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TESTING KUZNETS CURVE FOR THE SOCIALIST AND CAPITALIST PERIOD OF ROMANIA

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ABSTRACT

In the course of time much has been written about the relationship existing between economic growth and the level of pollution. Some authors believed that for the present level of pollution poor countries are the ones responsible because they don't take into consideration the degradation of the environment due to the fact that their main concern is to cover the basic needs of the population and to achieve economic growth. Another category of authors claimed that strongly developed countries that most times are also the ones to be the most industrialised and preoccupied by economic indicators to be the ones responsible. The one that makes to some extent the connection between the two types of theories is Kuznets which considers that up to a certain level of the GDP poor countries are responsible and after a certain point of the GDP is passed the problem of environmental protection appears on their list of priorities. In the present paper this theory was tested in the case of Romania during the socialist period as well as the capitalist one.

JEL CLASSIFICATION & KEYWORDS

■ Q44 ■ Q53 ■ ECONOMIC GROWTH ■ KUZNETS CURVE ■ POLLUTION ■ ECONOMETRICS

INTRODUCTION

Scientifically it is known that man appeared million years ago and only 2 – 3 centuries ago he fully integrated himself in the environment. The influences determined by the natural changes of the environment specific to earth (ice ages, continental drifts, volcanic activities, big meteors impact, etc.) have determined normal changes regarding human species adjustment to the newly created conditions. Man has lived millions of years like any other wild animal, fully integrated in nature, being an agriculturalist, fisherman and hunter. The grouping of humans into tribes or, later, in small or big states it didn't influence the environment, influencing only the psychic structure of the human being that has passed from homo sapiens to a socialised man enclosed by the "laws of the tribal or state organisation" in which he found himself.

Neither the discovery of fire brought any alteration to the environment, the latter one appearing much later, together with the industrialised era. From that moment man began to gradually break himself from the environment, to use its resources for personal or group interests and to eliminate whatever environment it was not helpful, laying the foundations of the so-called process of environmental pollution, or degradation of natural factors, which in recent decades has become very dangerous for the existence of the human species.

It must be understood the fact that the Earth is a giant ecosystem, understanding in the concept of ecosystem as the assembly of biotopes and biocoenosis in which close relations are established between organizations as well as between them and abiotic factors.

The harmful effects of human activity began with industrialization, characterized by several things among which: the discovery and widespread use of fossil fuels (coal, crude oil, natural gas) in order to produce electric and thermal energy produced by burning these and with the elimination of gases in the atmosphere and soil, implicitly rivers and groundwater, of the resulting slag; the intensive processing of metals and the removal of sterile as well as that of the resulting gases in the outside environment (see steel mills furnaces, aluminium production, etc.); the results arising from the industrial applications of the discoveries made in chemistry (taking into account the petrochemical industry, the factories that produce chemical fertilizers, factories producing the necessary hygiene items) animal breeding development and related industries, etc. However, although initially designed to create a favourable climate for the human being, unfortunately these have led to an unacceptably long load of the abiotic environment (air, water, soil), with catastrophic effects or possible catastrophic if no action is taken, for the existence of the human species and even life on Earth.

From the need to own and organize the productive and social system a new science appeared, that of the economy above all a "social science that studies the social problem of choosing in a scientific vision, which means that is built on a systematic exploration of the problem of choice."(Stiglitz EJ & Walsh EC, 2005)

Economy has developed and specialized in various fields and great economists were able to observe the polluting effect of people's activity (which currently operates within local, state and worldwide businesses aiming at present, towards a globalization of the economic activity). Although it was found more than a century ago the harmful influence of the economic activity on the environment have only in recent decades major concepts and new actions emerged such as sustainable development and national and international policies on the environment.

The noxious influences of environmental pollution in recent decades are reflected both on the biodiversity and on the human individual; harmful influences on the human individual are found under the form of biological damage (more rapid disease development and death), the disruption of the psychic and social framework and not least all the major economic implications due to the very high costs needed to cover health expenses, the costs of maintaining the equilibrium of the social structure of the individual's psychic affectivity nearest mental health.

