Approaches to Bioeconomic Modelling in correlation with Consumer Model and Biodiversity Indicators

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Abstract: In this study we analysed the characteristics of bio-economic models in agricultural systems and agro-biodiversity indicators. The classical bioeconomic models are used to analyze the human consumption of ecosystems for production. The analysis focuses on changes in a limited set of agro-biodiversity indicators that matter to human beings. In existing bioeconomic models incorporate ecological complexities and dynamics is limited. Although bioeconomic model provides useful methods to integrate economic values into environmental analyses, improved the dynamic interrelationships between natural processes and socio-economic systems is needed to allow an integrated assessment of multiple values. The overview will enable a more informed decision about whether and how bio-economic models/modeling can contribute to the development of integrated environmental decision support tools. The bio economic modeling it is important for evaluating the costs and benefits associated with environmental resource use.

Keywords: bio-economy; agro-biodiversity; modeling

JEL Classification: HI15

1. Introduction

In the economics literature, bioeconomic modeling is widely advocated as the paradigm to support integrated environmental management and the level of human consumes. The Commission Communication to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, the theme Innovating for Sustainable Growth: A Bioeconomy for Europe of 13 February 2012, stated that Europe is facing an unprecedented and unsustainable exploitation of its resources natural, with significant and potentially irreversible climate change and continuous decline of biodiversity, which threatens the stability of living systems depends. These phenomena are exacerbated by the increasing world population, estimated at over 30% over the next 40 years, and from 7 billion in 2012 to over 9 billion in 2050. Overcoming these complex and interrelated challenges requires research and innovation, to achieve, at all levels of society and economy, the rapid changes, concerted and sustainable lifestyle and the use of

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resources. Welfare and comfort of European citizens and future generations will depend on how the necessary changes will be made. European Strategic Action Plan for the bio-economy and are intended to pave the way towards a society more innovative, more efficient in terms of resource use and more competitive, which reconciles food security with the sustainable use of renewable resources for industrial purposes, ensuring at the same time, environmental protection. Strategy and Action Plan will provide content and innovative research programs in bio sectors and will help create a more coherent policy framework to better match the existing bio-economy policies at national, EU and global and the establishment of a more engaged public dialogue.

The bioeconomy strategy is that by 2050, biodiversity and ecosystem services provided - its natural capital - are protected, valued and appropriately restored for biodiversity's intrinsic value and for their essential contribution to human wellbeing and economic prosperity. The term bioeconomic is used to indicate that a model has both economic and biophysical components (Knowler, 2002). Bioeconomic models are extensions of traditional mono-disciplinary economic models, which typically aim to quantify human uses of ecosystems for production and consumption activities (Braat & van Lierop 1987). Successful integration of biological analyses and economics still constitutes a major challenge, both from the perspective of economic models incorporating biological data, and biological models integrating sound economic analyses. Economic theory stresses that the needs and wishes of the people (consumers) are allocated to “shaping” all economic activities. This idea is expressed in the literature as 'consumer sovereignty' in the sense that individuals, ie those who consume, are important for the economy. There are two types of response rather different question why consumers are important in an economy. One assumes traditional expressed by A. Smith, that final consumption is the ultimate goal of all economic activities; production and distribution takes place only to increase consumer welfare. In this view, consumers are justifying economic activity and, thereby, and economic theory. The other answer is the fact that people who say the economy because it generates demand for goods and services. Without this application, offer (production) in the economy would dilute or disappeared. Producers cannot continue production if no one buys their products. From this perspective, consumers are a source of demand that central mechanism that makes the economy work. Consumption is part of the life of each individual and an expression of wealth. Individuals have different needs, you meet using generally certain goods and services purchased, obtained by themselves in their own households or provided free or at prices lower than the market by institutions or government agencies (e.g., services health or education). Beyond the arguments justifying the importance of household consumption for the production process, it is based on other reasons that go from the reality that people means more than being only in the sense that consumers consume most direct link level objectives living.

