Quantifying Economic Performance: Forecasting in the Romanian Clothing Industry

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Abstract

This econometric modeling emphasizes quantifying various economic phenomena, particularly that which is diverse and unpredictable, as it provides important support to managers. Our approach aims to achieve an econometric multiple regression model to analyze economic performance through a case study conducted on a sample of 107 entities in the clothing industry in Romania. We considered Net Profit as a dependent variable and Fixed Assets, Current Assets, Equity, and Number of Employees as independent variables. The 4 hypotheses proposed were measured, tested, and validated using EViews software with multiple linear regression. The results of the model have been validated as econometric, so we believe that they provide useful predictions regarding analysis of the economic performance in the clothing industry in Romania.

Key word: economic performance, multiple linear regression, sample, forecasting, clothing industry
J.E.L. classification: L25, C51

1. Introduction

The clothing industry in Romania (Liviu Tudor, 2018; Vasile Burja, Teodora Maria Avram, 2018), as a branch of tradition and of major interest to the national economy, was transitioned by the global economic crisis starting at the end of 2007. The industry is also affected by a shortage of skilled workers in this sector. This crise affect the economic progress of Romania due to the negative consequences they inject into the industry. This would need improvement in order to respond to the requirements proposed by customers and brings challenges in attracting new customers. A recovery mechanism that involves the identification of an action plan may also unfortunately diminish the cash flow of the companies.

The statistical data used in the econometric study of the variables comes from the database of the website www.topfirme.com, which makes company tops based on the annual financial indicators declared by the users. We mention that the users are legal persons, companies in the clothing industry that are active in Romania and who are fully responsible for the accuracy of the data. This site is considered one of the best developed financial data providers on active companies in Romania and presents part of the financial statements publicly for informational purposes to consumers of information. The statistical data provider presents in the code CAEN 1413 - Manufacture of other articles of clothing (excluding underwear), "a percentage that represents 0.19% of the total active companies in Romania, a turnover equal to 7.3 billion lei representing 0.59% of the turnover of Romania, 103,284 employees representing 2.55% of the total employees in Romania, and a net profit of 481.20 million lei representing 0.55% of the profit of Romania". (Top Firme Site)

Creating a representative sample is not an easy task, but it is necessary. The econometric model presented in the present situation is based on a representative sample with 107 companies in the clothing industry in Romania, whose data were taken from the data provider www.topfirme.com. The selection criteria for the companies used was the turnover of more than 4 million lei (897,815 Euros), according to the 2021 - Balance Sheet and CAEN 1413. Because the study is a complex one, the financial data of the 107 companies was extracted over a period of 7 years from 2015 to

2021. In addition, it is necessary to mention that although in the category CAEN 1413 with a turnover of more than 4 million lei and 294 companies included, it was necessary to eliminate the following companies:

- companies that have missing data during 2015-2021;
- companies that recorded losses during the analyzed period;
- companies with indicators (variables) without values or values equal to 0 which lead to null or insignificant results;
- companies whose values differ greatly from the values of the other companies in the sample.

2. Literature review

Studying economic-financial research concerns using econometric modelling is increasingly common. However, econometric modelling in the Romanian clothing industry does not appear in the specialized literature we have researched. Therefore, we believe that the development of a multilinear regression model for the analysis of financial performance in a representative sample of the clothing industry in Romania can bring more knowledge to stakeholders.

In a restricted way, econometrics can be defined in the following forms (Andrei et al., 2008):

- Represents the result of a certain action, given the theoretical conditions, which consists in applying mathematical statistics to the economic data leading to the construction of a mathematical model;
- Represents the quantitative analysis of explicit economic phenomenon, which is carried out while taking into account certain working hypotheses and using the methods of statistical inference;
- It is an economic-social science in which the elements of economic theory, mathematics, and statistical inference are used in the analysis of an economic phenomenon;
- It is an instrument available to the economist that allows him to confirm or disprove the theories he builds.

Because we asked ourselves the question: "Why is it necessary to study accounting phenomena through econometric models?" we found the answer in the book entitled "Modele econometrice" (Tănăsoiu and Iacob, 2017). It said that, "economic theory studies economic phenomena and processes starting from the idea that they do not happen at random, but are based on laws, are relatively stable and relatively repeatable, and are specific to the nature of these phenomena. Phenomena of an economic nature are generally quantifiable, economic laws that can be described in the form of quantitative links (of numerical determinations) between these phenomena, which makes it possible to use statistics and mathematics from economic theory."

