A statistical study about the impact of capital structure on firm profitability in Egypt

Introduction:

The main objective of this research is to examine the correlation between the capital structure choice of Egyptian Industrial Goods, Automobiles and Services firms and their profitability and fill the gap in the literature about the presence of optimal Capital Structure for the Egyptian Industrial Goods, Automobiles and Services firms. In this research we will try to come up with an executable plan to enhance optimal capital structure. The findings from this research will help the managers to understand the impact that capital structure has on the profitability of the Industrial Goods, Automobiles and Services sector in Egypt.

Our dependent variable is Profitability (ROA). and the independent variables are total debt to total asset (TD/TA), total debt to total equity (TD/TE), short-term debt (STD/TA), long-term debt (LTD/TA).

Descriptive statistics

First, we are going to do some descriptive statistics for the response variable along with other independent variables.

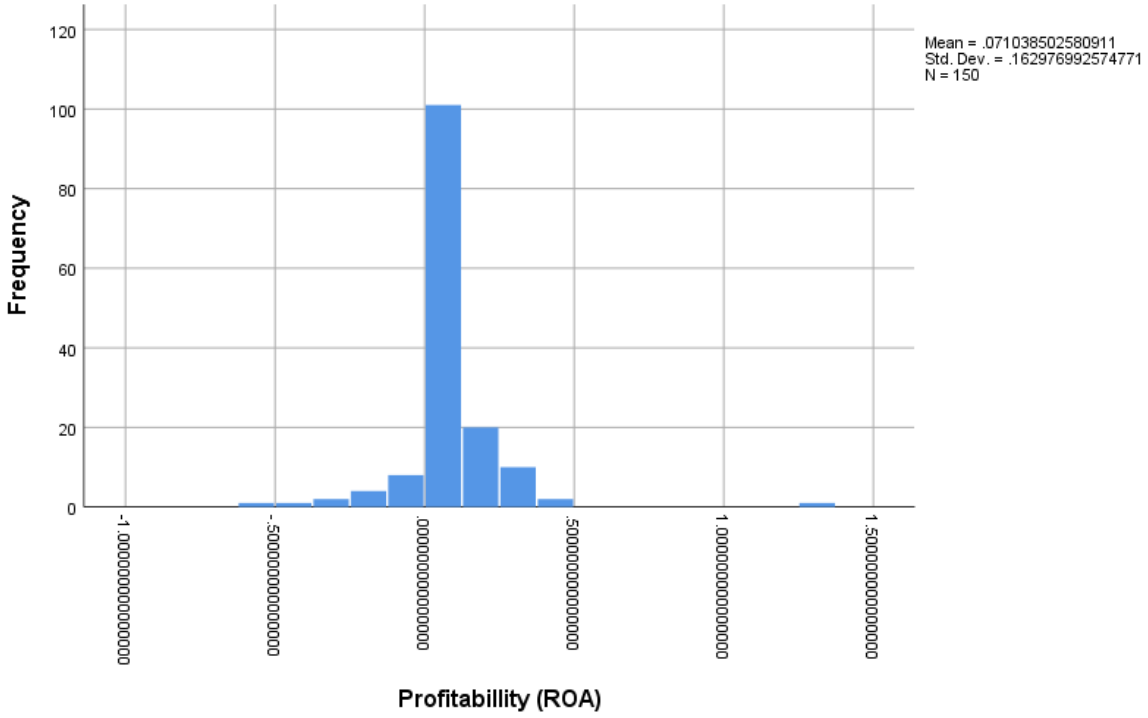
	N	Minimum	Maximum	Mean	Std. Deviation
Profitabillity (ROA)	150	-.500371507627244	1.254930169110930	.071038502580911	.162976992574771
Debt-to-assets ratio	150	.000000000000000	4.118444106554610	.449334810366752	.480843818115892
Debt-to-equity ratio	150	-13.078865991860972	31.764974022631170	.881370505711322	3.027466511684183
Short-term Debt-to-assets ratio	150	.000000000000000	1.205023680185410	.308540209629759	.198027959186843
Long-term Debt-to-assets ratio	150	-.011263786815379	2.913420426369200	.140794600736993	.347227558821381
Valid N (listwise)	150				

Table 1

First: The dependent variable: as we can see from table1 and graph 1 that the mean of profitability is 0.071 which means that the average of profitability is 0.071 thousand pounds. the standard deviation is 0.162976992574771 which means that the data are clustered around the

mean, and it also can be seen in graph 1, the range of our observations is (1.25493--0.5=1.75493) . in graph 1 we can see an outlier which is any observation after 1. we can also see that the graph is approximately normal.

