

THE ANALYSIS OF THE CORRELATION BETWEEN THE ECONOMIC GROWTH AND CRUDE STEEL PRODUCTION IN THE PERIOD 1991-2011

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The use of steel in the production of rolled necessary to any economy has determined a continuous increase of production. In the context in which this metal has become a foundation for the entire world, the steel production can be considered an important economic indicator in the analysis regarding the performance of a company. The purpose of this work is to analyze the trend of the crude steel production and the correlation between this and the economic growth. The data used were reported to a set of six countries for the period 1991 to 2011. The results obtained demonstrate the fact that the economic growth rate influence the production of crude steel, but in different proportions from a country to another.

Key words: crude steel, economic growth, gross domestic product per capita, regression analysis.

INTRODUCTION

The economic growth is a priority objective for any nation, being the main way to ensure wealth and to satisfy social needs of the population. It can be commensurate through the real growth rate of GDP, established by the ratio of total extra production obtained by an economy in comparison with the previous year. Logically, a higher quantity of goods and services available for consumption is synonym with an increase in the standard of living [1].

This objective must not become an „obsession” for governments from various reasons: firstly, the way in which the economic growth rate is determined requires prudence in its interpretation as the main factor of wealth (the gross domestic product is defined in general as being the ensemble of goods and services produced in the economy, in a determined period of time, so inclusively those used in armed conflicts or obtained in polluting activities) [2]; secondly, a higher level of GDP does not exclude the possibility of concentrating the wealth at the level of a society, which represents a small volume of revenues realized at the level of „the most”; another reason would be that of the negative effects determined by the economic growth (pollution, global warming etc.); also, the economic growth implies costs determined by the necessary resources, allocated additionally.

And still, the economic growth has a lot of benefits: the reduction of unemployment; the increase of the revenues realized; getting a higher volume of budgetary

resources that allow (in the context of efficient use of them) the allocation of a higher part for the insurance of some important public services (health, education, welfare). Also, investors are attracted of a country with a high real economic growth rate [3]. The economic growth is important because it represents the source of increasing the revenue and real salaries. Recording even small differences in the growth rates on long horizons at the level of different countries determines high differences in the living level [4].

In what measure can contribute the development of the steel industry, and especially, the production of crude steel at the economic developments, is the answer expected in this paper. For this, we have planned the achievement of a study on the most important countries that catalyze the production of crude steel, for the period 1991 - 2011.

The correlation between the economic development and the production of crude steel has been less analyzed and tested, in exchange being followed mainly the link between the consumption of steel or other metals and the economic development. Thereby, a conclusion has been that there is a certain level of the income per capita after which the consumption of steel starts to decrease, with the specification that the results are differentiated by taking into consideration the industry structure from each country, the example of China being the most relevant in this way (the steel consumption is much higher than in comparison with other countries, no matter the level of the gross domestic product per capita) [5]. Also, the metals market follows the phases of development or recession of the economy, the reduction of metals consumption from the recession period being persistent [6].

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THE EVOLUTION OF CRUDE STEEL PRODUCTION IN THE PERIOD 2000-2011

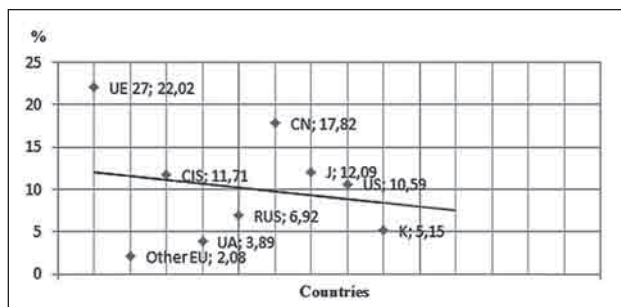
The development of steel industry in EU, amid restructuring and usage of new, performing technologies, has led to the achievement of high tech products, which generate value. The steel sector has become the preserve of multinational companies, small and medium enterprises acting usually at the level of iron production and of steel foundries. The main factors that act on the performance of the steel industry are the limited degree of the necessary primary resources and the high cost of them, at which we add that of the energy used in the production process. Although EU deals the second place among the top producers from the steel industry, in the last period there is an accentuation of the competition exercised by a number of countries such as China, Japan, Russia, South Korea, Ukraine and Turkey.

One of the most important increases of the crude steel production is recorded at the level of China. Thus, due to the increase in capacity of the steel industry, the volume of crude steel production has recorded a continuous increase

after the year 2000, and the accession of China at the World Trade Organization has meant the increase of steel exports. Due to the permanent tendency of increasing the steel production, China has become a country that imports necessary raw materials.