Current prospects of environmental degradation in the case in which it is maintained or increased the rate of pollution are unimaginable today. In order to flatten the ascending curve of destruction of the environment currently a series of measures are used, among which the one analysed in the present paper that refers to reducing the use of fossil fuels

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in order to provide the thermal energy required for heating houses and for preparing domestic hot water. If in the '70s humanity has faced for the first time the problem of replacing fossil fuels linked to the exploitation and the depletion of energy resources, the present situation is much worse, emphasising on reducing fuel consumption for reasons of survival. As an alternative it could be using nuclear energy but this has a series of disadvantages and a lot more dangerous implications than using the present combustibles.

From the perspective of the sustainable development of the energy sector presently it is emphasised the large – scale use of renewable energy that has a significantly low level of pollution and also the recovery of large scale flora. Despite their disadvantages renewable energy resources respectively the geographical area in which they are, season, ore, and so on, a global vision can be approached of a world energy system (solar panels in desert areas, major water courses hydro plants, wind fields in areas that present potential, geothermal plants in areas with considerable ores and the widespread use of heat pumps for the capture and use of geothermal energy – geothermal energy represents the energy stored in the crust of the Earth due to the solar energy's action on it).

Theoretical background regarding the connection between economic growth and environmental pollution

According to the classification made by Fisher in 1939 (Vogel P. Michael, 1999) and later developed by the economist Colin Clark and Frenchman Jean Fourastie, the sectors of an economy can be divided into three, namely: the primary sector where the activities from the extractive industry and agriculture are included, the secondary sector is dominated by the manufacturing and construction industry and the final sector, tertiary or of services, which as the name includes all service activities. They were also those that noticed after the tests they performed that less developed countries are mostly developed in the primary sector, that is agriculture, in developing countries dominates the secondary sector where a significant place among economic activities is occupied by industry and construction, and developed countries are characterized by the existence of the predominant tertiary sector. If we look things from this perspective, we can say that in the underdeveloped countries, where agriculture is the main branch of activity are not among the most polluting countries. Neither developed countries can be considered responsible for this problem because the realization of services is not a process that generates greenhouse gases in large quantities, so we can say that, according to the theory of Colin Clark and Jean Fourastie, developing countries are responsible for the current level of pollution because they mainly developed secondary sector, that is the industry.

In the course of history three theories remarked themselves regarding the connection between the level of development and pollution. The first theory is that of Carmelia Cămoşoiu, who believes that the problem is either cultural, or of mentality, or both. The author explains her theory in a comparative example between a citizen of a developing country, whose wage is low and a citizen from a developed country with a high wage. At a first analysis the author believes that the citizen from the country in development lacks culture and the specific education for a citizen, or love of beauty, because a clean unpolluted nature produces the same joy for a citizen from a developing country as for the one in a developed country. On the other hand, the author considers that an individual who is concerned for its daily existence and for insuring the necessary financial resources to satisfy needs, the beauty problem and that of decontamination is placed on an inferior position in his list of priorities. (Cămoşoiu, 2004)

Considering all these, statistics show with irrefutable data that poor countries carry the lowest pressure on the planet.

Table 1: Summary of hypothesized spatial lag and the surrounding market potential variable

Continent / Country	Carbon dioxide damage	Continent / Country	Carbon dioxide damage
China	1.11	Romania	0.50
Luxembourg	0.24	Czech Republic	0.57
Spain	0.19		0.18
Kenya		Niger	0.10 July

Source: Baltagi et al. (2007) and Blonigen et al. (2007)

We know that Luxembourg is the country with the highest GDP per capita of the European continent and Africa is where, despite the global food supply exceeds demand, a part of its population suffer from malnutrition or die due to lack of food.

Another theory is supported by William Nordhaus who made a comparative study on global carbon emissions as well as their implications. He starts from the information according to which in 2006 global carbon emanations were of 7.5 billion tons (27.5 billion tons of CO_2 = 3.67 tons CO_2). In order to a better understanding of this astronomical number, Nordhaus calculated emissions at individual level as follows: he assumes that an individual in a year he rides 10.000 miles in a car that uses one gallon at every 28 miles. In this case, the vehicle will emit one ton of carbon that is equivalent to approximately 4 tons of CO_2. (Nordhaus, 2008)

For heating the residence the individual will consume 10,000 kWh per year (which is the average kWh consumption per capita in U.S.A./year). If this energy is generated by burning coal, carbon emanations would be of 3 tons (about 11 tons of CO_2) per year. Overall, the United States emanations are 1.6 billion tons of carbon (6 billion tons of CO_2), which is 5 tons carbon (18.35 tons of CO_2) per capita, than the world average which is 1.25 tons (4.58 tons of CO_2).