The construction of the econometric model by studying the specific economic phenomena in this case refers to behaviours that best describe the nature and functioning of the economic system. The objective pursued within the econometric model is to enable companies to intervene efficiently as Bourbonnais (2015) states. At the same time, we believe that the model must also include the residual component seen as a representation of the differences that appear between the values determined in theoretical terms and the values measured in the real economy.

The company's performance has been analyzed in numerous literature studies using statistical tools, financial modelling or neural network techniques, quantitative variables, and qualitative variables. Through the research undertaken, we discovered studies (Maiga, 2014) about the relationship between the adoption of activity-based costs - performance and investigation of the association between the adoption of activity-based costs and the four performance measures of the production process: improvement cycle time, quality, cost, and profitability.

We made a model using a representative sample of the Romanian apparel industry through econometric analysis by using the variables in a financial performance study at the sample level. With validation of the proposed econometric model, we can improve the quality of the accounting information.

We agree with Yan and Su (2009), researchers at American universities, who believe that, "regression can be used to examine the set of independent variables, which can adequately explain the result. In other cases, multilinear regression is used to examine the effect of the result while accounting more for the factor that may influence the results."

Heteroscedasticity (Hayes and Cai, 2007; Salisu et al., 2019) is a specific feature of cross-sectional data, but can also be associated with time series data. This can take many forms and results from a variety of different processes. In the literature, we have found that there are several methods for detecting heteroscedasticity: the Breusch Pagan LM test, White's test, Glesjer LM test, Harvey Godfrey LM test, Park LM test, and Goldfeld-Quand test (Dufour et al., 2004). However, the EViews manual does not have built-in heteroscedasticity tests for panel data, which is why we limit the testing of heteroscedasticity for our model to only the cross-section heteroscedasticity LR Test.

We mention that the presented model estimates the regression equation using least squares LS or AR, with specific estimation settings for cross-section weights and the variance-covariance matrix of estimators - cross-section SUR (PCSE) in order to significantly improve the econometric model:

- The method of least squares (Van De Geer, 2005);
- The method chosen for GLS weights was cross-section weights (Jula, 2003);
- The covariance of the coefficients is calculated using the cross-section SUR (PCSE) method.

Based on the methods outlined, we performed an analysis of the various classical models of linear regression. We also analyzed the quality of the linear regression by t-statistic from Wald Test, and finally we presented the forecast of the dependent variable. As Gujarati and Porter (2009) show in the book "Basic econometrics" the applied tests can be explained as follows:

- The coefficient of determination R^2 measures the proportion of variation of the dependent variable represented by the variable or explanatory variables;
- The R-squared adjusted coefficient indicates how homogeneous the variable values are;
- F-statistic is the value that is obtained when performing the regression analysis to find out if the means between two groups of variables are significantly different, though they have a similar t-statistic;
- Prob (F-stat) is the marginal significance level of test F;
- For T-statistic, I observed from the specialized studies and the EViews manual that they verify the hypothesis that a certain coefficient is equal to 0.

3. Research methodology

To analyze the financial performance of Romanian companies in the clothing industry, econometric modelling through multiple linear regression was performed with the EViews program. We specify that in order to benefit from the most advanced functions of the program, we used EViews Illustrated Version 10+ from 2015 (EViews site), with which we managed to create the necessary worksheets, apply various tests, and forecast the data entered. We think that at present, the software EViews (Econometric Views) is one of the most widely used programs in econometric analysis. It has great utility in economic-financial research due to the simple to use menu, the integrated programming language, and the correctness of statistical results.

The econometric model presented measures the profitability and performance of Romanian companies in the analyzed industry, based on variables extracted from the annual financial statements of the companies concerned. As the current research focuses on performance analysis, we consider that the most representative indicator that exposes the efficiency and performance of a company is the net positive result of the financial year. Therefore, we considered net profit (Mazumder, 2015; Shelenko, Balaniuk, Sas, Malik, Matkovskyi, Levandivskyi, Humeniuk, 2021; Leny, Sausan, 2020) as the dependent variable and four other indicators in the annual financial statements as independent variables: fixed assets, current assets, equity and number of employees.

