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ECO-BIO-ECONOMIC PARADIGM IN THE CONTEXT OF SUSTAINABLE USE OF RENEWABLE RESOURCES

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Abstract. Public policies used in eco-bio-economy represent a network of interrelated decisions on economic, social, environmental level in order to implement some projects and measures with the purpose to continuously improve the life of current and next generations, by development of the central and local communities abilities to manage and effectively use natural resources, to stimulate innovation in social and environmental areas, by ensuring sustainable agriculture, food security, prosperity, environmental protection, biodiversity and economic and social cohesion.
The topic of this research deals with a new approach to the concept of sustainability analyzed in terms of eco-bio-economic vision, by setting out the main directions of public policies used to initiate global collective measures that can be defined and implemented through an appropriate international framework which is formed in time and is in a dynamic evolution.

Key words: bio-economy; eco-economy; sustainable development; "green growth"; environmental tax policies;

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Introduction

Worldwide the concern to combat the negative effects of climate changes and damages of the ecosystems and biodiversity is imminent in the current financial and food crisis. In this regard, the international community has reached a consensus related to the fact that in order to achieve a sustainable green growth is necessary to integrate the environmental sustainability requirements in key sectors programs and policies of states.

Green growth is a relatively new concept. The basic idea of the decision factors in designing a "green growth" is that environmental potentialities are not currently effectively exploited. The public policies of advertising of "green growth" are intended to promote sustainable development by reconciling the need for environmental sustainability with that of the economic growth and living standards. OECD report (OECD, 2011) underlines five additional

sources of growth by promoting some sustainable environmental policies:*growth of the productivity by use of natural resources; creation of opportunities to encourage innovation; creation of new markets and jobs; growth of investor confidence and assurance of stability in macroeconomic conditions, such as reduced volatility of the price of resources.*

Although there is no international consensus on how to turn operational the green growth in the context of sustainable development, most approaches would include four main elements: mitigation of emissions of greenhouse gases; adaptation of policies to climate changes, environmental protection in terms of ensuring the clean air and unpolluted water, natural beauty and biodiversity; innovation and providing green jobs. The hypothesis that starts the increase of interestfor the switch to green growth is that it will stimulate technological innovation and promote increased competitiveness in emerging industries. The prioritization of each area of interest that was previously mentioned varies from country to country. It is also generally accepted that green growth policies can operate through several channels, such as: prices and tax systems of each country, institutions, investments, social responsibility and innovation and technologies. In a mainstream approach, the optimization of the four elements of green growth focus on environmental protection, including gas emissions, as well as the sustainable management of land and water resources.

This analysis can provide important information and decision factors for the specialty literature having in view the EU policy concern for this new dimension of the economy, namely the bio-economy. Therefore, my research will accomplish a national and European context.

One public policies used in eco-bio-economy is the fiscal policy environment that is an increasingly important part of the EU fiscal policy. The purpose of the environmental tax reform is to reduce energy consumption and gas emissions, as well as the promotion of the development of environmental products and ecological technologies. An efficient charging system with implications for environmental protection can provide fiscal sustainability by achieving stable income distribution and may have implications on the social component. Thus, environmental taxes can ensure sustainable development, which is an essential introduction to the complex relationships between the economy, society and environment.

The factors of policydecision and democratic societies are forced to work in conditions of great uncertainty in the management of natural resources in the exercise of public policy and sustainable development objectives. In such circumstances, scientific information should serve as a basis for decisions about the problems of humanity. In addition, sustainable development is an area of vital importance within communities.

1. Methodology of research

The challenge of the research is to analyze and show theoretical concepts, to identify methods for assessing the impact of environmental policies and to carry out a series of empirical studies that reflect the efficiency and effectiveness of the public policies in eco-bio-economy by assessing the economic and environmental conventions, treaties, projects and measures taken in order to improve continuously present life and future generations.

The choice of the best research methods to achieve a comprehensive analysis in order to obtain different perspectives and to increase the accuracy of the study was influenced by access to data. The research strategy that we used is a mix of coherent research methods, techniques, procedures, tools used to achieve the intended purpose.

In this research we used quantitative research with design of traditional research with which we sought to determine the validity, reliability, objectivity, generalization, and trust the results and conclusions.

