CONTRIBUTION OF PRODUCTION AND IMPORTS OF CRUDE STEEL TO INCREASE GDP IN THE EUROPEAN UNION COUNTRIES DURING THE ECONOMIC CRISIS

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Abstract
Starting from the fact that imports and production is one of the direct factors influencing a country's economy, this paper analyzes the influence of crude steel production and imports on gross domestic product in 22 European Union countries in the period 2008-2013.

Keywords*: crude steel, import, economic growth, production*

1. Introduction

The metallurgical activities in the European Union countries recorded a significant decline during last years. It is crucial that Europe remains a steel-producing region, given the importance of the steel industry to the economy, society, environment and security of supply.

This paper analyzes, using the multifactorial regression model, the interdependence between the gross domestic product and the independent variables: crude steel production and import of crude steel in the member states of the European Union.

2. Literature review

The impact of the outbreak of the economic crisis in late 2008 is felt differently across industrial branches and its influence on their long-term developments is different [4].

The EU steel industry plays a vital role in many of Europe´s strategic supply chains. It offers value added products and services developed in close cooperation with its customers to create a stronger, lighter and more sustainable world [5].

Undoubtedly that there is no top field whose progress is not influenced by the performances of the used materials nowadays. The material is a "living organism" that is an integrated part of the human society and represents one of the main factors in its development.

The knowledge and rational use of the materials is an inexhaustible source of technical progress. Therefore, there is no surprise that this field is enjoying the economic interest, and especially the scientific one, materialized by the efforts allocated to researches [3].

The need to achieve certain positive effects in the operators' activity from the metallurgical industry is undeniable both in terms of the importance to create goods in this branch for the economic activity, and of their contribution to the economic growth [1].

In 2013 the Commission adopted a Communication Action Plan for a competitive and sustainable steel industry in Europe. The Communication recognized the strategic importance of steel to the EU due to its close links with many downstream industrial sectors such as automotive, construction and electronics [6].

3. Development of production and import of crude steel in the European Union countries

The main indicator of economic growth for a country is the Gross Domestic Product (GDP). It is obvious that the production is the engine of an economic recovery, leading to increased consumption and investment

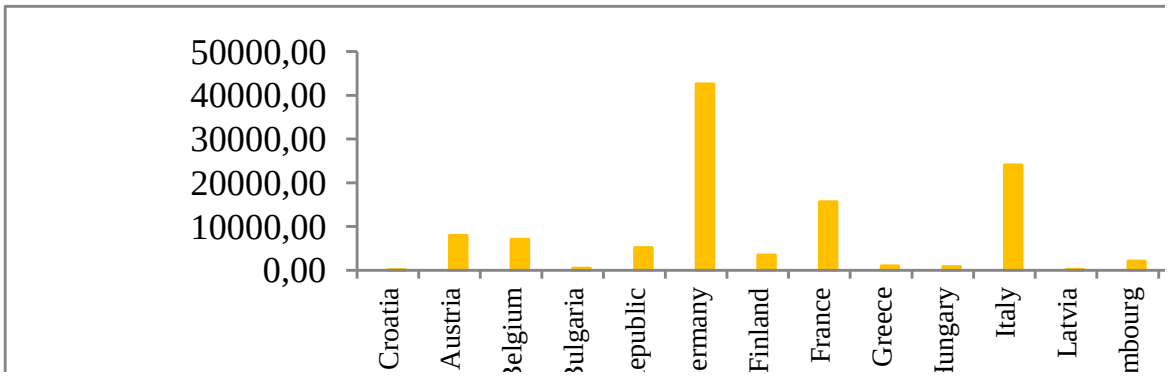

Figure 1 Crude steel in 2013 compared to 2008

If we look at Figure 1, it can be observed that Germany is the European leader in the production of crude steel in both 2008 and 2013, followed by Italy, Spain, France and Britain. Thus in 2008 Germany recorded 23.06 % of the total crude steel production of the European Union, Italy 15.39%, Spain 8.39 %, France 8.99 % and Britain 6.80 %. We can see that there was a decrease in the crude steel production in all European Union countries on the background of the economic crisis. Although the crude steel production of Germany in 2013 fell by 6.95 % compared to 2008, it remained the European leader with 25.63 % of the total crude steel produced in UE28. The crude steel production of Italy in 2013 also recorded a fall compared to 2008 by 21.28 %, but nevertheless it held second place with a percentage of 14.47 % of crude steel production achieved in the European Union countries.