Currently, China holds approximately 45,5 % from the steel production at global level, although the industry from the area is characterized by an accentuated decentralization. For a relevant picture of the evolution recorded on the market of crude steel production there can be seen Figure 1 and Figure 2 which highlight the modifications recorded in the hierarchy of the biggest producers in the year 2011, in comparison with the year 2001. Otherwise, the year 2011 has shown an increase of the global crude steel production with 6,8 % in comparison with the previous year, this reaching at 1 527 Mt.

According to the statistics performed by the World Steel Association, China has realized in 2011 a production of 683,9 Mt steel, being followed by Japan with

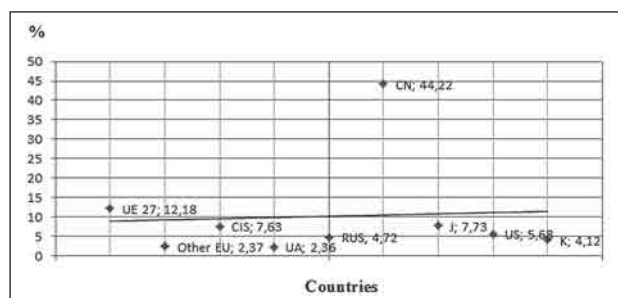


Legend: UE 27 - European Union; CN - China; J - Japan; US - United States; RUS - Russia; UA - Ukraine; K - South Korea; Other EU - other countries from Europe; CIS - Commonwealth of Independent State

Figure 1 The weight of crude steel production among the global production in the year 2001 for different countries and groups of countries

107,6 Mt, United States with 86,4 Mt, India with 71,3 Mt, Russia with 68,9 Mt [7].

This ranking shows one more time the supremacy of China in the production of crude steel (at global level, the production of crude steel has reached at 1527 Mt in the year 2011, from 851 Mt in the year 2001).



Legend: UE 27 - European Union; CN - China; J - Japan; US - United States; RUS - Russia; UA - Ukraine; K - South Korea; Other EU - other countries from Europe; CIS - Commonwealth of Independent States

Figure 2 The weight of crude steel production among the global production in the year 2011 for different countries and groups of countries

However, Hebei Group and Baosteel Group (leaders in the steel production from China) have had the second and third position in the year 2011 with 44,4 Mt and, respectively, with 43,4 Mt, Arcelor Mittal remaining the leader with a production of 97,2 Mt. The situation does not remain the same in what regards the consumption of steel. So, the biggest level of steel consumption per capita has been recorded in the year 2011 in South Korea (Table 1).

Table 1 The apparent crude steel use per capita in 2011 [7]

Countries	Apparent steel use Kg/per capita
South Korea	1 156,6
Taiwan, China	784,4
Czech Republic	595,7
Japan	506,7
Germany	479,6
Austria	473,1
China	459,8
Italy	459,5
Sweden	424,5
Belgium - Luxembourg	422,5

The implication of the state in the production of steel in some economies from the countries mentioned through the granting of subsidies has determined the reduction of prices at the level of all products, no matter the quality degree. In addition, the supplementary production requires raw materials in increasing quantities (as is known, EU is the biggest importer of raw materials for the steel industry), fact that determines an increase of the buying prices and, implicitly, of the production prices.

Another aspect worth noting is the one related to the environmental policy promoted. Thus, while the EU has

Table 2 Evolution of growth rate of GDP per capita between 2000 and 2011 / wt %, [8]

Countries	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
CN	6,7	7,6	8,4	9,4	9,4	10,7	12,1	13,6	9,1	8,7	9,9	8,7
J	-0,4	2,1	0,1	1,5	2,3	1,3	1,7	2,2	-1	-5,4	4,4	-0,9
RUS	10,5	5,6	5,2	7,8	7,7	6,9	8,6	8,7	5,3	-7,8	3,6	4,7
UA	6,8	13,2	6,1	10,6	13	3,4	8,1	8,6	2,9	-14,4	4,5	5,7
US	3	0	0,8	1,6	2,5	2,1	1,7	0,9	-1,3	-4,3	2,2	1
K	9,9	7,9	6,6	2,3	4,2	3,7	4,8	4,8	2	0	6	3,4

Table 3 Evolution of the growth rate of crude steel production between 2000 and 2011 for the analyzed countries / wt % [9]

Countries	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
CN	3,6	18	20,2	21,9	27,2	24,8	18,6	16,7	2,2	14,6	9,2	8,9
J	13,0	-3,3	4,7	2,5	1,9	-0,2	3,3	3,4	-1,2	-26,2	25,2	-1,8
RUS	1,1	-0,2	1,3	2,7	6,4	1,1	7,08	2,1	-5,3	-12,4	11,5	2,7
UA	15,7	4,2	2,8	8,4	4,8	-0,2	5,82	4,7	-12,9	-19,9	11,9	5,7
US	-11,4	4,4	1,6	2,2	6,4	-4,7	3,85	-0,4	-6,88	-36,2	38,3	7,1
K	5,0	1,7	-7,9	8,7	6,5	7,3	11,73	1,3	7,96	2,6	21,6	16,2

imposed limits to reduce industrial gas emissions (overcoming the allowances involves large fines), other countries have not followed suit (in 2007, China generated over 50 % of carbon dioxide emissions caused by production of steel).