The standard of living is a broader concept, meaning that its objectives are related to compliance with the set of human needs (basic or otherwise), but also obtain satisfaction through the use of goods and services. Consumption of goods and services as a whole and its composition, is one of the most relevant expressions of the living standards of the population of a country or human communities and direct way of measuring living standards. Along consumption, revenue is used as another measure of living standards of the population.

This method of measurement is found generally in developed countries that used to measure poverty (and the poverty line) income and not consumption. World Bank is developing projects to combat poverty in developing countries, with a strong emphasis on the use of consumption poverty measurement as one of the important landmarks in assessing the living standards of the population of a country. The choice of income or consumption to measure living standards is based on both theoretical considerations and practical. In theory the choice between income and consumption to measure living standards does not appear explicitly as they are considered in their totality are consumed income and the income and consumption are identical. In practice, there are significant deference between income and consumption, each with its significance in assessing the standard of living. The first is the savings, when the difference between income and consumption is positive. The accumulation of savings in household income can have an important significance for living standards, especially future generations. The second is the diseconomies, the difference between income and consumption is negative. This is the case particularly when elderly population who consume more than they earn, using savings during their working lives, whether this happened. Each of the two variables - income or consumption - expressing different aspects of living standards of the population, so these two economic aggregates should not be seen as opposites, but complementary.

The terms “sustainable consumption” and “sustainable production” are part of the current of thought that support sustainable development, the current generated by concern for use with greater care resources (natural) and environmental protection. In this context, consumption itself is not seen as a threat to current and future development, but the consumption pattern of negative environmental effects. In the system of national accounts, private consumption is captured as a component of gross domestic product (GDP) measured by expenditure approach, the group “final consumption expenditure”. The final consumption expenditure of households cover expenditure for the purchase of goods and services which are directly used to meet the individual needs of their members. The “final consumption of households” has a special significance in macroeconomic analysis, showing how a country's production achieved in one year is for individual consumption of the population. This part of the production (GDP) is spent on meeting individual needs has the highest proportion of GDP (55-75%), depending on the policies aimed at welfare and those pursuing economic development of a nation, long-term (savings and investments). Final consumption expenditure of households is also used in international comparisons is an important element in evaluations of development and welfare policies of different countries, in the medium and long term. In the EU projections on GDP growth the level in the period 2012-2018 is decreasing (fig.1).

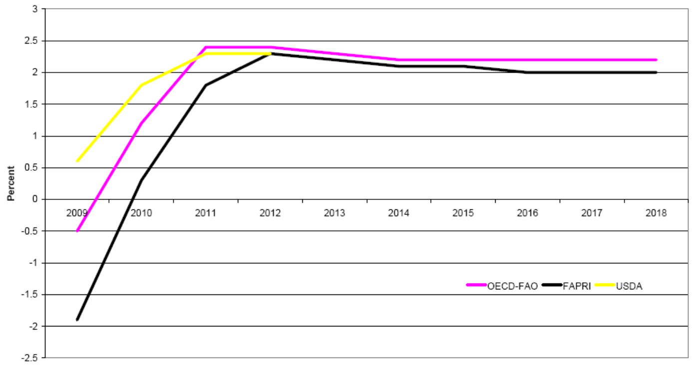

Figure 1. Projections on GDP growth 2009-2018 (EU)

Source: European Commission (2009)

The main methods of analysis used to highlight the influence factors on changes in consumption in general, consumer spending funds in particular are: regression and correlation and elasticity calculation. The regression method can reveal the relationship between the dependent variable (request, expense etc.) and the independent variable (income, price etc.) on the basis of functions called regression functions. The ratio of the number of factors taken into regression analysis is simple or multiple. In a simple regression linear form, ($Y = a + bx$), b parameter called regression coefficient how much the changes (increases or decreases) in average variable of results / dependent to change the unit of the variable factor. The sign of the parameter b depends on the direction of the link: $b > 0$ indicates a direct effect; $b < 0$ indicates a reverse effect. Correlation method is used in direct connection with regression and consists in determining indicators (such as correlation coefficient, correlation ratio) which measures the intensity of the relationship between the dependent variable and the independent variable (factors), the degree of influence of each factor considered important. The calculation of elasticity generally demand (purchases) income and price developments in particular is also a commonly used method to analyze the influence of these factors consumption.