One of the biggest challenges in effective and efficient formulating and regulation of some environmental policies is the uncertainty that can interpose when making decisions. By manipulating the exact scenario of the future, and modeling tools properly calibrated, the development of good practice policies would, theoretically,become academic (Kelly JA et al., 2012). The issue of uncertainty regarding the future cannot be solved immediately, and the role of scientific research, models and expertise in implementing effective policies in an efficient way is vital. However, Holling claimed that "science, models, specialty knowledge, expertise and policies based on these are not the final answers, but is only a manner to guide a continuous process of intervention in complex ecosystems." (Holling et. al., 1978).

For the purpose to impress the reality field related to sustainable development and eco-bio-economy at empirical level, in the context of identifying previously accumulated expertise, we investigated relevant and recent references. They provide academic context to define eco-bio-economy by summarizing research in two directions: eco-bio-economy discipline and sustainable development concept and further development of ecological modernization.

It is known by specialists that in the world the American scientist, Lester Brown, one of the pioneers of the concept of sustainable environmental development, launched in 2001 (Brown, 2001), the eco-economic theory, which emphasizes the importance of ecology and environmental protection in sustainable development of mankind, an alarm signal to the Earth's limited

natural resources. "Ecological and economic deficits not only shape our future but also our present," said Lester Brown in October 2010.

Also, after 40 years, the American scientist Nicholas Georgescu Roegen with Romanian origin (Roegen, 1971) launched the concept of bio-economy, which brings into question the role of human being in anthropogenic ecosystems, by presenting statistics on negative energy balance in case of excessive consumption of raw materials and lack of prospects for future generations.

The researcher TerryMarsden (Marsden, 2009) highlights the difference between the two dynamic and intensely debated paradigms: bio and eco-economy that can ensure sustainable development through different paths of development in time, space and place.

In reports on the future of European bio-economy (KBBE, 2010; EuropaBio, 2010; OECD, 2009) it is stated that the basic conditions for successful implementation of its economic and regulatory conditions are favorable. Although bio-economy develops in different ways in different countries (Stuart and Sorenson, 2003), public support and effective coordination are necessary for carrying out the first stage of development of this industry.

In 2012, the European Commission adopted a strategy for sustainable bio-economy in order to ensure the smart green growth in Europe. The goal is a more innovative economy with low carbon use, by reconciling demand for a sustainable agriculture and fisheries, food security and sustainable use of biological renewable resources for industrial purposes, while ensuring biodiversity and environmental protection. Therefore, the plan focuses on three key aspects: developing new technologies and processes for the bioeconomy; developing markets and competitiveness in bio sectors, by forcing policy makers and stakeholders to cooperate more closely. EU bioeconomy already had in 2011 a turnover of almost € 2 trillion and has more than 22 million persons employed, 9% of total employment in the EU.

The need to increase public funding for research and innovation in the bio-economy has been recognized within Horizon 2020 (European Commission, 2012). The amount of nearly 4.7€ billion has been proposed to provide "food security, achieving sustainable agriculture, marine and maritime research and other fields of bio-economy". It is also noted that further actions will be taken in order to combat climate change, resource efficiency and raw materials.

The economic activities related to the production of biomass and subsequent conversion into energy, chemicals, materials and other products called bioeconomy "biobased economy that aims to reduce dependence on fossil fuels and differs from traditional uses of biomass by applying tools and

advanced biological knowledge (OECD, 2009). However, the sustainability of bio-economy has been discussed in recent years due to the impact of economic activities posed to the economy, environment and society, namely those related to competition with food production of food in full crisis and change by using land with implications for the production of greenhouse gases.