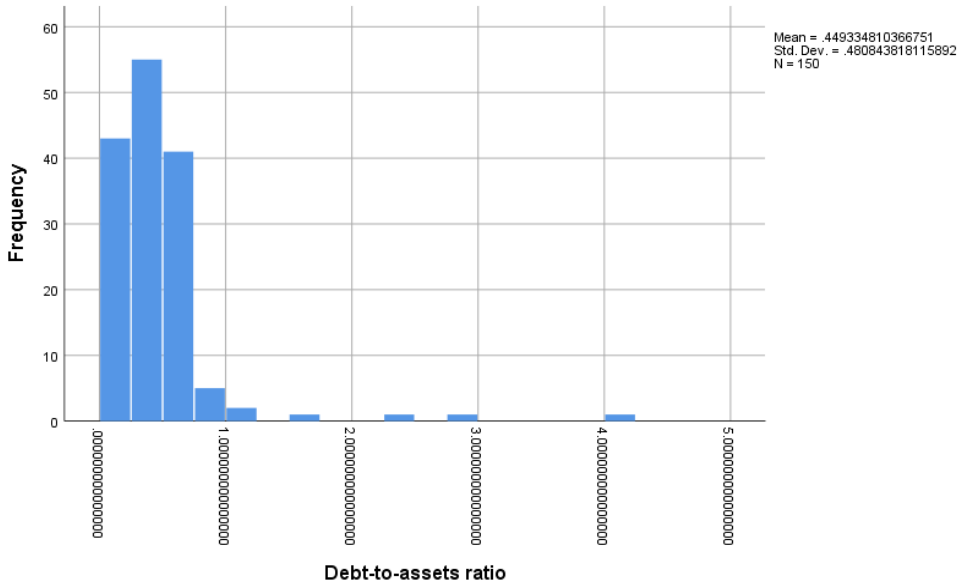
Graph 1



Second: The independent variables:

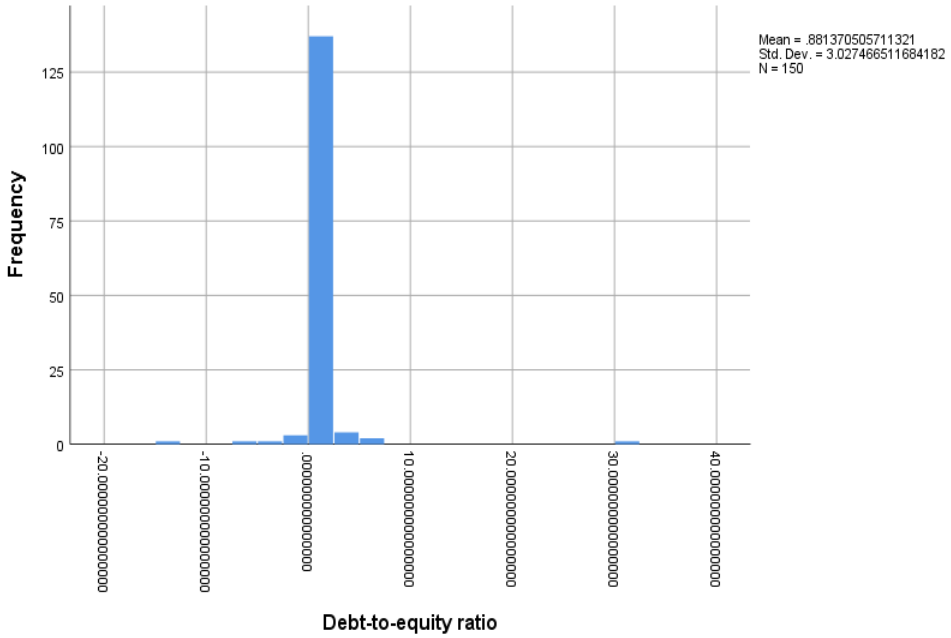
1)The mean of debt to assets ratio is 0.44933 which means that its average is 0.44933 and standard deviation is 0.48 which means the data is clustered around the mean and it what can be seen in graph 2 and the maximum of the data is 4.118. in graph 2 we can see that any observation after 2 is considered an outlier. The graph is positive skewed .