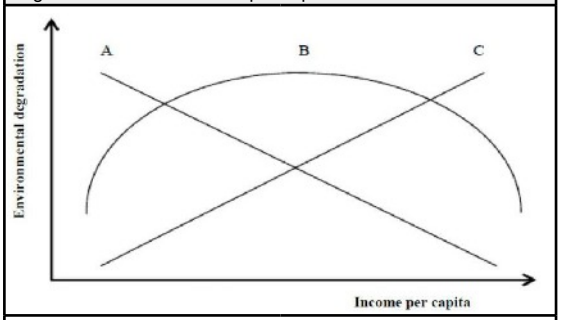
The example given by William Nordhaus and the presented statistical data reinforce some theories according to which pollution (calculated emissions of CO_2) increases directly proportional with economic growth. In a world where economic growth is the most important indicator of a country and also its goal every year comes up the relevant question: What will happen to the environment and inhabitants of this planet?

And the third theory is provided by Kuznets, who presents a graphic demonstration which he calls Kuznets curve. This curve starts on the assumption that trade liberalization has positive effects on the environment. In the early stages of the environmental movement some scientists have asked "how big is the availability of natural resources and to which extent can they provide sustainable growth?" To this question the neo-classics responded that economic growth is not prevented by natural resources. Then they continued a series of debates between the so-called pessimists who argued that natural resources are depleting and intensive economic growth would lead to the extinction of the human species and of other species, while on the opposite side of the debate were the optimistic, among which the neo-classics. While debates continued over the years it has been proven eventually few decades ago that the pessimists were not able to foresee technical progress. But the optimists had

not been completely right either, because today's reality in which pollution implicitly global warming causes a series of negative effects on the economy, on ecosystems and on the human species. Thus, around the 1980's aspects regarding the thinning of the ozone layer, global warming, the loss of biodiversity began to be intensely debated.

In the 1990s the specialized literature on the relationship between the economy and the environment has proliferated. To this category also belongs Kuznets's theory that argues that in the beginning stages of economic development the environmental degradation will increase at high speed to a certain level of income (to the point of turning). This relationship between the income per capita and the level of pollution is presented as a form of inverted U curve. (Gallagher, 2008)

Figure 1: The analysis of the link between environmental degradation and the income per capita - Kuznets curve



Source: Gallagher (2008)

In what follows we will try an analysis of this theory, highlighting its weaknesses but also its strengths. Through this curve Kuznets wants to highlight the relationship between the two analyzed sizes namely the pollution degree and the economic development, that take a primary route, then a second and finally a third. In the first phase (quadrant A) the economy is dominated by the primary sector, which as defined by the Australian Colin Clark and Frenchman Jean Fourastie, represented by agriculture and mining. This phase corresponds to the economic start in which the attraction of resources and their accumulation take place, and when the economy has registered a certain level (of 1000-1200 $ / person) (Pohoaţă, 2010) of income environmental degradation becomes a major problem. In quadrant B a maximum point of pollution is reached (around an increase of $ 3,000 / person), and this quadrant corresponds to the period in which the second sector dominates, that is the period in which the manufacturing industries are predominant, when the pressure on the lands, forests and on the environment is maximum. Then takes place the shift to the tertiary sector (when the GDP / capita reaches values of approx. $ 10,000) when the accumulation of wastes and massive pollution determines public awareness regarding the implications resulting from pollution which leads to large amounts of money from the state budget to be allocated in the implementation of measures designed to protect the environment. In addition, legal action will be taken against pollution and polluters causing thus the orientation towards those industries that are efficient and clean.

In this case, the environment is regarded as a normal good. In other words, according to the income elasticity of demand is greater than zero, maybe even more from which it can be deduced that as the income increases (in general the one calculated per capita) the care for the environment will increase as well, perhaps even more than directly proportional. In addition, rich countries are more capable in fulfilling the imposed criteria for having a healthy environment due to the ability to purchase cleaner technologies.

