

# Discussion on Collaborative Teaching of Econometrics in the Field of Environmental Economics

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**Abstract:** To capitalize on the synergies between the Econometrics course and the Environmental Economics major, this paper aims to enhance students' ability to conduct empirical analysis and practical application using econometric models. It also seeks to promote collaborative teaching through case studies and model research. The primary focus is on the hot research issues within the field of environmental economics, utilizing the econometric model as a vehicle for instruction. To achieve this, the paper proposes the development of a comprehensive case library specific to environmental economics. This resource will serve to optimize the case teaching approach, incorporating the use of econometric software, and fostering interactive teaching models between educators and students. By implementing these strategies, the paper outlines a path and mode for collaborative teaching that effectively bridges the gap between econometrics and environmental economics.

**Keywords:** Econometrics; Environmental economics; Case teaching method

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## 1. Introduction

Econometrics plays a crucial role in the education of undergraduate students majoring in economics as it serves as a bridge between economic theory and real-world phenomena. By utilizing mathematical and statistical methods, econometrics enables students to understand economic theory and apply statistical tools and models to solve practical problems. The Econometrics course is mandatory for economics students<sup>[1-3]</sup>. According to relevant research data, more than 50% of students expect to integrate theoretical knowledge with practical applications through case teaching. They aim to develop skills in using econometric models and software tools to address practical economic problems<sup>[4-6]</sup>. Therefore, case teaching is of great importance in the field of econometrics, providing students with a challenging and practical learning environment where they can apply their acquired knowledge and skills to real-life scenarios. This teaching method enhances students' empirical analysis ability, teamwork skills, and innovative thinking, thereby laying a solid foundation for their future academic research or career development<sup>[7-9]</sup>.

However, the current teaching approach in econometrics has certain limitations. The main focus is on theoretical teaching, lacking practical case analysis and interactive teaching methods. Consequently, there is a disconnection between the theoretical system and its practical application. Moreover, the classroom instruction primarily revolves around classic econometric models, while the teaching cases used are outdated, failing to timely incorporate social and economic hot topics. As a result, students' interest and their ability to independently analyze real economic problems are compromised<sup>[10-13]</sup>. To address these issues, it is necessary to not only stay updated on modern econometric theory and methods but also comprehensively apply various knowledge from economics courses to conduct empirical case studies that align with students' interests. A comprehensive and systematic approach should be adopted to analyze problems in econometrics<sup>[14]</sup>.

Econometric models are highly effective in addressing research issues within the field of environmental economics. Environmental economics is an applied economic course that emerged due to resource and environmental issues such as climate change, energy, water resources, and ecological environment<sup>[15,16]</sup>. It possesses strong theoretical and practical significance, as well as an interdisciplinary nature. With the increasing focus on global climate change and the commitment of the Chinese government to carbon neutrality and carbon peaking goals, the importance of environmental economics in China is becoming increasingly prominent. This interdisciplinary discipline can provide a scientific basis for government decision-making, promote sustainable development, and protect the ecological environment<sup>[17,18]</sup>. Econometric models play a vital role in empirical analysis within the field of environmental economics, aiding researchers in evaluating the effectiveness of environmental policies, exploring the relationship between the environment and the economy, and predicting future environmental changes.

In order to enhance students' ability to conduct empirical analyses and solve practical economic problems using econometric models, it is essential to focus on hot research issues in the field of environmental economics. By allowing students to combine relevant theories from environmental economics with econometric modeling methods, they can effectively analyze and address prominent environmental problems. Consequently, their abilities to work in resource and environmental management and related fields will be significantly improved. Moreover, this approach helps to cultivate students' understanding of the rational and efficient utilization of natural resources, the protection of the natural environment, and the importance of sustainable development. It also fosters their sense of social responsibility, professional literacy, and spirit of unity and cooperation.

## **2. Analysis of the key measures for collaborative teaching**

### **2.1. Establishment of a case library in environmental economics**

The application of econometrics in the field of climate change is extensive. By establishing appropriate econometric models, in-depth analysis of climate change issues can be conducted to evaluate policy effectiveness, assist decision-making, and provide a scientific basis for addressing climate change. Teachers can build a case library focused on the following main areas:

- (1) Environmental assessment and pricing case: By employing evaluation and pricing models such as the Cobb-Douglas production function, input-output model, cost-benefit analysis, and ecological footprint assessment model, the economic value of environmental resources can be explored. This facilitates the measurement of environmental resource utilization and management costs. For instance, optimization models can determine how to allocate limited resources reasonably while ensuring sustainable development, thereby achieving a win-win situation of economic benefits and environmental protection.
- (2) Cases related to energy and carbon emissions: In the process of achieving carbon neutrality and

peaking, environmental economics provides economic assessment tools and policy recommendations. These tools examine how to promote energy transformation and low-carbon economic development through economic means, resulting in reduced carbon emissions. For example, building multiple regression models to analyze the carbon pricing mechanism and influencing factors aids in improving China's carbon emission trading market. It also incentivizes enterprises and individuals to reduce carbon emissions and promotes the development of low-carbon technologies. Spatial autocorrelation models and spatial econometric models can be constructed to analyze the spatial heterogeneity and correlation of carbon emissions. Additionally, full lifecycle analysis models can assess the carbon emission footprints of different industries and products, thus exploring optimized emission reduction paths.