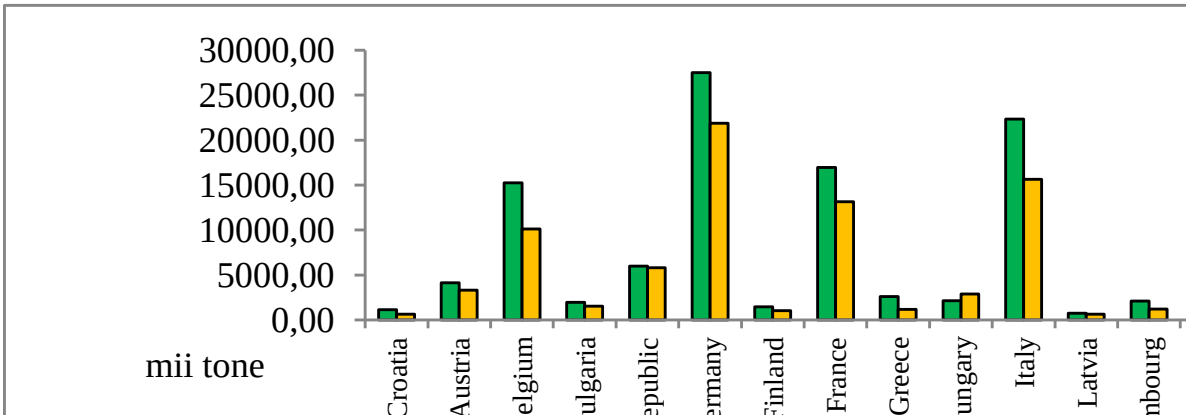

Figure 2 Imports of crude steel in 2013 compared to 2008

From Figure 2 it can be seen that Germany also ranks first in the imports of crude steel in 2008 with a percentage of 17.80 % of total crude steel imports in the UE28 and in 2013 with 18.41 %. Second place is occupied by Italy, which recorded a percentage of 14.46 % of total European Union's crude steel imports in 2008, and a percentage of 13.15 % in 2013. France is at a greater distance with 10.98% in 2008 and 11.07 % in 2013, followed by Belgium with 9.86 % in 2008 and 8.50 % in 2013.

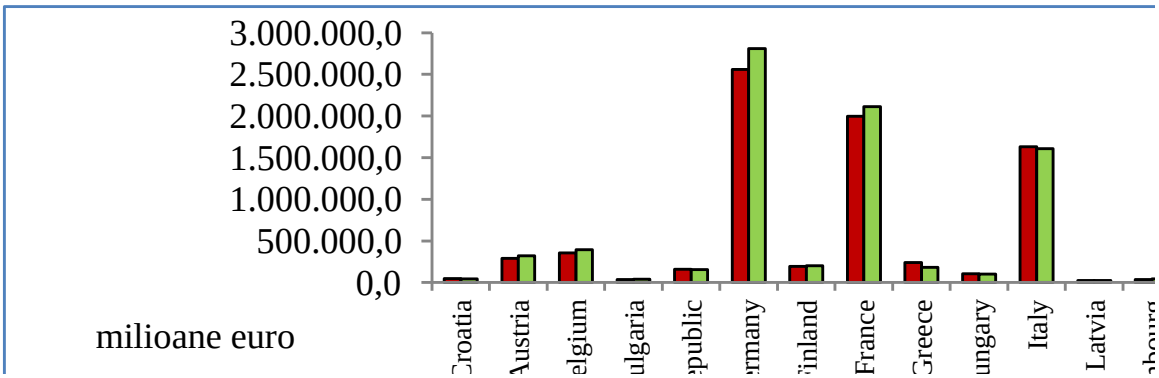

Figure 3 The evolution of GDP in 2013 compared to 2008

If we analyze the main indicator of economic growth shown in Figure 3, we may also note that the highest value is recorded by Germany, followed by France, Britain and Italy.

4. Use of the multifactorial regression model to analyze the correlation between the economic growth, production and imports of crude steel

The interdependence between the gross domestic product and a number of independent variables in the member countries of the European Union are analyzed using the multifactor regression model.

