VYTAUTAS MAGNUS UNIVERSITY
Faculty of Bioeconomy Development

The Dynamic Impact of Economic and Social Factors in Agriculture on the Ecological Footprint: The Case of Lithuania

Algirdas Justinas Staugaitis, Daiva Makutėnienė
Vytautas Magnus University Agriculture Academy, Studentų str. 11, LT-53361 Akademija, Kauno r.

SBD CONFERENCE

Introduction

Human economic activities, whether agricultural or otherwise, frequently have a negative impact on ecosystems, resulting in serious environmental problems such as environmental degradation. The increasing concentration of carbon dioxide in the atmosphere is one of the primary causes of global warming, so the number of droughts, floods, hailstorms, hurricanes, landslides, and other natural phenomena that disrupt people's activities and lives is increasing all over the world. On the other hand, increased economic activity may provide additional resources to combat environmental issues and raise society's environmental awareness. As a result, the environmental Kuznets curve (EKC) is frequently used when analysing a country's potential and challenges in sustainable development, green economy, and green growth. This hypothesis tests whether there is an inverse "U" shaped relationship between energy use and economic development growth and is especially important when analysing developing countries to assess whether, at a certain point, ecological footprint use begins to drop, resulting in fewer greenhouse gas emissions.

Reducing carbon dioxide (CO_2) emissions is the primary means of mitigating the adverse effects of global climate change, which has attracted significant attention from around the globe. The growth of carbon dioxide (CO_2) emissions is caused by many factors, including economic growth, financial development, urbanisation-related and other social factors, the use of renewable energy, etc. In this context, agriculture also plays a very important role, as it is one of the main sectors in terms of CO_2 emissions in the world and in the European Union.

This research aims to empirically examine the impact of social and economic factors on ecological well-being in Lithuania.

The research seeks answers to the three questions:
1) Is the EKC hypothesis of an inverted U-shaped ecological Kuznet's curve valid?
2) Does the percentage of the labour force working in agriculture contribute to environmental degradation, and to what extent?
3) What factors lead to environmental degradation in Lithuania?

The main research hypotheses can be stated as **H1**: economic growth has a positive but reducing effect on the ecological footprint;
H2: the ratio of labour force working in agriculture has a positive effect on the ecological footprint;
H3: economic factors have a positive effect on the ecological footprint.

Eurostat databases are used to gather data on all selected indicators. To compare the economic outcomes of various nations, the gross value added is analysed in purchasing power parities at the current prices for each year.

Methodology

The aim of this research is to analyse the impact of social and economic factors on ecological well-being in Lithuania. Variables used in the study include ecological footprint (global hectares per capita), social (percent of labour force working in agriculture) and economic (economic growth, renewable energy consumption, trade openness) factors.
The research analyses Lithuanian data from 1995 to 2022 and applies the autoregressive distributed lag (ARDL) for time series analysis.
The dependent variable, in this instance, changes (Δ) in ecological footprint, can be explained through short-term and long-term effects from previous time periods. The classic definition of the ARDL model is provided below:

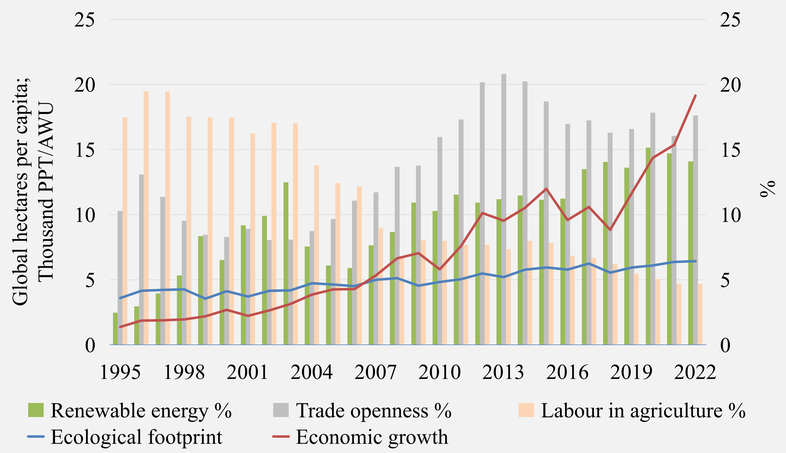
$$\Delta Y_t = \mu + \rho Y_{t-1} + \theta X_{t-1} + \sum_{i=1}^{p} a_i \Delta Y_{t-1} + \sum_{i=0}^{q-1} \omega_i \Delta X_{t-1} + \varepsilon_t.$$

where: Y is the dependent variable; X is the independent variable; μ, ρ, θ, a, ω are model parameters; ε is the residual error; Δ is the change in the first order; i is the time lag; p and q are the number of time lags; and t is the time.

The ARDL model is used as a multiple regression model. After calculating the coefficients and p-values, statistically insignificant variables are removed from the model. To test the EKC hypothesis, the parameter θ should be statistically significant and negative.

Results

We provide a graph illustrating the dynamics of the variables used in the study.



The dynamics of the variables used in the study

Results

Next, we provide the results of the ARDL modelling indicating coefficients and p-values for each variable in absolute terms and changes in that variable.

Results from the ARDL modelling

Full model			After omitting insignificant variables	
Variable	Coeff.	p-value	Coeff.	p-value
const	0.1128	0.9057	1.0351	0.0016
Economic growth (-1)	0.1863	0.3427		
Renewable energy (-1)	0.0349	0.7213		
Trade openness (-1)	0.0204	0.8903		
Labour in agriculture (-1)	0.1328	0.4369		
Ecological footprint (-1)	-0.5280	0.2925		
Δ Economic growth (-1)	-0.1214	0.4359	0.1913	0.0026
Δ Renewable energy (-1)	0.0649	0.6178		
Δ Trade openness (-1)	0.1541	0.4637		
Δ Labour in agriculture (-1)	-0.0036	0.9862		
Δ Ecological footprint (-1)	-0.1672	0.6524	-0.8451	0.0017

From the results provided only constant, change in economic growth and previous changes in ecological footprint have a statistically significant effect on changes in ecological footprint. The effect of economic growth has a positive coefficient value, therefore, only H3 can be partially accepted. Economic growth in absolute terms has no negative sign, therefore. There is no evidence that economic growth has a reducing effect on the ecological footprint.

Main conclusions

- The research results indicate that only economic growth has a significant effect on the ecological footprint in Lithuania. However, this effect is linear, showing that there is no evidence for a point in economic growth when the ecological footprint starts to reduce or stabilise.
- The ratio of labour forces working in agriculture has a negative effect on the ecological footprint, but this effect is not statistically significant. Another important observation from this study is that ecological footprint grows at a reducing ratio; however, the p-value for this effect is > 0.05.
- The study has important practical implications. The study demonstrates that while economic growth can have potentially beneficial effects on greenhouse gas emissions, it is insufficient on its own to improve environmental quality. The primary responsibility of policymakers is to address these issues.
- Future research can be expanded by using extended ARDL versions, such as NARDL, in order to assess the asymmetry between economic growth and ecological footprint. The research can also be expanded by adding more countries to the study.

If it is a part of the project, please put here the information and logo