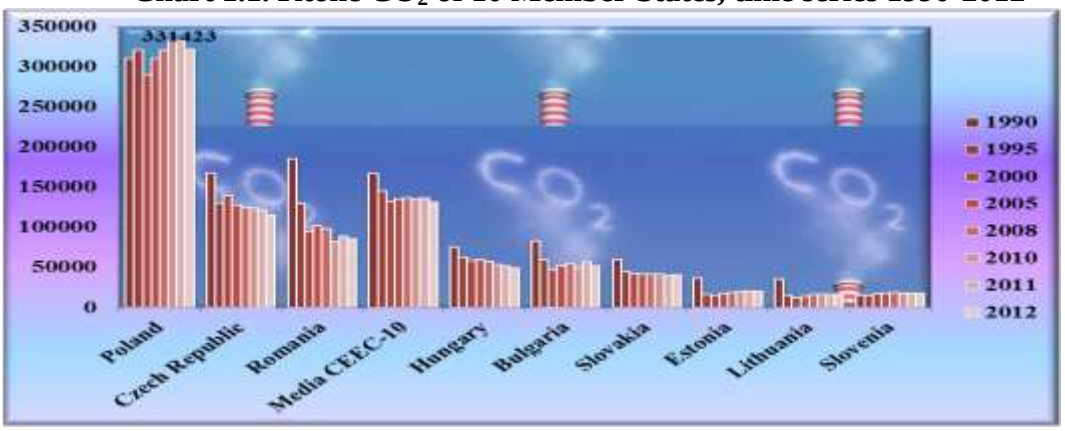
It is important to recognize that the design of the future is inherently uncertain, and the purpose of the modeling exercise is to gain insights into the processes of change in response to actions that occur because of external factors such as changes of policies. As I will argue in this thesis, the reduction of some of the uncertainty results from the environmental policy could be achieved through a model which allows a comparison. This could lead to a final consensus or not, but it may help to improve the modeling knowledge in order to make better informed decisions.

2. Series of data. Instruments used for the data series processing

After joining the European Union on 1 May 2004 the countries of Central and Eastern Europe: Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovenia, Slovakia and January 2007 (Romania, Bulgaria), their main objective was to harmonize the public policies with requirements andEuropean law in order to increase living standards in these countries. For this purpose were carried out profound and coherent economic reforms and fiscal in order to ensure better interaction and coordination between Member States of the European Union and the reduction of the gap between them and the countries of Western Europe.

According to OECD, environmental taxes increases revenues due to payments made on each unit of waste emissions in order to achieve environmental objectives (OECD, 2007) the case study evaluates the performance achieved by each country byoptimal designing of fiscal policy environment and achieving income taking into account that most economic criteria should be a dynamic compatibility with the social-human and environmental dimension (ecological balance) with the view of ensuring sustainable development (Daly, 2008). Then I decided to evaluate which was the impact of environmental taxes on climate change and reducing emissions of greenhouse gases in the post-communist EU countries?

Chart 1.1. Ktone CO_2 of 10 Member States, time series 1990-2012



Source: Own processing of data taken from the database of the European Commission: Emission Database for Global Atmospheric Research (EDGAR)

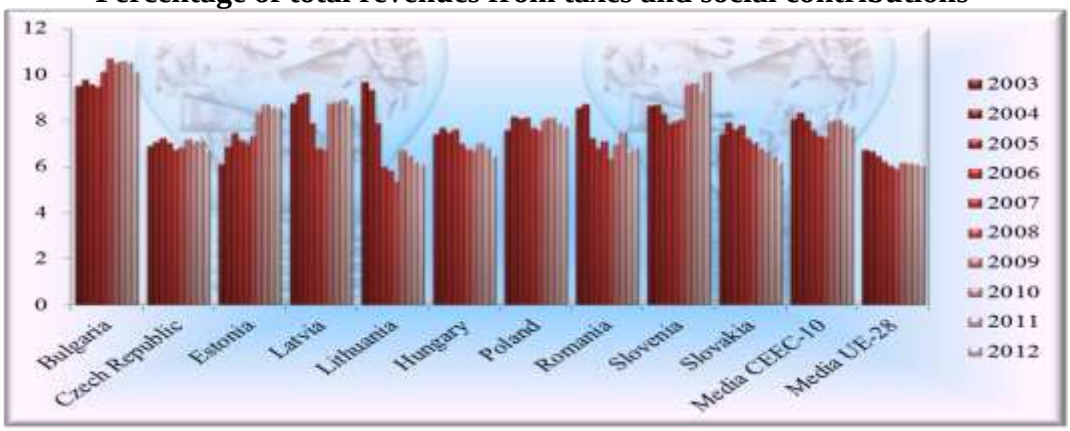
Chart 2.1 shows that in the countries of Central and Eastern Europe, total emissions of greenhouse gases (CO_2) added to the atmosphere, is around 7,4 billion tones in the last 20 years. During this period, the largest absolute increase in CO_2 emissions in CEEC-10 countries this took place in 2010, when Poland has added more than 331 million tons in the atmosphere.