- (3) Sustainable development policy analysis case: Environmental economics studies the economic policies necessary for sustainable development, including resource management, environmental taxation, and subsidy policies. By constructing models to simulate the impact of different policy options on the environment, decision-makers can better understand the possible outcomes of policy measures. This enables the formulation of the most effective environmental policies based on model results. Through comprehensive consideration of social, economic, and environmental factors, environmental economics provides support for the government in formulating scientifically sound and reasonable sustainable development policies.
- (4) Evaluation case of emission reduction policies: Econometric models can be used to evaluate the effectiveness and cost of different emission reduction policies. For example, dynamic panel data models can analyze the impact of carbon pricing policies on greenhouse gas emissions. Additionally, econometric models can analyze the impact of energy subsidies on energy consumption and economic growth, thus evaluating the cost-effectiveness of subsidy policies and the impact of subsidy adjustments on the economy. Predicting and simulating models can assess emission reductions, economic costs, and other relevant indicators under different policy options. This supports decision-makers in formulating the most effective emission reduction policies <sup>[19,20]</sup>.

## 2.2. Optimization of case teaching methods

Case teaching holds significant importance in econometrics education. Firstly, it allows students to combine abstract theoretical knowledge with practical situations, reinforcing their understanding and mastery of concepts and methods while fostering problem-solving skills. Secondly, case teaching trains students' skills in collecting, organizing, processing, and analyzing data. This is beneficial for cultivating their empirical analysis skills and equipping them with the necessary tools to address practical economic problems. Furthermore, case teaching often takes place in small groups, enabling students to exchange ideas, share experiences, and collaborate on solving case-related issues. Lastly, case teaching encourages students to consider how they can apply econometric theories and techniques to identify and analyze economic problems in the real world. It prompts them to propose innovative research methods and practical solutions.

Several key steps are involved in conducting case teaching of econometrics in undergraduate classrooms:

- (1) Selection of appropriate cases: Teachers guide students in raising relevant research questions and selecting cases from the constructed environmental and economic case library. This promotes students' engagement and enhances their practical skills.
- (2) Guiding students in problem analysis: Before modeling, students collect and organize data based on the requirements of the case. Teachers guide students in obtaining data from databases, statistical

yearbooks, or online resources. Students learn how to handle data, deal with outliers and missing data, choose suitable econometric models for problem analysis, interpret model results, and discuss the impact of research conclusions on environmental and economic issues.

- (3) Encouraging teamwork: Through group discussions and collaborative projects, students are encouraged to communicate and collaborate with one another, enhancing learning outcomes.

### **2.3. Utilizing econometrics software**

Econometrics software is specifically designed for conducting econometric analysis and modeling. These tools offer rich functionality and statistical methods, enabling researchers to process data, estimate models, conduct hypothesis testing, and generate corresponding results and reports. Commonly used econometrics software includes Stata, R, EViews, and Matlab. For undergraduate students, learning to use EViews software for empirical analysis is appropriate. EViews is a commercial software that focuses on econometric analysis. It can estimate and infer various econometric models, such as regression analysis, panel data models, and time series models. Through its functions, parameter estimation, hypothesis testing, confidence intervals, and other operations can be performed to obtain quantitative explanations and predictions of economic problems. EViews provides an intuitive and user-friendly interface along with various econometric tools, suitable for beginners and professional researchers alike. In the classroom, guided by teachers, students learn to use econometric software, thus improving their data processing and analysis skills through practical operations and model estimation. Students are encouraged to utilize EViews software for empirical research and to write empirical papers. By collecting data, constructing models, and interpreting results, students gain a deeper understanding of environmental and economic issues and make valuable contributions to research using econometric methods.

### **2.4. Developing an interactive teaching model**

In terms of teaching methods, innovative and diverse approaches should be employed. Exploring the use of teaching methods such as “case-based,” “thematic,” “discussion-based,” and “peer evaluation-based” can promote teaching reform and practice in econometrics. These methods stimulate students’ enthusiasm and initiative in learning, and enhance the educational role of the curriculum while improving teaching effectiveness. The case-based teaching method uses standardized cases provided by textbooks to guide students in case analysis and discussion, enabling them to deepen their understanding of relevant theoretical knowledge points. The discussion-based teaching method is integrated throughout the entire teaching process, with 3–5 people forming study groups to discuss and analyze the scientific application of model methods and the rationality of results. The peer evaluation teaching method involves students presenting their actual case results to teachers and other students for evaluation and feedback. Similarly, students should also evaluate and provide feedback on the effectiveness of teachers’ explanations. This mutual evaluation promotes the improvement of teaching effectiveness.

## **3. Conclusion**

In the teaching of econometrics, it is imperative to establish a bridge between important courses in related majors and practical work. Through research-based case teaching methods, students recognize the importance of relevant courses and learn how to apply their professional knowledge to solve practical problems. By constructing a distinctive case library related to environmental economics, guiding students in the use of econometric software, and fostering empirical paper writing during case teaching, students’ practical and application skills are enhanced. This cultivates their problem-solving skills in environmental and economic

issues, thereby providing strong support for the development of environmental economics and the resolution of environmental problems.

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