Graph 2



2)The mean/average of debt-to-equity ratio is 0.8813 and standard deviations is 3.02746 which means the data is clustered around the mean and the maximum data is 31.76497 and a minimum of -13.07886599186 . the graph contains an observation after 3 which is an outlier and the graph

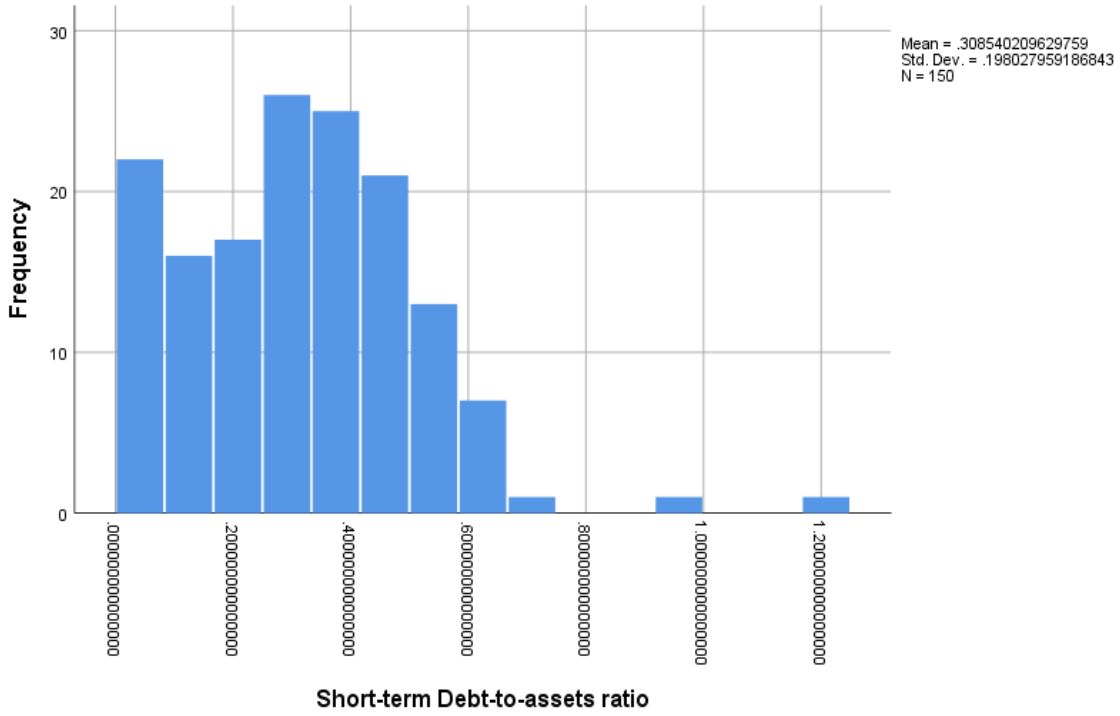
Graph 3



Is approximately normal.