The tendencies of CO_2 emission from 2009-2012 were estimated for the energy sector based on fossil fuel consumption from 2009-2012.In the period 1990-2012, Romania ranks three of the ten post-communist EU countries analyzed in terms of carbon dioxide emissions released into the atmosphere.In most of the 10 CEEC, the carbon dioxide emissions decreased slightly from 2005-2012.

Further, we compared the revenues from environmental taxes as a percentage of total revenues from taxes and social contributions in 10 European countries, members of UE. Between 2003 and 2012, the share of environmental taxes in total tax in the countries of the CEEC-10 exceeded the one registered in the European Union (28 countries), with an average of 7.8% compared to 6.2%.In the same period, the share of environmental taxes in total tax recorded in Bulgaria ranks first among countries post communist in 2008 with a maximum of 10.7% of total fees.

Between 2003-2012, "green" tax revenues in Romania as a percentage of total tax receipts are higher than in Slovakia, Hungary, Czech Republic, Lithuania, but less than the revenues recorded in Bulgaria, Slovenia, Latvia, Poland, Estonia.

Chart 2.2. Total environmental taxes in 10 EU countries in 2003-2012
Percentage of total revenues from taxes and social contributions



Source: Own processing of data taken from the database of the European Commission Eurostat, Environmental Tax Revenues

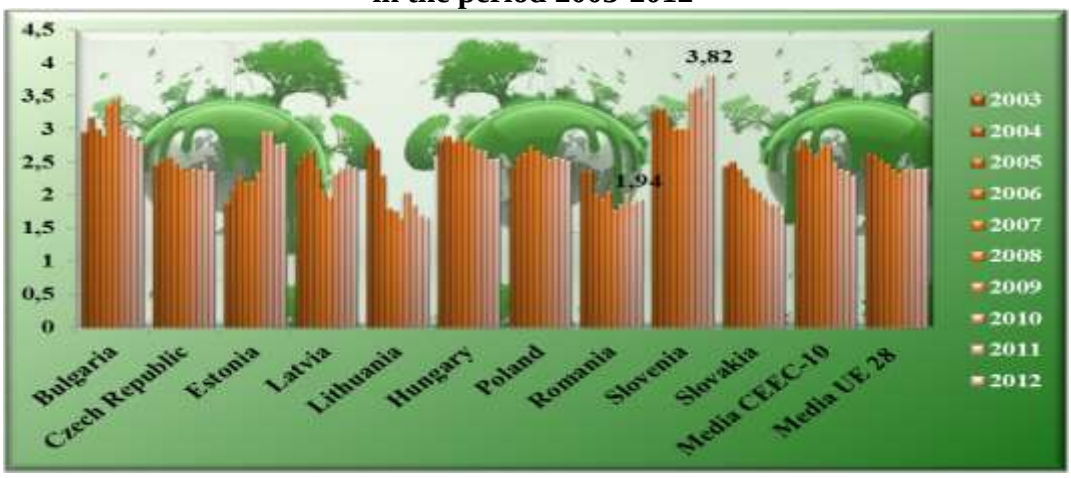
With a rate of 1.94% of GDP, representing 2.5 billion, revenue from environmental taxes in Romania, in 2012, were positioned below the EU-28 (2.4%), ranking 18 place.

Between 2003 and 2012, Romania has received 21 billion Euro of green taxation. Also, at the EU-28 level, Germany charged from environmental taxes a record of 560 billion Euro, and in the countries of Central and Eastern Europe, Poland has received 77 billion throughout the period.

During the analyzed period, the highest level of environmental taxes as a percentage of GDP, was registered in Slovenia in 2012 (3.82% of GDP). In Romania, revenues from environmental taxes as% of GDP decreased with 0.18% in 2012 in comparison to those collected in 2003.

For analytical purposes, environmental taxes are divided into four categories: energy taxes (including taxes of CO_2), shipping charges, pollution and resources taxes. In the countries of Central and Eastern Europe, most of the revenues were realized from excise duties on energy products (with an average of 1.8% of GDP). A percentage of 0.22 from GDP represented the income taxes on transport. In 2014, excise taxes on energy products and electricity in Romania increased.

Chart 2.3. Total environmental taxes as% of GDP in 10 EU countries, in the period 2003-2012



Source: Own processing of data taken from the database of the European Commission EUROSTAT, Environmental Tax Revenues

A structural analysis of environmental tax revenues in the period 2003-2012 shows the predominance of income from taxes on energy and fuels in all Eastern European states. During 2003-2012, the fiscal revenues from these taxes ranged from 0.3% to 0.5% of GDP, close to the EU-27 average, while pollution and resource taxes recorded values between 0.1% -0.3% of GDP.