We find that the proposed independent variables are indicators on the annual financial statements, and thus manage to provide a detailed picture of the existing and analyzed situation. We chose these variables because we consider that they are elements that directly influence the net

profit of the financial year. At the same time we consider that they are conclusive in the analysis of financial performance. Fixed assets and current assets are considered to be the most important predictors for the independent variables because they present the situation of economic resources during a financial year. Therefore, the annual financial statements of the selected companies help the proposed demonstrations.

The proposed econometric multiple linear regression model is as follows (Rencher and Schaalje, 2008; Albulescu, 2010; Mihaiu, Opreana, Cristescu, 2010; Peter Schmidt, 2020):

$$Y = \beta 0 + \beta 1 \times X1 + \beta 2 \times X2 + \beta 3 \times X3 + \beta 4 \times X4 + \varepsilon \quad (1)$$

Where: Y - Dependent variable; β0 - Regression constant; β1 → β4 - Regression coefficients for the independent variables; X1 → X4 - Independent variable; ε - Variable, interpreted as an error (disturbance)

Linear regression model testing was performed with EViews software using the stepwise regression procedure. The use of the method started with zero predictors, after which the strongest predictor of the model was added, then the second predictor was added, and the process continued until the last independent variable was tested.

Benoit (2011); Amand F. Schmidt, Chris Finan (2018); Douglas Curran-Everett (2018); Pardoe Iain (2020) shows in the study of the linear regression model with logarithmic transformations that, "logarithmic variables by transforming a regression model are a very common way of dealing with situations where there are nonlinear relationships between dependent variables and the independent ones". In this case, we want to have an econometric model as representative, so we proceed to improve the model according to the formula below:

$$Log(Y) = \beta 0 + \beta 1 \times Log(X1) + \beta 2 \times Log(X2) + \beta 3 \times Log(X3) + \beta 4 \times Log(X4) + \varepsilon \quad (2)$$

Thus, we find that we are dealing with a transformation into a log-log or double log multilinear regression model (Benoit, 2011). Although the presented model essentially comprises various econometric hypotheses, based on the literature studies (Romano et al., 2010; Hoover, 2013) we propose to further their own research hypotheses and analyze economic performance:

- H_1: The increase of assets used by the sample companies over a long period, which have positive influences in the sense of increasing the net profit;
- H_2: The increase of current assets for the sample companies leads to the decrease of net profit;
- H_3: Sample companies that succeed in increasing their equity, succeed in increasing their net profit;
- H_4: The increase in the number of employees within the sample companies can lead to an increase in the profitability registered.

4. Findings

The proposed econometric model is a complex one due to multiple linear regressions, which analyze the influence of net profit on fixed assets, current assets, equity, and number of employees. Assisted by these, we can present the descriptive statistics of the sample for the analysis of the financial performance specific to the Romanian Clothing Industry.

Table no. 1 Descriptive statistics of the sample

	Net profit	Fixed assets	Current assets	Equity	Number of employees
Mediate	1,905,146	5,789,908	9,627,364	9,902,305	260,7837
Maximum	23,221,534	41,868,041	1,35E+08	90,867,765	1,356
Minimum	380	8733	130168	4613	4
Standard deviation	3,358,936	7,640,358	14,614,685	13,914,019	260.9637
Jarque-Bera	5,118.154	935.6413	8,547.648	2,432.397	593.5317

Probability	0.0000	0.0000	0.0000	0.0000	0.0000
The amount	1,43E+09	4,34E+09	7.21E+09	7.42E+09	195.327
The sum of the standard deviation	8,44E+15	4,37E+16	1.60E+17	1.45E+17	50940333
Number of observations data	749	749	749	749	749

Source: authors' processing by EViews program

Using the descriptive statistics of the sample presented in table no. 1, we managed to get our first information. The average, the standard deviation, and the maximum and minimum values were extracted for each variable from the total of 749 observations. The table also shows that, according to the Jarque-Bera test, the data series does not have a normal distribution and the probability is zero. In addition to the above, the descriptive statistics provide detailed calculations that refer to the sum total for each variable and the sum of standard deviations. By observing the minimum and maximum values, we can specify that the data series are not homogeneous due to the very large differences between values.

