{cases} H_0 : \beta_0 = 0 \\ H_1 : \beta_0 \neq 0 \end{cases}$$

In order to investigate the relevance of the independent the following hypotheses can be used:

$$\begin{cases} H_0 : \beta_1 = 0 \\ H_1 : \beta_1 \neq 0 \end{cases}$$

$$\begin{cases} H_0 : \beta_2 = 0 \\ H_1 : \beta_2 \neq 0 \end{cases}$$

$$\begin{cases} H_0 : \beta_5 = 0 \\ H_1 : \beta_5 \neq 0 \end{cases}$$

Value of the test statistics is computed as follows:

$$t_{\beta_i} = \frac{\beta_i - 0}{S_{\beta_i}} \quad i = 0,1,2,3,\ldots,10$$

Distribution of the above test statistics for the large samples is standard normal distribution, thus, the acceptance and the critical regions are as follows:

The judgment is such that if the t statistic is placed in the critical region then the null hypothesis would be rejected.

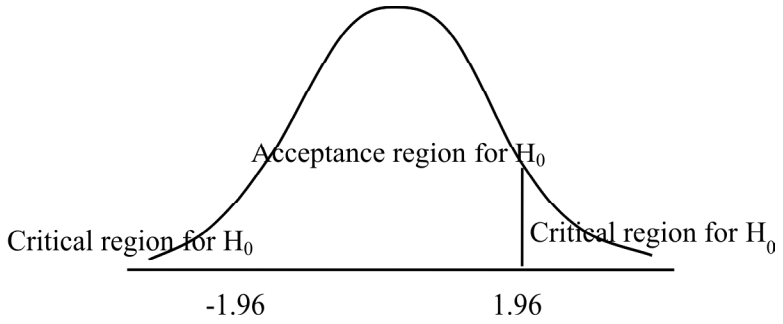

Table 5.4

Parameters	*Beta*	*S.D.*	*Standard beta*	*t statistic*	*Signifi-cance Level*	*Tolerance*	*VIF*
Constant	10.201	0.241		42.30	0.00		
Raw material inventory	-0.079	0.053	-0.13	-1.51	0.14	0.84	1.20
Capital in terms of assets	0.024	0.098	0.02	0.25	0.81	0.82	1.22
Capital in terms of fixed assets	0.065	0.024	0.26	2.71	0.01	0.72	1.39
Workforce in terms of personnel expenses	0.008	0.019	0.04	0.45	0.65	0.68	1.47
Workforce in terms of number of employees	0.002	0.000	0.57	5.55	0.00	0.63	1.58

The value of t statistic for the variables raw material inventory, capital in terms of assets, capital in terms of fixed assets, labor in terms of personnel expenses and workforce in terms of the number of employees are equal to -1.51, 0.25, 2.71, 0.45 and 5.55, respectively. Accordingly, this statistic for raw material inventory, capital in terms of assets and labor in terms of personnel expenses is insignificant, whereas in other cases it is positively significant. The value of t statistic for the intercept at the confidence level of 95% is placed on the critical region of null hypothesis. In other words, t statistic for the intercept is significant.

The values of VIF, which is the cause of increase in variance, can be considered as an indicator for the detection of multicollinearity among the independent variables so that if its value is more than 10 then multicollinearity between independent variables would be possibility. Maximum value of this index, for the variable of workforce in terms of number of employees, is equal to 1.58.

For the appropriate estimation of the model the stepwise method was used. In this method, variables with higher significance are entered into the model with higher priority, until when all the significant variables are entered into the model. This method has the following advantages:

1. The model is optimal so that in addition to being very simple has a very high coefficient of determination. In other words, reduction in the coefficient of determination does not affect it.
2. If variables have multicollinearity then will not be entered into the model simultaneously. In case of severe multicollinearity of two variables, simultaneous presence of them in the model would be insignificant.

Table 6.4

Steps	*Multiple correlation*	*Coefficient of determination*	*Adjusted coefficient of determination*	*S.D.*	*Durbin-Watson*
First	0.66	0.43	0.42	0.77	
Second	0.70	0.49	0.48	0.73	1.84

The coefficient of determination in the second stage is equal to 0.49 that with respect to the full model show no significant reduction. It should be noted that in the final model 2 variables out of 5 variables were significant.