But according to Camelia Cămăşoiu's theory in some cases even that of Kuznets in many writings it was considered to be accurate but only if there are certain specifications, additions, such as the fact that the issue of beauty, the desire for a clean environment but especially the aspirations chosen by people can be made to the extent that the state, the form of government permits it. For example, in the case of socialist Romania, dreams, aspirations and desires of individuals were only partially fulfilled, in the manner in which they complied with the requirements imposed by the state. In the situation in which the problem of environmental degradation is not a priority for the state, it was the one that coordinated all activities; their concerns were not heading in that direction.

Data and methodology

The dependence between the economic variables can take many forms. In the book Handbook on Trade and the Environment the author starts with the study of the link between CO_2 and GDP / capita form the hypothesis that between the two variables there is a parabolic connection. Thus we will try to see whether in the case of Romania that form of the connection is suitable to determine the relationship between the mentioned variables that is we will try to determine whether the Kuznets curve is checked or not having as starting point the statistical data between 1960 and 2010 (Gallagher, 2008). As Romania, within its history has passed two main periods: one of socialism, dictatorship and one that gradually settled capitalism. We know that, during the socialist period decisions were taken at the centre and the main goal was achieving growth and creating a bigger "prosperous Romania". As nature was regarded as state property in which its main right was to exploit it.

In the multiple regression analysis first of all are taken into consideration the aspects linked to the identification of the explanatory variables. We will use data regarding the amount of carbon dioxide (CO_2t), and on GDP per capita during 1960 - 2010. In order to identify the relationship between the two variables we graphically represented the data for the two studied periods. Specifying an econometric model involves choosing a mathematical function (f(x)) which can be described by the relationship between the two variables. In the case of a single factor model, the most commonly used method is the graphical representation of the two rows of values using the point cloud. Based on the graphics made with the use of the point cloud, we noted that for the period 1960-1990 the most representative model would be the linear regression model because the strip on which the points are located resembles a straight line. In respect to the second period, namely 1990-2000, I noticed that the most representative model that studies the relationship between the two variables is the parabolic model because the strip on which the points are located resembles a straight line.

Starting from the abovementioned things we can consider that the first regression model proposed in the study of the carbon dioxide evolution according to the GDP/capita for the period 1990-2010, is the parabolic regression model of the form (Stern D.I., 2004)

$$CO2_t = c(1) * GDP_t + c(2) * GDP_t^2 + c(3) + \varepsilon_t$$

The testing of the validity of the parabolic model

After testing the collinearity with the help of the correlation matrix we can conclude that the presence of collinearity at the level of this regression model is missing. Next we turn to estimate the parameters of the parabolic regression model.

In the cases of the multifactorial model the parameters can be estimated by several methods. To determine the parameters of the model we will use the generalized method of the least squares. In order to test the validity of the hypothesis that is based on the classical model will use various statistical tests.

After the calculations, the Student statistical value associated to the free coefficient c(3) indicates that they do not have a significant influence on the endogenous variable, because the calculated measures are smaller in absolute value than in the tabular measure, this think suggesting us that the multiple regression model estimated above is not valid. For this reason we will eliminate the free ratio model. Thus the regression model becomes

$$CO2_t = c(1) * GDP_t + c(2) * GDP_t^2 + \varepsilon_t$$

The obtained results indicate the fact that the new model is valid because the Student statistical values calculated for the two parameters are larger in absolute value than the tabular value equal to 1.96 for a significance threshold of 5%. Thus we can conclude that the null hypothesis H_0 for all the parameters of the regression equation is rejected, these being significantly different to zero, thus we can state that the exogenous variables are significant as well as at the total population level. Also we can assert that due to the negative value of the *c(2)* coefficient the Kuznets curve is checked (the peak is up).

As for the intensity of the connection we can say that based on the obtained results at sample level between the endogenous variable and the exogenous variables there exist a weak connection, the value of $R^2 = 0.19$, being very close to one.

To study the size of the total population, we will use the Fisher test.