Chart 2.4 Structure of environmental taxes as% of GDP, average years 2003-2012

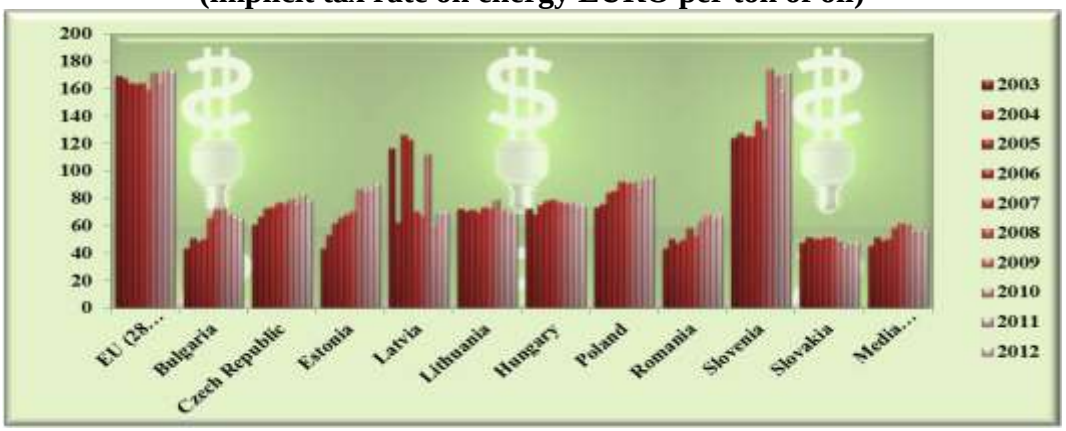
Source: Own processing of data taken from the database of the European Commission EUROSTAT, Environmental Tax Revenues

The largest increase in the percentage of environmental taxes in total taxes and contributions was in Estonia, 2.7% in 1995 to 8.56% in 2012, followed by

Latvia and Bulgaria. One of the explanations for this is that the total tax revenues are lower in Estonia than in other EU countries which contribute to a larger allocation of environmental taxes in total tax. A second reason is the increase in revenues from excise taxes on fuel in Estonia, Bulgaria and Letonia.

According to BP Energy Outlook 2035 report, global energy consumption is expected to increase by 41% from 2012 to 2035 - compared with 55% in the last 23 years (52% in the last twenty) and 30% in the last ten.

Chart 2.5 Excise duties on energy products and electricity (implicit tax rate on energy EURO per ton of oil)



Source: Own processing of data taken from the database of the European Commission EUROSTAT, Environmental Tax Revenues

A percentage of 95% of this increase in demand is expected to come from emerging economies, while energy consumption in advanced economies in North America, Europe and Asia as a group is expected to grow very slowly - and begin to decline in later years of the forecast period. (BP Energy Outlook 2035, 2014)

Oil, gas and coal is expected to register around 27% of the total mixture, in 2035, and the rest will be provided from nuclear, hydro and renewable. Among fossil fuels, gas has the fastest growing. (2014 BP Energy Outlook 2035)

In 2013, excise duty on electricity used by households in Slovenia increased by 3.05%. A further significant increase in excise duty in 2013 compared to 2010 levels was in natural gas used as fuel in Bulgaria (0.42%) and Slovenia (0.4%). Also, a relatively large increase in excise duty on natural gas with over 0.38% in 2013 compared to 2010was in the Czech Republic. In Hungary, where energy taxes formed 2% of GDP in 2010, a significant increase in excise duty on LPG (0.42%). (Male S., 2013)