Table 4.7

Steps	*Parameters*	*Beta*	*S.D.*	*Standard beta*	*T statistic*	*Significance Level*	*Tolerance*	*VIF*
First	Constant	10.105	0.19		52.05	0.000		
	Workforce in terms of number of employees	0.003	0.00	0.66	7.67	0.000	1.00	1.00
Second	Constant	10.069	0.18		54.63	0.000		
	Workforce in terms of number of employees	0.002	0.00	0.57	6.58	0.000	0.89	1.13
	Capital in terms of fixed assets	0.068	0.02	0.27	3.14	0.002	0.89	1.13

The value of t-statistics for the labor force in terms of number of employees is positively significant and equal to 6.58 as well as for the Capital in terms of fixed assets is positively significant and equal to 3.14. The value of t-statistics for the intercept is equal to 54.63 that at the confidence level of 95% is placed in the critical region of the null hypothesis. The estimated model is as follows:

$$LnY_{it} = 10/07 \ \ +0/002X_{3it} + 0/068X_{5it}$$

Interpretation of coefficients: with the control of capital in terms of fixed assets, with one unit increase in the workforce in terms of number of employees the logarithm of the net earnings would increases 0.002 units. With the control of the workforce in terms of the number of employees, with one unit increase in the capital in terms of fixed assets then the logarithm of the net earnings would increases 0.068 units.

5.3. Examining the **Validity of the Model**

The reliability of the estimated models depends upon the extent to which the required presuppositions are met. The most important of these assumptions include:

1. Normality of residuals,
2. Homogeneity of variance,
3. The lack of autocorrelation between residuals,
4. Existence of linear relationship and the lack of outliers,
5. The lack of multicollinearity between the independent variables,

In this study, using tests as well as diagnostic diagrams the validity of presumptions were investigated, including:

1. Kolmogorov-Smirnov test was done at the first stages,
2. Residual plot with respect to the estimated values. The lack of any pattern in this diagram indicates variance equality. These diagrams are given in the Appendices.
3. Durbin-Watson test: values close to 2 indicates the lack of autocorrelation. These values were calculated in the previous sections.
4. Scatter diagrams: these curves are presented in the Appendices.
5. To check for multicollinearity, VIF statistic was used. If the value of this parameter is less than 10, it indicates the lack of multicollinearity, i.e. the lack correlation between independent variables (These values have been calculated in the previous sections).

CONCLUSIONS

The first hypothesis: there is a significant relationship between the workforce in terms of the number of employees and the net earnings.

Given that the value of the probability, i.e. 0.00, is less than 0.05 as well as the value of correlation, i.e. 0.66, it results that there is a significant relationship between workforces in terms of the number of employees with the net earnings.

On the other hand, given that the value of correlation is positive and between 0.50 and 0.75, it results that there is a significantly positive correlation.

Findings suggest that there is a significantly positive relationship between labor productivity in terms of the number of employees and the net earnings.

The second hypothesis: there is a significant relationship between the productivity in terms of raw materials inventory and the net earnings.

Given that the value of the probability, i.e. 0.29, is greater than 0.05 as well as the value of correlation is equal to -0.12, it results that there is a significant relationship between productivity in terms of raw materials inventory with the net earnings.

On the other hand, given that the value of correlation is negative and between 0.00 and -0.25, it results that there is an inverse weak relationship.

Findings suggest that there is no significant relationship between productivity in terms of raw materials inventory with the net earnings. Also, researchers do not found any research with similar hypothesis.

The third hypothesis: there is a significant relationship between the productivity of capital in terms of fixed assets and the net earnings.

Given that the value of the probability, i.e. 0.00, is less than 0.05 as well as the value of correlation is equal to 0.46, it results that there is a significant relationship between the productivity of capital in terms of fixed assets with the net earnings.

On the other hand, given that the value of correlation is positive and between 0.25 and 0.50, it results that there is a semi-significant positive correlation.

Findings suggest that there is a significant relationship between the productivity of capital in terms of fixed assets and the net earnings.

The fourth hypothesis: there is a significant relationship between the productivity in terms of total assets and the net earnings.

Given that the value of the probability, i.e. 0.36, is greater than 0.05 as well as the value of correlation, i.e. -0.10, it results that there is no significant relationship between productivity in terms of total assets and the net earnings.

On the other hand, given that the value of correlation is negative and between 0.00 and -0.25, it results that there is an inverse weak relationship.

Findings suggest that there is no significant relationship between the productivity of capital in terms of fixed assets and the net earnings.

The fifth hypothesis: there is a significant relationship between productivity of work in terms of personnel expenses and the net earnings.

Given that the value of the probability, i.e. 0.07, is less than 0.05 as well as the value of correlation is equal to 0.20, it results that there is a significant relationship between the productivity of work in terms of personnel expenses with the net earnings.

On the other hand, regarding that the value of correlation is positive and between 0.00 and 0.25, it results that at the confidence level of 90% there is a semi-significant positive correlation.

Findings suggest that there is a significant relationship between the productivity of work in terms of personnel expenses and the net earnings.

SUGGESTIONS FOR FUTURE RESEARCH

- Regarding that the productivity Indicators are divided into two categories, i.e. indicators the total and partial productivity Indicators, thus, it suggests that researchers to test total productivity Indicators of the companies listed in Tehran Stock Exchange,
- It also suggests measuring and analyzing the relationship of the net earnings with the productivity Indicators based on the added value,
- On the other hand it suggests measuring and analyzing the effect of productivity indicators on the net earnings and the functional performance.

Resources

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