The analysis starts from a data set comprising: the dependent variable - Gross domestic product (y_i), and the independent variables: crude steel production - POB (x_1), and import of crude steel - IOB (x_2).

The data were taken over a period of 6 years (2008-2013) from the Eurostat database and Steele Statistical Yearbook 2014 for a total of 22 countries (Austria, Belgium, Bulgaria, Czech Republic, Germany, Finland, France, Greece , Hungary, Italy, Latvia, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, Croatia). There are missing from the analysis: Denmark, Estonia, Ireland, Lithuania, Malta, Cyprus due to the lack of data on production volume and imports of crude steel.

The gross domestic product is expressed in euro and the production and imports of gross crude steel in tons.

In order to see to what extent the dependent variables influence the GDP growth, it is started from the following structure of the regression model in the analysis:

$$y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \varepsilon \quad (1)$$

where $\beta_0, \beta_1, \beta_2$ are the parameters of the model, and ε – random variable.

The value of parameters and random variable are calculated using the "Regression" procedure in Excel, and the statistical power of the model is also tested with the t test, F test and Durbin Watson test, opting for a confidence level $\alpha = 0.05$.

To begin with, the multiple correlation coefficients are calculated to measure the intensity between resultative variable and factorial variables, and the coefficients of determination to establish the percentage that the independent variables influence the dependent variable.

Table 1 **Statistics of regression**

Summary output	**Summary output**
	for $\beta_0 \neq 0$
Multiple R	0.884944
R Square (R^2)	0.783126
Adjusted R Square (R_c^2)	0.779764
Standard Error	353872.3
Observations (n)	132

Source: own processing by using [8, 9]

It can be seen from Table 1, that the value of the multiple correlation coefficient (R) is high, which leads to the conclusion that there is a pretty intense relationship between the gross domestic product and the production and import of crude steel.

Looking deeper to the connection between these variables with the help of the multiple determination coefficient, we can say that: 78.31 % of GDP was influenced by the independent variables.

The standard error of the proposed model has the value of 353,572.3.

Table 2 **Analysis based on ANOVA table**

ANOVA	$\beta_0 \neq 0$				
	Degree of freedom df	**Sum of squares SS**	**Variation MS**	**F**	**Significance F**
Regression	2	5.83E+13	2.92E+13	232.9082	1.53E-43
Residual	129	1.62E+13	1.25E+11		
Total	131	7.45E+13			

Source: own processing by using [7, 8, 9]

From Table 2, correlated with the values that: $F_{tabelat} = F_{a;k-1;n-k} = F_{0,05;2;129} = 3.0692832$, may have, there could be said that $F_{tabelat} < F_{calculat} = 232,9082$, so the null hypothesis is rejected in favor of the alternative one.

Therefore, it can be said that the chosen model is statistically significant and not just accidental.

The same conclusion of validity of the model, the strong dependence between variables, can also be drawn from the value of significance threshold *Significance F = 1.53E – 43 < 0.05*.

Table 3 **Value of the model coefficients and the analysis of the significance threshold**

$y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \varepsilon$					**Interpretation of P-value**	**The interval from where the coefficient takes values**	
	Coefficients	Standard Error	t Stat	P-value		Lower 95%	Upper 95%
Intercept	3690.022	43854.47	0.084142	0.933074	> 0.05, this coefficient is not statistically significant, but only accidental.	-83077.1	90457.17
X Variable 1	50.70386	8.983035	5.644401	1E-07	< 0.05, the coefficient is significantly different from zero	32.9307	68.47701
X Variable 2	30.49365	14.92612	2.042972	0.043092	< 0.05, the coefficient is significantly different from zero	0.961948	60.02535

Source: own processing by using [8, 9]

It can be said that the value of gross domestic product in the European Union countries is significantly influenced by the volume of production and imports of crude steel, analyzing the variance.

According to Table 3, the following econometric model can be built.

$$y_i = 3690.022 + 50.70386x_1 + 30.49365x_2, \quad (2)$$

The interpretation of model coefficients though changes:

- a change of one unit in the crude steel production volume is a change of the gross domestic product by 50.70386 units;
- a change of one unit in the crude steel imports volume produces a change of gross domestic product by 30.49365 units.