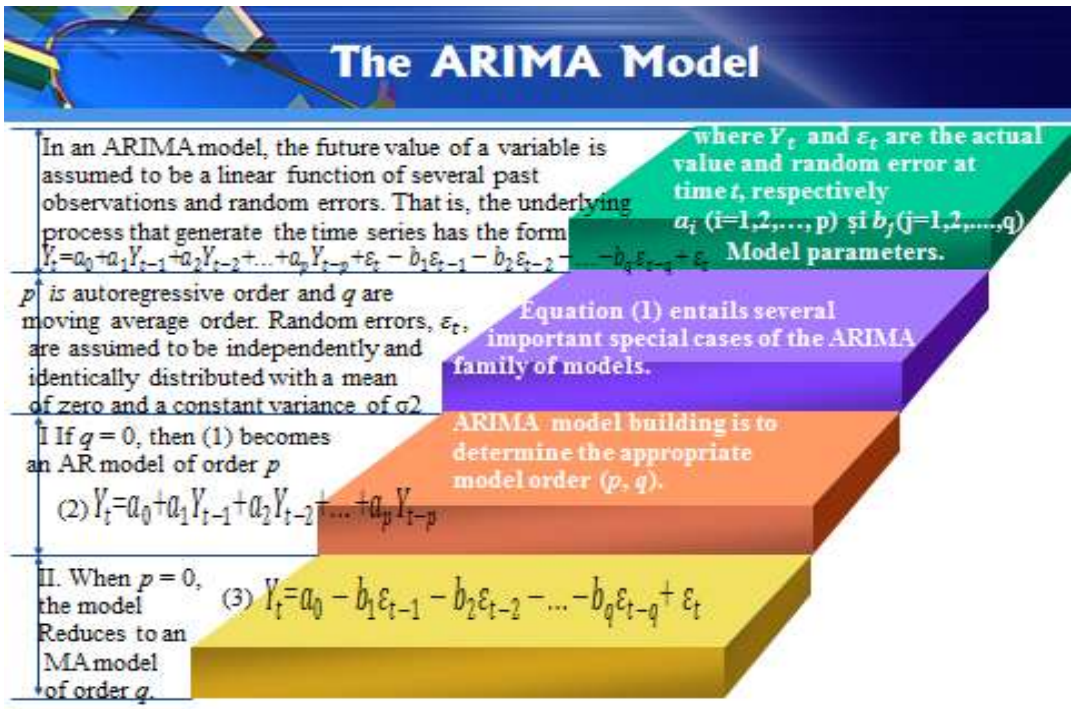
The implicit tax rate on energy from Romania and Bulgaria is 68 or 66 per ton of oil equivalent, while the EU-28 is over a 173.

In "Cold Start for the Green Innovation Machine" article, the authors underlinethe fact that till now, the implicit tax rate on energy in the EU-27 is too small and fragmented carbon price in the EU emissions trading system is too volatile and expenses public research dedicated to energy and environment are too small. (2009, Aghion, P et. Al.)

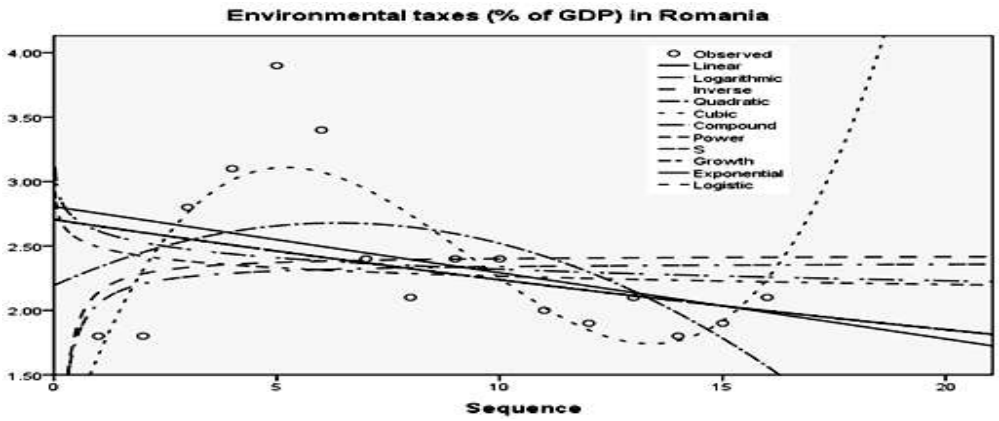
3. Estimation of environmental tax revenues in Balkan countries by using ARIMA model of prognosis

Trend analysis of environmental tax revenues help us to understand how decision factors in Romania have implemented public policy environment through air pollution control and natural resource management and predict whether they will achieve the goal of sustainable development to reduce greenhouse gas emissions greenhouse emissions and ensure action plans of the European Commission for environmental purposes.

The forecasting model of revenues from environmental taxes in Romania is based on the methodology proposed by Box & Jenkins [1], [2], [3], [4] for the prediction of a variable, by using as database only its past and presence.