$H_0 : \overline{R^2} = 0$

$H_1 : \overline{R^2} \neq 0$

In order to choose the correct hypothesis we will determine the calculated size (F_{calc}) that is going to be compared to F_{tab} read in the Fisher annex.

$$F_{calc} = \frac{R^2}{1 - R^2} \cdot \frac{T - p}{p - 1} = 4.29$$

Since $F_{calc} = 42.02 > F_{tab} = 3.10$ results that the null hypothesis is rejected, so the influence of the exogenous variables on endogenous variable is significant. As the difference between F_{calc} and F_{tab} is higher, the relationship between the variables and the total population is stronger. Thus, we can say that the intensity of the relationship between the variables chosen for the study is medium to strong in the level of the total population because the between the two values there is a relatively large difference.

Testing the fundamental hypotheses regarding the random variable ε

The hypothesis of the independent values of the residual variable ε_i. This hypothesis requires the verification of the relationship:

$$cov(\varepsilon_t, \varepsilon_k) = E(\varepsilon_t, \varepsilon_k) = 0 \ (\forall) \ t,k=\overline{1,20}$$

In order to detect the autocorrelation the residual variables are used a series of statistical tests. For this study we will use the Durbin-Watson test. Starting from the relationship:

$$\varepsilon_t = \rho \varepsilon_{t-1} + u_t$$

The hypothesis:

H_0: $\rho = 0$, with the alternative

H_1: $\rho \neq 0$

This ρ is the autocorrelation coefficient of errors. In order to choose the correct, it is determined the statistics

$$DW_{calc} = \frac{\sum_{i=1}^{20} \left(\hat{\varepsilon}_i - \hat{\varepsilon}_{i-1} \right)^2}{\sum_{i=1}^{20} \hat{\varepsilon}_i^2} = 0.32$$

Working with a threshold of significance level $\alpha = 0.01$, the number of the exogenous variables is $k = 2$, and the number of observations T = 20, the Durbin-Watson distribution table the values are read $d_1 = 0.86$ and $d_2 = 1.27$. Since $0 < DW_{calc} = 0.32 < d_1 = 0.86$, the errors are positive autocorrelated, the hypothesis H_0 is the one that is rejected, so the hypothesis of independent errors is not checked.

In order to eliminate the autocorrelation phenomenon we will estimate parameter ρ with the help of the Cochrane-Orcutt method (Andrei & Régis, 2008). After calculations, we obtained the parameter

$$\rho = 1 - \frac{DW_{calc}}{2} = 0.84$$

Thus the series of residues can be written like this:

$$\varepsilon_t = 0.84 \cdot \varepsilon_{t-1} + u_t \quad (1)$$

From the parabolic type of the linear regression model:

$$CO2_t = c(1) * GDP_t + c(2) * GDP_t^2 + \varepsilon_t \quad (2)$$

and

$$CO2_{t-1} = c(1) * GDP_{t-1} + c(2) * GDP_{t-1}^2 + \varepsilon_{t-1} \quad (3)$$

Substituting in the relationship (1) we obtain:

$$CO2_t - (0.84 * CO2_{t-1}) = c(1) *$$

$$(GDP_t - 0.84 * GDP_{t-1}) + c(2) * (GDP_t^2 - 0.84 * GDP_{t-1}^2) + u_t$$

In the next step we will check the qualities of the new model repeating the same steps as for the previous model. The estimation of the parameters of the new model of parabolic regression we used the method of the least squares.

The results related to the two parameters of the new model show that values of the Student statistics calculated for the two parameters are larger in absolute value than the tabular value equal to 1.96 for a significance threshold of 5%. Thus we can conclude that the null hypothesis H_0 is rejected for all the parameters of the regression equation, these being significantly different from zero, the exogenous variables are significant and the total population.

For measuring the intensity of the dependence of the endogenous variable regression factors, it is determined the coefficient of determination. At sample level between the endogenous and exogenous variable exists a medium intensity relationship, because R-squared = 0.273897. In order to determine if this intensity is maintained at the total population level, we will use the Fisher test. Because $F_{calc} = 7.16 > F_{tab} = 3.10$ means that the null hypothesis is rejected according to which between the variables would not exist a relationship, so the influence of the exogenous variables on the endogenous variable is significant.