2. Material and Methods

Agro-economic models are mainly used to predict the impacts of changes in environmental resources (soil and water quality) on agricultural production. Bio-economic modeling of agricultural systems can be characterized by three different methods: mathematical programming, regression and accounting. Regression models use statistical estimates of region-specific agro-biodiversity production functions based on observed relationships between physical characteristics of the land and farm inputs, policies, prices.

The regression models are constructed from observed historical relationships and can therefore not easily predict alternative future scenarios and not include feedback effects between changes in agricultural production and environmental conditions. The following example will be estimated and a regression equation to illustrate a model water exploitation index (WEI), population in Romania and greenhouse gas emissions by sector (1 000 tones of CO2 equivalent)- GGE using in period: 1990-2014. Series used: water exploitation index (WEI).-population (POP), greenhouse gas emissions (GGE) by sector (1 000 tones of CO2 equivalent) since 1990 with the data source: www.insse.ro-Tempo-online database. For a description of the analyzed phenomenon we built a model of the form:

D(WEI)= C(1)*(POP) + C(2)*GGE+ C(3) + C(4)*T

Dependent Variable: D(WEI)
Method: Least Squares
Date: 04/15/15 Time: 12:31
Sample (adjusted): 1991 2014
Included observations: 24 after adjustments
D(WEI)= C(1)*(POP) + C(2)*GGE+ C(3) + C(4)*T

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	8.590005	0.000302	0.284523	0.7789
C(2)	-8.720005	0.000334	-0.261245	0.7966
C(3)	-2408.544	7146.130	-0.337042	0.7396
C(4)	34.43051	45.55658	0.755775	0.4586

R-squared	0.196286	Mean dependent var	-100.0000
Adjusted R-squared	0.075729	S.D. dependent var	343.2200
S.E. of regression	329.9684	Akaike info criterion	14.58688
Sum squared resid	2177583.	Schwarz criterion	14.78323
Log likelihood	-171.0426	Hannan-Quinn criter.	14.63897
F-statistic	1.628155	Durbin-Watson stat	1.441306
Prob(F-statistic)	0.214506		

With option View/Actual, Fitted, Residual/Actual, Fitted, Residual Graph it si represented the effective value of the dependent variable, the estimative value and regression errors. (Fig.2)

Figure 2

Adjusted / Estimated water exploatation (green line) is close to the empirical value of an endogenous variable (red line). The blue line, and is thus the graph residues, which may be the difference between two values above the other.

Estimation Command:

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LS D(WEI)= C(1)*(POP) + C(2)*GGE+ C(3) + C(4)*T

Estimation Equation:

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D(WEI)= C(1)*(POP) + C(2)*GGE+ C(3) + C(4)*T

Substituted Coefficients:

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D(WEI)= 8.595*(POP) - 8.717*GGE- 2408.5 + 34.4*T

3. Results and discussions

In the model developed there is a direct relationship between water exploitation index (WEI) and population growth POP, and a statistically insignificant relationship with the greenhouse gas emissions (GGE).

The coefficient of population growth (POP) from regression model it is $\hat{\beta}_1$ = 8.598 and standard error $SE(\hat{\beta}_1)$ = 0,003, and statistic $\hat{t}_1$ = 0.28, calculated : $\hat{t}_1 = \frac{\hat{\beta}_1}{SE(\hat{\beta})_1} = \frac{\text{Coefficient}}{\text{Std.Error}}$; valoarea p (*p value*) = 0.77, which shows that the population is an important factor influencing the water exploitation index WEI.

The coefficient of greenhouse gas emissions (GGE) is $\hat{\beta}_2 =$ -8.717, eroarea standard $SE(\hat{\beta}_2) =$0,03, iar statistica $\hat{t}_2$ = -0,26. The sign of parameter does not influence the result of comparison between t and t calc spreadsheet calculation is used because the estimated absolute value.