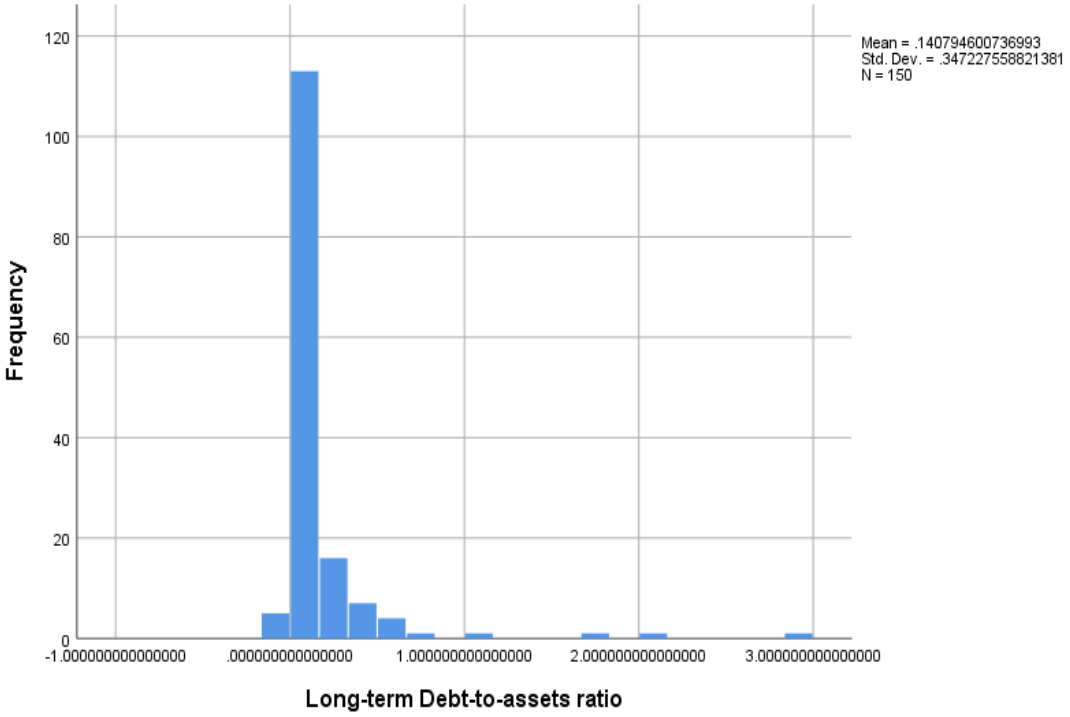
3) the mean/average of Short-term Debt-to-assets ratio is 0.3085 and standard deviation is 0.198 which means that the data is clustered around the mean and the maximum of the data is 1.205. the graph contains outliers after 0.8. and the graph is positively skewed .

Graph 4



4) the mean/average of long-term Debt-to-assets ratio is 0.14079 and standard deviation is 0.347227 which means that the data is clustered around the mean and the maximum of the data is 2.9134 and the minimum is -0.01126. any point after 1.5 is considered an outlier.

Graph 5



Statistical analysis

-Our dependent variable is profitability which we want to study the relationship between it and the rest of the other independent variables which affect the dependent variable.

-Our data contains 146 observations, and the aim of the study is modeling the relationship between profitability and the other variables in the data set.

We are going to use SPSS software to try getting a model that satisfies all the linear regression assumptions and all its coefficients are significant. We will compute different models and test their coefficients significant and whether it makes sense or not.

First model:

Table 2

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.735[a]	.541	.531	.081308308658907

In table 2 we can see that the R-square value is 0.541 which means that 54.1% of the dependent variable is explained by the independent variable and that the model is effective in explaining the relation ship .

Table 3

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.098	3	.366	55.373	.000[b]
	Residual	.932	141	.007		
	Total	2.030	144			

As we can see in the highlighted part of table 3 we can conclude that the model is significant and a good fit .

Table 4

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.077	.013		5.916	.000
	Debt-to-equity ratio	.000	.002	.005	.079	.937
	Short-term Debt-to-assets ratio	.042	.040	.070	1.049	.296
	Long-term Debt-to-assets ratio	-.260	.023	-.770	-11.490	.000

a. Dependent Variable: Profitabillity (ROA)

This table 4 is computed by the enter method , we removed 5 observations as a result of being outliers tested using case wise diagnostics ,as we can see from this table “table 4” that it gave us 2 insignificant coefficients which are short-term debt to assets ratio and debt to equity ratio and it excluded debt to assets ratio variable so this model makes no sense, and it is not reliable so we will try getting other models by different methods.