Testing the fundamental hypotheses according to which the random u_t

The independence hypothesis of the residual variable u_t values. In order to detect the autocorrelation of the residual variables we will use the Durbin-Watson test (Meşter, 2012). This time we will start from the relationship:

$$u_t = \rho u_{t-1} + \omega_t$$

In this case the Durbin Watson statistic is equal to 1.599689, so $d_2 = 1,27 < DW_{calc} = 1,599689 < 4-d_2 = 2,73$, so we can conclude that the errors are independent, the hypothesis of independence of errors is checked.

The hypothesis of homoscedasticity of the residual variable u_t. In order to verify the hypothesis of homoscedasticity we will use the White test. Starting from the relationship:

$$u_t^2 = \alpha_0 + \alpha_1 GDP_t + \alpha_2 GDP_t^2 + \alpha_3 GDP_{t-1} + \alpha_4 GDP_{t-1}^2 + \omega_t$$

It is intended to study if there exists or not a relationship between the variables.

It is determined this time too the measure calculated of the Fisher test. Since F_{calc} = 0.934909 and F_{tab} = 3.10 the hypothesis H_0 hypothesis is accepted, which means the model is homoscedastic. The H_0 hypothesis cannot be rejected; this thing guaranteeing a 90% probability.

Testing the normality of the random variable u_t distribution. Due to the importance of the normal distribution in modelling various statistics, were constructed different special tests of concordance to check the normality different distributions. One way to verify the normality hypothesis of errors is through the Jarque - Berra test, which is an asymptotically test that is valid for a large sample, which follows a chi-square distribution with 2 degrees of freedom.

Since $JB_{calc} = 2.90 < \chi^2_{tab(\alpha;5)} = 5.99$; from this results the normality of errors hypothesis cannot be rejected at the total population level, the errors are normally distributed. Because all three hypotheses about the random variable were checked, results that the model is valid, so it can be used for making predictions.

Since we are interested in the GDP, which is the OX axis (as it is an independent variable), is sufficient to find out the ratio of value *–c(1)/2*c(2)* because the value is in the OX axis. Thus we will have the GDP / capita at the top of the parabola equal to:

$$\frac{-c(1)}{2*c(2)} = \frac{-32.3813}{2*(-0.002629)} = 6158$$

Testing the linear model

The second model that was proposed for study is the relationship between the evolutions of the carbon dioxide (CO_2) in respect to the *GDP/capita* during 1960-1990 and has the form of:

$$CO2_t = c(1)*GDP_t + c(2) + \varepsilon_t$$

The testing of the validity of the linear model

After testing the collinearity with the help of the correlation matrix we can conclude that the presence of collinearity at the level of this regression model is missing. Next we turn to estimate the parameters of the parabolic regression model.

In the cases of the regression model the parameters can be estimated by several methods. To determine the parameters of the model we will use the generalized method of the least squares. In order to test the validity of the hypothesis that is based on the classical model will use various statistical tests.

After the calculations that were made, the values of the Student statistic calculated for the two parameters are higher in absolute value than in table value equal to 1.96 for a significance level of 5%, and the associated probabilities of these are equal to zero. Thus we can conclude that the null hypothesis H_0 is rejected for all the parameters in the regression equation, these being significantly different to zero. So, we can say that the exogenous variable is significant in the level of the total population. We can also say that between the carbon dioxide and *GDP/capita* is a direct relationship during 1960-1990, due to the positive values of the c(1) coefficient which shows us that it is verified.

In conclusion we can say that in the case of Romania, during 1990-2010 Kuznets curve is shown. More specifically we can say that the threshold of 6,158 $ per capita (which is the peak of the parable reached during 2006-2008) Romania is characterized by a linear relationship between growth and the level of pollution because, since 2006 the relationship between the two variables became an inversely proportional one. But if we add the fact that starting with 1995 the services sector began to develop determining Romania to pass among developed countries according to the classification made by Colin Clark and Jean Fourastie, we could believe that Kuznets's theory is correct. Another argument leading to its veracity is the fact that during 2004-2008 Romania has experienced a period of economic boom combined with the EU Sustainable Development Strategy and that may be responsible to some extent for reducing pollution.