For the analysis of the covariation by the correlation method, we establish the correlation of the sample variables:

Table no. 2 Correlation of sample variables

	Net profit	**Fixed assets**	**Current assets**	**Equity**	**Number of employees**
Net profit	1.000000				
Fixed assets	0.522377	1.000000			
Current assets	0.771312	0.657031	1.000000		
Equity	0.755767	0.826405	0.837604	1.000000	
Number of employees	0.672373	0.662707	0.614701	0.727636	1.000000

Source: authors' processing by EViews program

By visualizing table no. 2, we can say that the analysis of the correlations between the variables of the sample leads us to the idea that between all variables there is a direct and positive connection (correlation), because all of the values of the possible correlations are over 0.50.

In order to analyze the stability of the time series we use the "unit root" test, which takes into account the exogenous structural breaks in the deterministic components. The main feature of this test is the assumption that deterministic structural changes occur instantaneously, but only at certain times (Hepsag, 2017).

*Table no. 3 Stability of sample time variables**

	Statistics	**Probability**	**Number of companies observed**
Net profit	-25.8499	0.0000	107
Fixed assets	-11.5598	0.0000	107
Current assets	-11.0471	0.0000	107
Equity	-15.2053	0.0000	107
Number of employees	-27.7353	0.0000	107

* Joint proposal by Levin, Lin & Chu method with individual effects - Gujarati and Porter (2009)
Source: authors' processing by EViews program

The Levin-Lin-Chu statistical table applied for the model variables has statistical values below 0 and a zero probability, which means that all the standard test levels of the model are significant. Therefore, we consider that the all-time series analyzed are stationary.

Table no. 4 Heteroscedasticity testing

Statistical test	Value	df	Probability
Panel cross-section Heteroscedasticity LR Test*	636.8545	107	0.0000
Restricted LogL	-1,339.005	744	
Unrestricted LogL	-1,020.627	744	

* *LR* - Likelihood ratio
Source: authors' processing by EViews program

The heteroscedasticity test (Oscar L. Olvera Astivia, Bruno D. Zumbo, 2019) starts from the null hypothesis, where the residues are in homoscedasticity. Following the values obtained in the cross-section based on the panel cross-section Heteroscedasticity LR Test, we reject the null hypothesis and accept the alternative hypothesis.

The multiple linear regression model found in the form described in the previous paragraph can at this time substitute the constant and the coefficients, according to the EViews representation:

$$Log(NETPROFIT) = 2,35842509351 - 0,3032922132278 \times Log(FA) + 0,256483913623 \times Log(CA) + 0,617622994569 \times Log(Eq) + 0,422960791987 \times Log(N) \quad (3)$$

Where: FA - Fixed Assets; CA - Current Assets; Eq - Equity; N - Number of Employees

Taking into account the formula in which the coefficients are substituted, we can actually switch to applying various statistical tests to be able to verify whether our model is valid from all points of view. Following the introduction of statistical data in the EViews program, we present the results of the regression for the sample proposed in the Romanian clothing industry.

Table no. 5 Description of the econometric model

Variables	Coefficient	Standard error	t-Statistic	Probability	Total observed data
C	2.358425	0.376531	6.263556	0.0000	749
LOG(FA)	-0.303292	0.058942	-5.145645	0.0000	749
LOG(CA)	0.256484	0.039845	6.437056	0.0000	749
LOG(Eq)	0.617623	0.062385	9.900176	0.0000	749
LOG(N)	0.422961	0.050731	8.337345	0.0000	749

Note: C - constant
Source: authors' processing by EViews program

Analyzing the statistical data for the sample of the 749 observations, we can say that the percentage increase of the independent variables leads to the following situations, based on the confidence intervals resulted and presented in table no. 5:

- The rise in percentage of fixed assets reduces the net profit by 30.23%. By this, we say that H1's own research hypothesis is not accepted;
- The rise in percentage of current assets increases the net profit by 25.65%, so that the proposed research hypothesis, H_2 cannot be accepted;
- The rise in percentage of capital increases the net profit by 61.76%, and in this way the H3 research hypothesis can be accepted;
- The rise in percentage of the average number of employees increases net profit by 42.29%, and thus we can accept the research hypothesis H_4.