-we tried the forward method and it only included 1 variable and excluded 3 variables and the same for the backward method and stepwise method.

Model 2 :

Table 5

ANOVA[a,b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.524	1	.524	41.060	.000[c]
	Residual	1.825	143	.013		
	Total	2.349[d]	144			
2	Regression	1.264	2	.632	82.634	.000[e]
	Residual	1.086	142	.008		
	Total	2.349[d]	144			

We can see in the highlighted part in table 5 that the model is significant and a good fit.

Table 6

Model Summary[d,e]

Model	R	R Square[b]	Adjusted R Square	Std. Error of the Estimate
1	.472[a]	.223	.218	.112974850129436
2	.733[c]	.538	.531	.087438537963818

In this table we can see that the r-squared is 0.538 which mean that 53.8% of the dependent variable is explained by the dependent variable and that the model is effective in determining the relationship.

table 7

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	Long-term Debt-to-assets ratio	-.159	.025	-.472	-6.408	.000	1.000	1.000
2	Long-term Debt-to-assets ratio	-.292	.023	-.869	-12.438	.000	.667	1.500
	Short-term Debt-to-assets ratio	.237	.024	.687	9.835	.000	.667	1.500

a. Dependent Variable: Profitabillity (ROA)

b. Linear Regression through the Origin

After failing the 4 methods to compute a reliable model we removed the constant variable to avoid multicollinearity and compute a reliable model, after removing the constant we tried the enter method and the stepwise but the stepwise included one variable more than the enter method and it also gave an r squared adjusted more than the one of the enter method, we also removed an outlier using case wise diagnostics .

And as we can see in table 7 all the coefficients are significant so we will rely on this model “model 2“.

After choosing the model we will check the assumptions of the linear regression.

First assumption: "multicollinearity"

Table 8

Coefficients[a,b]

Model		Collinearity Statistics	
		Tolerance	VIF
1	Long-term Debt-to-assets ratio	1.000	1.000
2	Long-term Debt-to-assets ratio	.667	1.500
	Short-term Debt-to-assets ratio	.667	1.500

a. Dependent Variable: Profitabillity (ROA)