Then the obvious question followed: does this theory apply in any situation, in any case, regardless of the form of government or standard of living? Obviously a poor country that barely manages to provide food for people will not be concerned with the problem beauty of the environment. But most times, not only the level of the GDP counts but also the form of government. Kuznets has tested his model on the capitalist countries, but in these circumstances the question is whether it is valid for socialist countries, where most cases the target is to increase economic indicators and not welfare. The most eloquent example is that of socialist Romania and China, where no matter the registered economic outcomes, the environmental problem remains unresolved. According to this reason, we tested this model during 1960-1990 in Romania.

As for the intensity of the connection we can say that based on the obtained results at sample level between the endogenous variable and the exogenous variables there exist a very strong connection, the value of R^2 = 0.7, being very close to one.

To study the size of the total population, we will use the Fisher test.

$H_0 : \overline{R^2} = 0$

$H_1 : \overline{R^2} \neq 0$

In order to choose the correct hypothesis we will determine the calculated size (F_{calc}) that is going to be compared to F_{tab} read in the Fisher annex.

Since F_{calc} = 551 > F_{tab} = 3.10 results that the null hypothesis is rejected, so the influence of the exogenous variable on endogenous variable is significant As the difference between F_{calc} and F_{tab} is higher, the relationship between the variables and the total population is stronger. Thus, we can say that

the intensity of the relationship between the variables chosen for the study is medium to strong in the level of the total population because the between the two values there is a relatively large difference.

Testing the fundamental hypotheses regarding the random variable ε

The hypothesis of the independent values of the residual variable ε_i. This hypothesis requires the verification of the relationship:

$$cov(\varepsilon_t, \varepsilon_k) = E(\varepsilon_t, \varepsilon_k) = 0\ (\forall)\ t,k=\overline{1,30}$$

In order to detect the autocorrelation the residual variables are used a series of statistical tests. For this study we will use the Durbin-Watson test. Starting from the relationship:

$$\varepsilon_t = \rho\varepsilon_{t-1} + u_t$$

The hypothesis:

H_0: $\rho = 0$, with the alternative

H_1: $\rho \neq 0$

This ρ is the autocorrelation coefficient of errors. In order to choose the correct, it is determined the statistics

$$DW_{calc} = \frac{\sum_{i=1}^{30}\left(\hat{\varepsilon}_i - \hat{\varepsilon}_{i-1}\right)^2}{\sum_{i=1}^{30}\hat{\varepsilon}_i^2} = 0.74$$

Working with a threshold of significance level α = 0.01, the number of the exogenous variables is k = 2, and the number of observations T=30, the Durbin-Watson distribution table the values are read d_1 = 1.13 and d_2 = 1.26.

Since $0 < DW_{calc}=0.74 < d_1 = 1.13$, the errors are positive autocorrelated, the hypothesis H_0 is the one that is rejected, so the hypothesis of independent errors is not checked.

In order to eliminate the autocorrelation phenomenon we will estimate parameter ρ with the help of the Cochrane-Orcutt method (Andrei & Régis, 2008). After calculations, we obtained the parameter

$$\rho = 1 - \frac{DW_{calc}}{2} = 0.63$$

Thus the series of residues can be written like this:

$$\varepsilon_t = 0.63 \cdot \varepsilon_{t-1} + u_t \quad (1)$$

From the parabolic type of the linear regression model:

$$CO2_t = c(1)*GDP_t + c(2) + \varepsilon_t \quad (2)$$

and

$$CO2_{t-1} = c(1)*GDP_{t-1} + c(2) + \varepsilon_{t-1} \quad (3)$$

Substituting in the relationship (1) we obtain:

$$CO2_t - (0.63 * CO2_{t-1}) = c(1)*$$
$$(GDP_t - 0.63*GDP_{t-1}) + c(2)*(1-0.63) + u_t$$

In the next step we will check the qualities of the new model repeating the same steps as for the previous model. The estimation of the parameters of the new model of parabolic regression we used the method of the least squares.

The results related to the two parameters of the new model show that values of the Student statistics calculated for the two parameters are larger in absolute value than the tabular value equal to 1.96 for a significance threshold of 5%. Thus we can conclude that the null hypothesis H_0 is rejected for all the parameters of the regression equation, these being significantly different from zero, the exogenous variable, *GDP/capita* are significant and the total population.