As it can be used regardless of sample size, we considered it appropriate to apply the t-statistic where we found that during the seven years analyzed only one decrease of one of the financial indicators from the coefficient in the sample was recorded. Because of this, we believe that the sample score is significant for current assets, equity, and the average number of employees, and less significant for fixed assets versus the net profit. It is preferable that the t-statistic likelihood is below 5%, and in our present case equals 0 (table no. 5). Due to this small recorded value, we show

that the observations are incompatible with the null hypothesis. As a result of the observations shown by the t-statistical calculation, we believe that the null hypothesis should be rejected in favour of an alternative one.

Table no. 6 The results of the econometric model

Weighted statistics	
R^2	0.674051
R^2 adjusted	0.672299
S.E. of regression	1.397585
F-statistic	384.6422
Prob (F-statistic)	0.000000
Mean dependent var	21.14644
S.D. dependent var	13.72285
Sum squared resid	1,453.213
Durbin-Watson stat	0.771504

Source: authors' processing by EViews program

The results of the proposed improved econometric model are presented in table no. 6. By applying the method of the smallest squares (R^2) (Brătucu et al., 2017; Buturac, 2021), we found that the model has a small value of 36.12%. Therefore, we proceeded to improve the model by applying cross-section weights and cross-section SUR (PCSE), and R^2 became 67.41%. The improvement was significant, which implies that the improved regression model is in line with the proposed observations. Finally, we can say that in 67.41% of the sample companies in the Romanian clothing industry the variability of the data is explained by the average value. By comparing the coefficient of determination with the corrected one, we observe that the latter decreased by 0.18%, so we can interpret the corrected R^2 value as optimal because it falls within the normal values that are generally found in such a model, i.e. between 0% and 100%.

F-statistic presents a very high value in the current econometric model, which suggests that from an objective perspective all variables are statistically important and the probability is equal to 0. We consider that the F-statistic for the 749 observations presents significant results and all explanatory variables have a significant impact on net profit.

Another statistic for the econometric model applied to the sample from the Romanian clothing industry is the Durbin-Watson statistic. Based on the value obtained, 0.77, we can say that no conclusive decision can be made on the presence of autocorrelation.

In trying to apply the tests to our sample, we consider that certain validation hypotheses are observed. These hypotheses refer to:

- the absence of multicollinearity = 1/(1-R2) is 3.0679 is lower than 4, therefore the result is satisfactory, therefore we can consider the proposed net profit forecasting model;
- the parameters of the regression model associated to explanatory variables are statistically significant;
- the model errors should be normal and the same for all observed data;
- no correlation between model errors.

The improvement of the model is a beneficial one, and through this summary of the econometric model we have presented all the diagnostic tests that can be applied to the statistical data with financial variables. We believe that the main reason preventing us from achieving better results is due to the sample in which companies with different dimensions of turnover are included. There were major differences in the size of turnover of the sample companies, which can be divided into two broad categories depending on the form of organization: joint stock companies and limited liability companies. As a result, the statistical cloud is not sufficiently homogeneous, but a massive elimination would have led to insignificant statistical results. In order to verify the model's veracity we present the Wald test, followed by a final forecast of the dependent variable.

Table no. 7 Wald Test

Statistical test	Value	df	Probability
t-statistic	8.954242	744	0.0000
F-statistic	80.17846	(1,744)	0.0000
Chi-square	80.17846	1	0.0000
Null hypothesis: *C(1) + C(2) + C(3) + C(4)+ C(5) = 0*			
Summary of the null hypothesis:			
Normalized restriction (= 0)		**Value**	**Standard error**
C(1) + C(2) + C(3) + C(4) + C(5)		3.352201	0.374370

Source: authors' processing by EViews program

The Wald test is used to evaluate the common significance of a set of coefficients for observation, if they are equal to 0. This statistical test can be detailed by individually testing each parameter in order to determine their individual significance. In the present case the null hypothesis took the form C (1) + C (2) + C (3) + C (4) + C (5) = 0, and as can be seen from the F-statistic and Chi visualization -square, the tests have the same values but far exceed the limit of acceptance of the null hypothesis in the case of the F test. Therefore, we have to accept the alternative hypothesis. The reported probability represents the marginal significance level of the F test. The included Wald Test is the t-statistic based on the values presented in table no. 5, and thus we can say that the alternative hypothesis in favour of the null one must be accepted in this case as the t-statistic is not equal to 0.