The latter can be explained by the fact that the imports may contribute to gross domestic product growth using crude steel as raw material in other industries, after the production process achieving new finished products in the importing country by increasing the investments in the new technologies, job growth, increase of consumption and even product export with final destination.

We have made another test of the model through t test. We considered the statistical safety and compared the data displayed by the application with the theoretical one. The conclusions were drawn as follows: for the independent variables x_1, x_2, the null hypothesis is rejected because $t_{calculat} > t_{0,5;132} = 1,9781$.

Next, to check the independence hypothesis of errors, the value of Durbin-Watson variable is calculated based on the residues calculated by the "the regression" procedure of the used application. Thus:

$$d = \frac{\sum_{i=2}^{n}(\varepsilon_i - \varepsilon_{i-1})^2}{\sum_{i=1}^{n}\varepsilon_i^2} = \frac{2.7E+13}{1.62E+13} = 1,671359, \quad (3)$$

where ε_i – is the residues.

The obtained value is compared with the critical values $d_u = 1.73100$ and $d_l = 1.70049$ taken from Durbin-Watson distribution table for $n = 132$ and $k = 1$. It can be seen that the calculated value is less than d_l, resulting a positive autocorrelation of the values and thus the null hypothesis is rejected. To make the best decision, it is verified if $d > 4 - d_l = 2.29951$.

It is concluded that the null hypothesis is rejected, and the chosen model is statistically significant.

The quality of the model is also facilitated by the graphs presented in Figure 4, automatically built by the used application.

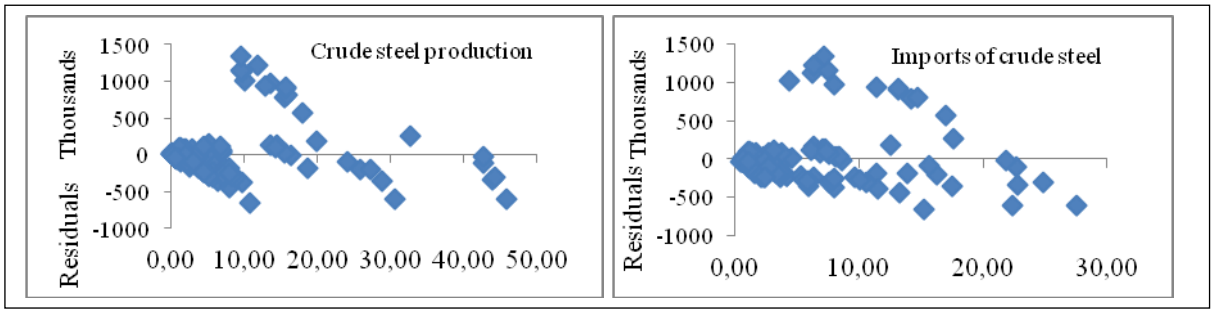

Figure 4 The graphs for residues for each independent variable

The normal probability plot is presented in Figure 5 hence it results an approximately linear distribution of probabilities.

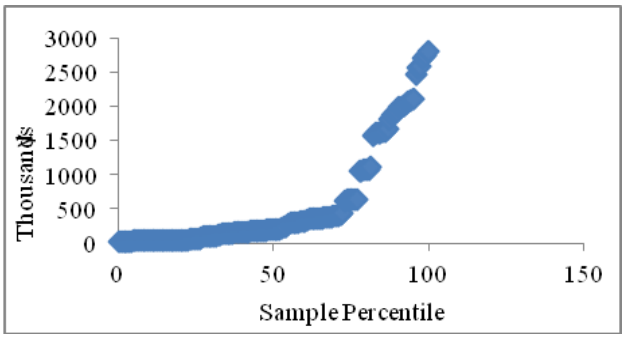

Figure 5 Normal Probability Plot

The econometric modeling is based on the assumption that the variables of interest are random in the sense that the values they will take in the future are uncertain.

From the analysis carried out for a series of 132 observations, it results that the amount of gross domestic product in the European Union countries is influenced by the production and import of crude steel.

5. Conclusions

The analyzed indicators, correlated with quality management in companies, both in terms of labor productivity and finding foreign markets to sell their products, insure the economic growth and stability in the country.

European Union countries must find ways to fund the metallurgical sector companies so that they can develop their business through new investments, which improve the production of products specific to the activities in metallurgy.

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