

# The Significance of Introducing Mathematical Theoretical Models in Undergraduate Teaching of International Economics in China

Yuwen Gong<sup>1</sup>, Miaomiao Zhang<sup>1,\*</sup>

<sup>1</sup>School of International Economics and Trade, Anhui University of Finance and Economics, Bengbu, Anhui 233030, China

---

**Abstract:** In the process of teaching International Economics at the undergraduate level in China, students are often found to be negative to learning the ‘complex’ mathematical models. Based on this phenomenon, this paper discusses the reasons for students’ negative feelings and the significance of teaching mathematical models, and finally proposes corresponding teaching suggestions. The results of this paper show that it is far more important for undergraduate students to understand the meaning of constructing ‘mathematical theoretical models’ for ‘complex’ mathematical models in international economics than for students to ‘memorize’ the specific process of model construction. As instructors, they should focus on the development of students’ ‘intuition’ in economics rather than the simple transmission of knowledge. The teaching methods and assessment methods of the courses need to be reformed, and there is an urgent need for universities to promote the reform in collaboration.

**Keywords:** International Economics, Undergraduate Education, Mathematical Models, Teaching Reform.

---

## 1. Introduction

International Economics is a branch of Economics that studies the optimal allocation of scarce resources in the world and the science of international economic relations that occur in the process [1], while Economics is a science that studies how a society uses scarce resources to produce valuable goods and distributes them among different individuals [2]. It can be seen that there are similarities between the two courses, they both study the optimal allocation of resources and both of them are social sciences; the difference between the two lectures is that International Economics is a worldwide study of the optimal allocation of resources among sovereign societies, while Economics is a study of society, and human society contains multiple dimensions, such as cities, provinces, countries, cultural regions, etc.

In view of the above, the International Economics textbooks at the undergraduate level usually analyze international economic problems based on the basic tools of Economics, such as production possibility curves, social non-differentiation curves, Edgeworth box plots, provision curves, etc. These basic tools are the ‘mathematical theoretical models’ in the textbooks which will be discussed in this paper. In the actual teaching process, it is not difficult to find that undergraduates are negative to the learning of ‘mathematical theoretical models’ during studying the lecture of International Economics, which is considered ‘tedious, boring and difficult to learn’, and students are not highly motivated to learn [3].

## 2. Problems in Teaching Mathematical Theoretical Models

### 2.1. Lack of Practical Application

One of the basic characteristics that an economic model should have been ‘replicability’, which means that the basic mathematical model can be improved so that it can be used to study ‘new’ problems in the real economy. However, at the stage of undergraduate education in China and other countries,

the mathematical theoretical models in the textbook ‘International Economics’ are all simplified models. The advantage is that it can help undergraduates to better understand the theoretical content. but it can also have the disadvantage of not having the basic characteristic of ‘replicability’, that is, after students learn the model, they cannot use the model to analyze other real-world problems, and the practical application of the model itself is very low. This kind of learning content without practical application cannot meet the social needs of economics majors for ‘practical skills’, which makes undergraduates lack interest in learning and makes it difficult for them to motivate themselves to learn independently.

### 2.2. Not Only Economic Issues

In the real world, international economic issues are not only economic issues, but also political issues. Politics and economy are two aspects that are interrelated and inseparable. For example, when teaching a chapter on regional economic integration to students, although it is possible to analyze the conditions under which a country forms a customs union with other countries is more likely to result in an increase in net economic welfare from the perspective of economics. However, when students put the issue in the context of the real international political and economic environment, it is not difficult to find that choice between countries to advance regional economic integration is often predicated on political friendship and never on economic interests as a single consideration.

Therefore, when using scientific economic methods to analyze international economic issues, it is often only possible to provide a single perspective for analyzing the issues. International economic issues in the real world cannot be fully portrayed by the ‘simplified’ mathematical models in undergraduate textbooks. In the teaching process, if you completely deviate from the world political and economic background, and simply use mathematical models to explain international economic problems, it will lead to detachment from reality. Discussing international economic issues in an

ideal 'political vacuum' environment not only makes it difficult for students to connect mathematical models in books with practical issues of international economics, but also makes it easier for students to question the 'meaningfulness' and 'practicality' of mathematical models in the international economics courses.

### 2.3. Different Training Objectives

Since the lecture of International Economics is a sub-discipline of Economics, many textbooks in China are currently based on the undergraduate textbooks of United States universities. In view of this, clarifying the similarities and differences in the training objectives of undergraduate education in China and the United States is the premise for further in-depth research. However, it is not easy to identify clear similarities and differences, because on the one hand, this issue goes back to the essence of undergraduate education, and on the other hand, the 'training objectives' documents designed by universities are often abstract concepts, principles, and 'empty shells' that are disconnected from the actual teaching content (Yin, 2012) [4] and are only 'good intentions' (Drake Bock, 2008).