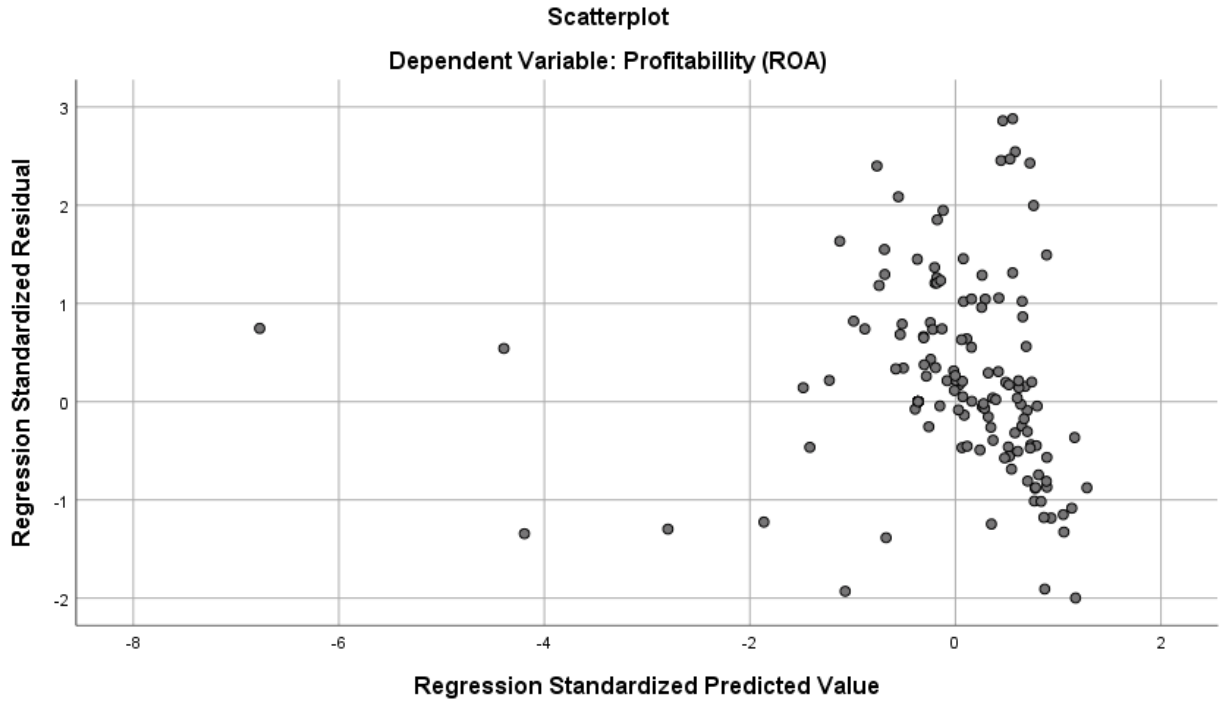
b. Linear Regression through the Origin

We used SPSS to investigate multicollinearity using collinearity statistics, Collinearity statistics measure the relationship between multiple independent variables by giving a score for each independent. The "tolerance" is an indication of the percent of variance in an independent that cannot be accounted for by the other independent variables, hence very small values indicate that an independent variable is redundant. The VIF, which stands for variance inflation factor, is (1 / tolerance). The VIF scores should be close to 1 but under 5 is fine and 10+ suggests high collinearity so the variable may not be needed. All the values in this analysis have scores from 1 to 1.5 so there is no need to remove any variables as we can see in the highlighted column in table 8.

So there is no multicollinearity and this assumption is valid .

Second assumption:" heteroscedasticty"

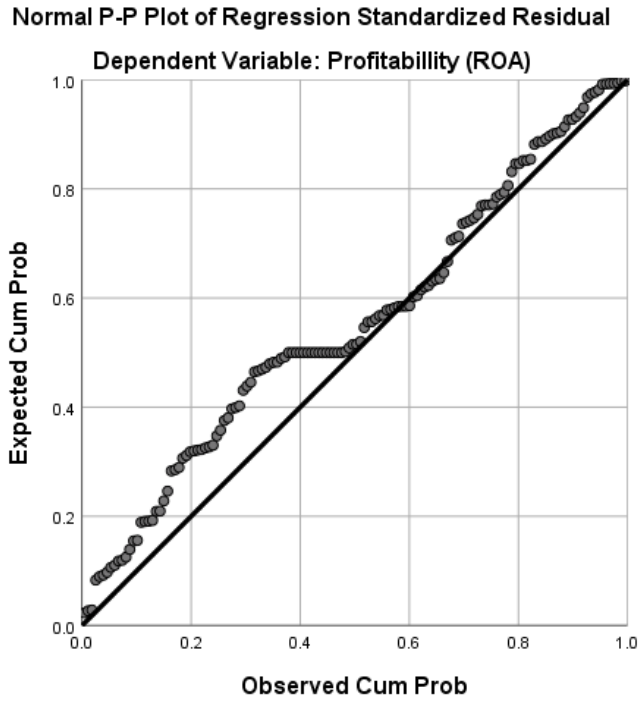
Graph 6



Based on the Scatterplot output above, it appears that the spots are diffused and do not form a clear specific pattern. So it can be concluded that the regression model does not occur heteroskedasticities problem.

Third assumption: "normality "

Graph 7



As we can see in the graph above, it contains some deviations, so the data isn't completely normal but according to the central limit theorem since the data observations are greater than 30 then the data is approximately normal.

Fourth assumption: "autocorrelation"

Model Summary[d,e]

Model	R	R Square[b]	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.472[a]	.223	.218	.112974850129436	
2	.733[c]	.538	.531	.087438537963818	.668

By comparing the value of the Durbin Watson test by Durbin Watson table with alpha 5% with k=2 we found that dL=1.598 and dU= 1.651 and 4-dU=2.349 and 4-Dl=2.402 , so we can conclude that there is a positive autocorrelation , so this assumption isn't satisfied .