We can say that the final restriction for the Wald Test is not fulfilled, which leads us to reject the null hypothesis. This suggests that the variables in question can be removed without greatly affecting the model. The tested case involves a single restriction but there is a tendency over time, because the econometric model that is the subject of the case study presents statistical data from companies in the active clothing industry in Romania for the last 7 calendar years (2015-2021).

Table no. 8 Forecasting Log (NETPROFIT)

Root Mean Squared Error	1.463081
Mean Absolute Error	1.035250
Mean Abs. Percent Error	8.956801
Thell Inequality Coefficient	0.054559
Thell U2 Coefficient	1.075536
Symmetric MAPE	8.259707

Source: authors' processing by EViews program

We consider it useful for the model to include the forecast of the dependent variable. For this, the net profit for the logarithmic series was foreseen for the 107 companies of the econometric analysis. It can be observed that the standard deviation of the residuals is greater than 0.79 with respect to the correlation coefficient because not all points are on the regression line, therefore errors are identified. In addition, we find that the average of the absolute errors as a difference between the predicted and the real value presents a relatively high value from the point of view of the average forecast. The coefficient of inequality of the forecast is below 0.06, which means that the predictive accuracy of the model is good. From our observations, the forecasted net profit presents oscillating values from one company to another and a decreasing trend. This fact can be interpreted in a negative way because typically a lower net profit leads to a worsening economic situation for a company.

Following the findings with the net profit forecast in table no. 8, we believe that from the perspective of econometric analysis the clothing industry is undergoing many changes that have negative financial influences for companies. Even the oscillations that are observed in the forecast chart of the dependent variable of the model are not beneficial, because they only show a financial stagnation of the respective company.

5. Conclusions

In addition to the multitude of tests applied and based on the analysis of the expected net profit for each company, we can see that the described sample presents the following situation:

- 14.02% of the sample companies show an increase of the expected net profit in all 7 years of the analyzed period. In order to establish a forecast of the logarithmic net profit, it is preferable to carry out a detailed analysis of the 15 companies that led to this increase of net profit;
- 36.45% of the companies present an increase of net profit in more than 4 years of the analyzed period.

Based on the above, to determine if the econometric model of multiple linear regression can be validated we briefly present the following findings:

- We can say that the first hypothesis of validation of the model is respected, in the sense that between the independent variables (fixed assets, current assets, equity, average number of employees) there is no multicollinearity;
- From the statistical results of the model, we can say that the economic-financial indicators taken into consideration as independent variables are statistically significant and financially representative;
- From the perspective of errors - are presented as normal values for all 749 observations and representative data at the sector level, therefore we can consider the hypothesis as valid;
- Per the findings, we validate the last hypothesis proposed that there is no correlation between the errors of the statistical model.

In conclusion, the multiple regression model presents an analysis of the forecast (Forecast) with improved dependent variables. We specify that the model forecast is dynamic and anticipates the previous values of the described variable that are used to form a forecast of the subsequent values for the dependent variable of the logarithmic multiple linear regression model.

As a result of all the details made during the presentation, we consider that the econometric model is correct from all points of view and meets all the necessary measures for validation. The model shows that in 67.41% of the cases the net profit expresses the proposed multiple regression equation, therefore the model is valid.

We can say that the exposed model is efficient because it estimates the forecast of net profit. For a 1,000 lei increase in fixed assets, a net profit decrease of 300.29 lei is implicitly generated. In the same conditions, the increase of current assets leads to an increase of 256.48 lei of the net profit, the increase with 1,000 lei of capital leads to an increase with 617.62 lei, and the increase in the number of employees leads to an increase of net profit with 422.96 lei. As a result of the presentations and interpretations made, the assumptions of the performance quantification model have been validated. There are no predictor variables that lead to the reduction of net profit improved by logarithm and the use of estimates.

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