For measuring the intensity of the dependence of the endogenous variable regression factors, it is determined the coefficient of determination. At sample level between the endogenous and exogenous variable exists a strong intensity relationship, because R-squared = 0.808689. In order to determine if this intensity is maintained at the total this intensity is maintained at the total population level, we will use the Fisher test. Because F_{calc}=122.58 > F_{tab}=3.10 means that the null hypothesis is rejected according to which between the variables would not exist a relationship, so the influence of the exogenous variables on the endogenous variable is significant.

Testing the fundamental hypotheses according to which the random u_t

The independence hypothesis of the residual variable u_t values. In order to detect the autocorrelation of the residual variables we will use the Durbin-Watson test (Meşter, 2012). This time we will start from the relationship:

$$u_t = \rho u_{t-1} + \omega_t$$

In this case the Durbin Watson statistic is equal to 1.863286, so d_2 = 1,26 < DW_{calc} = 1,863286 < 4-d_2 = 2,74, so we can conclude that the errors are independent, the hypothesis of independence of errors is checked.

The hypothesis of homoscedasticity of the residual variable u_t. In order to verify the hypothesis of homoscedasticity we will use the White test. Starting from the relationship:

$$u_t^2 = \alpha_0 + \alpha_1 GDP_t + \alpha_2 GDP_t^2 + \alpha_3 GDP_{t-1} + \alpha_4 GDP_{t-1}^2 + \omega_t$$

It is intended to study if there exists or not a relationship between the variables.

It is determined this time too the measure calculated of the Fisher test. Since F_{calc} = 0.769026 and F_{tab} = 3.10 the hypothesis H_0 hypothesis is accepted, which means the model is homoscedastic. The H_0 hypothesis cannot be rejected; this thing guaranteeing a 90% probability.

Testing the normality of the random variable u_t distribution. Due to the importance of the normal distribution in modelling various statistics, were constructed different special tests of concordance to check the normality different distributions. One way to verify the normality hypothesis of errors is through the Jarque - Berra test, which is an asymptotically test that is valid for a large sample, which follows a chi-square distribution with 2 degrees of freedom.

Since $JB_{calc} = 0.01 < \chi^2_{tab(\alpha;5)} = 5.99$; from this results the normality of errors hypothesis cannot be rejected at the total population level, the errors are normally distributed. Because all three hypotheses about the random variable were checked, results that the model is valid.

This theory is criticized by today's reality. It is true that rich countries are those that have the ability to invest in new technology that has the ability to protect to some extent the environment, but let us not forget that an economic growth means more products made, and more used resources which implies more emitted pollutants. (Stern, 2004) Another criticism of this model is given by the fact that pollution is calculated per capita fact that determines that in most cases of some countries with a numerous population (as China) this theory cannot be demonstrated. (Madisson, 2007)

An overlooked aspect by most theories is given by the fact that rich countries do not have an air so polluted because they have developed their industries in other countries in order to keep for them cleaner air. One of the supporters of this idea is the American monetarist Milton Friedman who

recommends the opening of polluting enterprises in poor countries, because in this manner the "United States will breathe fresh air" (Florea, 2008). These countries that allow the development of highly polluting industries on the territory of their country are also called "pollution havens". (Carson, 2004)

Conclusion

More precisely, we can say that Kuznets's theory, according to which countries tend to pollute up to a certain level of GDP respectively that level at which the primary needs and desires of the individual are most satisfied and afterwards for the environmental issues, population health and beauty issue to acquire new dimensions.

It should be added that the theory of Camelia Cămăşoiu and in some cases even that of Kuznets in many writings was considered to be accurate but only if there are certain specifications, additions, such as the fact that the issue of beauty, the desire for a clean environment but especially the aspirations chosen by people can be made to the extent that the state, the form of government permits it. For example, in the case of socialist Romania, dreams, aspirations and desires of individuals were only partially fulfilled, in the manner in which they complied with the requirements imposed by the state. In the situation in which the problem of environmental degradation is not a priority for the state, it was the one that coordinated all activities; their concerns were not heading in that direction.

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