DATA ANALYSIS

The purpose of this paper is to investigate the relationship between crude steel production and economic growth. The most studies that have reported to the correlation between economic development and metals market are focused on short time or on a single country, and usually they followed the consumption of metals. In this paper we examined the dates for six countries (China - CN, Japan - J, Russia - RUS, Ukraine - UA, U.S. - U.S. and South Korea - K) for the period between 1991 - 2011 (except for Russia and Ukraine, for which the data refers to the period 1993 - 2011). The data used refers to the economic growth rate per capita (Table 2) and to the growth rate of crude steel production (which was calculated based on chain-based indices, depending on the volume of crude steel production recorded at the level of each country), Table 3.

The model used similar to the type of linear equations with the variable the economic growth rate (x_1):

$$Y_i = a_1 x_1 + \varepsilon \quad (1)$$

where: a_1 is the parameter model; ε - random variable.

RESULTS AND DISCUSSION

Development of the industry is an important factor with major influences on economy.

In this context, any component of industry can contribute at the economic growth and can be influenced by it. So, between crude steel production and economic growth can be a connection. To identify this correlation, we used a set of empirical data regarding the real rate of

GDP per capita and the growth rate of crude steel production from six countries, for 21 years. The sample was selected in report to the place held in the top of crude steel producers.

Data processing was realised by correlation and regression analysis, the results achieved allowing the identification of a correlation between the two variables considered. Interpretation must be done separately because the results do not converge in the same direction.

Thus, for China it has been identified a correlation between the dependent variable and the independent one, the correlation coefficient registering a value of 0,83, which shows a direct, close link. The resulting equation is:

$$Y_{CN} = 1,23 x_1 + 8,171 \quad (2)$$

The coefficient of multiple determination shows that 70,24 % of the crude steel production variation can be explained by the influence of economic growth.

The situation recorded in the other countries in the sample is summarized in Table 4.

Table 4 The correlation model and the size of the influence of the independent variable

Country	Model	Coefficient
J	$Y_J = 2,1 x_1 + 10,158$	0,18
RUS	$Y_{RUS} = 0,76 x_1 + 6,346$	0,43
UA	$Y_{UA} = 0,83 x_1 + 8,346$	0,51
US	$Y_{US} = 2,55 x_1 + 11,732$	0,21
K	$Y_K = 0,86 x_1 + 7,728$	0,31

From the obtained models it can be observed that general level of significance is not extremely high but the regression parameter is positive in the case of the analyzed countries, fact that shows a direct connection between the two correlated variables (the sign of coefficient for the growth rate of GDP per capita is positive), in different proportions.

A highlight of this issue is presented in Figure 3 for China (the connection is significant in this case). The result has demonstrated the validity of the hypothesis

for this country, which has registered a continued increase at both variables.

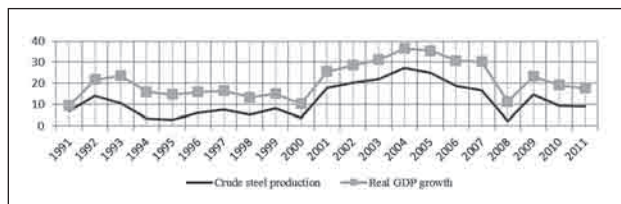


Figure 3 Evolution of the crude steel production and the economic growth in China

CONCLUSIONS

The analysis effectuated sought to identify the correlation between crude steel production and the economic growth dimensioned with the help of GDP per capita. Outcomes show that a positive economic growth rate is accompanied by a growth rate of crude steel production in the same sense, with little exceptions, even if not on the same level. The positive trend of economic growth in the analyzed period for China and South Korea supports this assertion. With few exceptions, Russia and Ukraine is located on the same tendency. At their level, the crude steel production is influenced in proportion of 43,8 % and respectively 50,7 % by the economic growth. However, in Japan and United States there is evolutions in the opposite directions in many years, the influence of the economic growth variable on the crude steel production being very small (under 20 %). In conclusion, the crude steel production is also influenced by other factors, among which are registered: export demand (economic crisis hit caused a significant decrease in external consumption with direct implications on domestic production); tendency to reduce prices of finished products, through the involvement of countries in

this sector; excessive fragmentation of production; inefficient consumption of energy resources; technologies use in production; availability of primary resources in steel production. Steel producing countries should consider the actual situation in the profile industry and formulate viable strategies, according with the influence exerted by the economic environment but also by the mentioned factors, to ensure a positive trend of the economic growth and production of crude steel on the background of ensuring environmental protection.

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Note: The responsible for English language is S.C. PURTRAD S.R.L., Târgu Jiu, Romania