I noticed that the time series of revenues from environmental taxes as% of GDP in Romania is not stable; therefore we used the stabilization through differentiation of order 1, resulting in this way the order of differentiation *d*. At this point of the analysis I decided that for the values of the parameters *p* and *q*, the ARMA (p, q) models the best stationary series that were obtained. A criterion in this sense is behavior of autocorrelation functions (ACF).



ACF curves led me to the conclusion that income series of environmental taxes as a percentage of GDP is represented by a cubic regression model, as shown in the figure above.

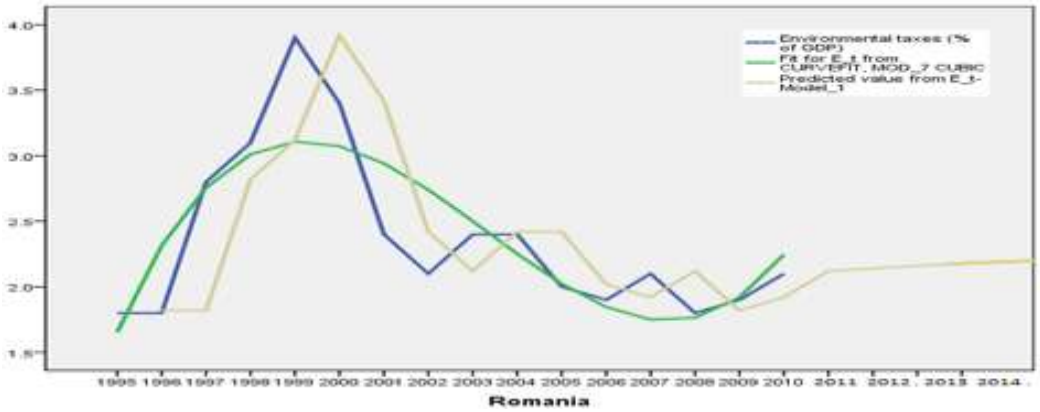
First we calculated the Pearson R coefficient, which has a very high value of 0.855 in Romania. So we can say that R is significant.

Before to forecast the values revenues from environmental taxes as a percentage of GDP for the period between 2013 and 2016, we have to test three hypotheses related to the model errors.Firstly, by using T test, we see that the average error is zero.

By Kolmogorov-Smirnov the normality of distribution was tested. Because the value of Sig. is greater than 0.05 (0.81) the distribution is normal in all three cubic models.Finally, there should be no autocorrelation between errors. Box-Ljung values of ACF diagrams are greater than 0.05, so they are significant for 95% of the analyzed data.

Years/value prognostic	**2013**	**2014**	**2015**	**2016**
Romania	2%	2.12%	2.14%	2.15%

Chart 3.1. Predicted values revenues from environmental taxes as% of GDP in Romania



The ARIMA model is of type (0,1,0). Figure 3.1 shows that the predicted values of the cubic models are very close to the real ones, so we can conclude that the models are correctly chosen.

Conclusions

Following the research I found that there is the potential development of an integrated environment for sustainable development, especially one that incorporates eco-bio-economy, although there are a number of issues that must be considered. In the countries of Central and Eastern Europe, total emissions of greenhouse gases (CO_2) added to the atmosphere is around 7.4 billion tones in the last 20 years. During this period, the largest absolute increase in CO_2 emissions in CEEC-10 countries took place in 2010, when Poland has added more than 331 million tons in the atmosphere.

At the same time we have shown that in most states of Europe, most of the revenue from environmental taxes are made from energy and transport taxes. In order to show that Romania has implemented environmental public policies through air pollution control and natural resource management and to predict whether it will achieve the goal of sustainable development to reduce emissions of greenhouse gases and ensure the action plans of the European Commission for environmental purposes we performed a structural analysis of all revenues from environmental taxes.

The simulation of revenues from environmental taxes in Romania by autoregressive modeltype average ARIMA and the predicted results were explained in details. The final results showed that ARIMA model could effectively be used in simulating and predicting revenues from environmental taxes, and on this basis, the decision factors can make an efficient planning for the future of the regional ecological sustainable development. Currently, in order to ensure eco-bio-economy is necessary to establish economic policies based on

ecological principles capable to support the progress and sustainable development. The transition to a sustainable economy requires changes in fiscal policy by adjustment means of environmental taxes.

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