The value of this probability is 0.79. The value of t calc (8717) is higher than the value of t table (0.003) and therefore greenhouse gas emissions (GGE) is an important factor influencing the water exploitation index.

The coefficient constant term in the regression model is = -2408.5, standard error = 7146, t-statistic = 0.33 expressed, with probability p value of 0.73. So the term is significant endorsement for the regression model chosen.

Report of determination (R2) shows the percentage is explained by the influence of significant factors. It is calculated as: use in assessing the quality of the model. It can take only values in the range [0,1]. The values are closer to the value 1, the model is better.

The regression model is specified in this period we can say that growth can explain variation greenhouse gas emissions (GGD) with water exploitation index (WEI) consumption.

The agro-biodiversity models can optimize demand for environmental inputs that would maximize farm profits, subject to input and/or output prices, available capital or labor, and prevailing environmental conditions in the context of climate or land availability. Optimization models have the advantage of allowing a detailed specification of farm management activities and restrictions simultaneously, including technologies, multiple crop rotations, livestock management, and different soil. The analytical focus of agro-economic optimization models is typically that of profit maximization or cost minimization, with environmental parameters exogenous to the model such as account for environmental pollution impacts from agriculture Extensions in bio-economic farm modeling will need to allow integrated analyses of multiple values (environmental costs and profits) affected by agricultural systems.

Biodiversity is the main indicator, which expresses the durability and stability of the area in direct relationship with life and the environment. Monitoring biodiversity both quantitatively and qualitatively gets us in contact with the environment, as the biodiversity is in continuous change. Solely through measuring biodiversity one can perceive the sudden changes that directly affect the quality of life. Following the indicators of diversity a reconsideration of the proportion of domestic animals can be made, bearing in mind the number of animals per hectare, according the law. The correlation of biodiversity with demographic pressure and the determination of the structure of animal numbers and of the coefficients established by the CE Regulation.

4. Conclusion

The Bio-economic models are based on the economic paradigm that values are derived from *impacts on human welfare*. The objective function in bio-economic models is to allocate environmental resources to those uses that yield the highest net benefit to human beings. Assessing the impacts of environmental management changes requires analyses of human welfare effects. Develop a new Bio-economic model it is necessary for development of human society requires a change of old concepts, especially economic ones and their connection to specific environmental management and the current crisis. In this respect, the basic components of the concept of sustainable development are: bio-economy and environmental protection. Thus, the bio-economy should develop mechanisms, criteria, tools, models of social development. Finding optimal alternatives between economy and environment depends on the ability of decision makers to choose and use financial and economic instruments to promote environmental protection activities: taxes (taxes) that can be promoted in the form of tax differentiation; subsidies that encourage change in attitude and funding available to stop pollution; introduction of new mechanisms of market economy (trade emission rights, insurance); incentives for financial consolidation etc. Bio-economic modeling allows this assessment by evaluating the costs and benefits associated with environmental resource use. Bio-economic models offer a useful addition to existing biophysical/ecological models by allowing thorough analyses of socio-economic values, and making testable predictions about environment-human interactions. It is now to develop the integrated modeling, and use the bio-economic modeling experiences, as economic costs and benefits. Future modeling efforts should aim to include market and nonmarket impacts of environmental changes in their framework. Enhanced representation of natural processes and dynamics would improve the ability of bio-economic models for IA of various policy objectives. This necessitates a more integrated approach that acknowledges the multiple linkages and feedbacks between natural and socioeconomic systems.

In our reserch we developed one model using the series from water exploitation index (WEI), population in Romania and greenhouse gas emissions by sector - (GGE) using in period: 1990-2014.Theoretically with GGE growth should increase the water exploitation index (WEI) , but up to a certain level. The econometric model has shown that water exploitation index needs at the individual level is approximately constant, being influenced by specific biological factors and influences population growth and greenhouse gas emissions, which directly influences can have negative impacts on biodiversity agro ecosystems.

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