The German philosopher Karl Jaspers (2007) [5] pointed out that a university should be a community of scholars and students dedicated to the search for truth, and that the academic and scientific training students receive at the university level is potentially valuable, regardless of their post-graduation professions. This shows that it believes that university education should be oriented to academic research training and the cultivation of scientific spirit.

Qian Yingyi (2003) [6] points out that, compared with the United States, the current undergraduate education in China is oriented to cultivate professional talents, with the characteristics of detailed professional settings, many courses and strong skill orientation. In contrast, undergraduate education in the United States focuses more on teaching ideas, ways of considering problems, and tools for analyzing them, without teaching specific skills. The study of economic principles at the undergraduate level focuses more on the development of economic intuition. Mo Jiafeng (2017) [7] analyzed the model of economic professional training at the Massachusetts Institute of Technology (MIT) in the United States and pointed out that MIT focuses more on cultivating students' independent thinking skills, critical thinking skills and problem-solving skills, while China places emphasis on cultivating disciplinary knowledge.

Yin (2012), based on the National Medium and Long-term Education Reform and Development Plan (2010-2020), argues that the most important goal of undergraduate talent training in China is to meet the 'practical needs of society' and 'the development needs of students', while pointing out that the current stage of undergraduate education in China is still influenced by traditional elite education, in which students study only to pass exams and earn credits, lacking in ability and quality training, resulting in the cultivation of undergraduate talents not only out of touch with the needs of society, but also failing to meet the needs of individual students. Wang Pingxiang (2018) [8] also argues that with the massification and popularization of higher education in China, the crisis of the current elite education concept in undergraduate teaching is more highlighted, leading to misalignment of training objectives and disconnection from social needs. And the same trend seems to exist in the United States for university education. Drake Bock (2008), former

president of Harvard University,[9] has pointed out that the rapid growth in the number of undergraduate students in the United States means that higher education is no longer an elite education, but has become an education for the American public, where students are more interested in the development of vocational competencies. This shift is related to market demand on the one hand and is caused by the increasing demand of employers for employees' knowledge and skills; on the other hand, it is related to social value orientation, and increased students regard material achievement and career success as the driving force for learning rather than a love of knowledge itself.

## 3. The Significance of Introducing Mathematical Models

### 3.1. Importance of Scientific Nature of Economics

Economics is considered to be the most 'mathematical' and 'scientific' discipline in social science, and it is the crown jewel of the social sciences. What is science? For the definition of science, this study refers to the approach of Jin Yuelin [10] and defines it according to the method - 'Broadly speaking, the methods or tools used in science are about the following three: (1) experimental, (2) observational, and (3) theoretical.'" The scientific nature of economics is reflected in the use of these scientific research methods: both experimental methods, such as randomized controlled experiments; observation methods, such as econometric research methods based on historical data; and theoretical method, such as the theoretical model research method mentioned in the textbook 'International Economics'. As Mankiw [11] stated, 'Economists study the economy in much the same way that physicists study matter and biologists study life, first formulating theories, then collecting data, and then analyzing data in an effort to prove or disprove their theories.'

The 'theoretical method' based on deductive reasoning, which is different from the other two scientific methods, is the only scientific method that can guarantee 'certainty', that is, if the premise is assumed to be true, the conclusion obtained through abstract deduction must be true [12]. The mathematical theoretical model is to use the language of mathematics to put forward theoretical assumptions and rely on the rigorous and precise mathematical relationship of logical reasoning to deduce theoretical conclusions, which is one of the methods of theoretical reasoning and deduction. Mathematical model is a powerful analytical tool for economics, which can help economists to analyze intricate economic behaviors and phenomena with concise images and mathematical structures [13].

### 3.2. Cultivate Undergraduates' Academic Research Interest

Although the theoretical models in the undergraduate textbook 'International Economics' are not reproducible, they allow undergraduates to understand how economists use the theoretical research methods of mathematical models to conduct scientific research in the most understandable way and help them get familiar with major academic histories in the field of international economics. Some students are more likely to develop a research interest in economic theory because of this, and then choose to continue their studies. In their postgraduate studies, they might further study replicable and applicable economic theoretical models.

## 4. Suggestions for Undergraduate Teaching of International Economics

### 4.1. Attention should be Paid to Explaining the Scientific Spirit of Mathematical Models

The purpose of teaching mathematical theoretical models during 'International Economics' should be to let undergraduates understand what the 'scientific spirit' of economic research is, rather than simply instilling model knowledge that is not reproducible and applicable. For the 'Mathematical Theoretical Model' in the undergraduate textbook of 'International Economics', it is far more important for undergraduates to understand the meaning of building a 'Mathematical Theoretical Model' than for students to 'memorize' the specific process of model building. As a teacher of the 'International Economics' course, he should pay attention to explaining the meaning of learning mathematical theoretical models to students and take the cultivation of 'scientific spirit' and logical thinking ability as the main training goal of mathematical theoretical model teaching in the 'International Economics' course. At the same time, it is also necessary for students to understand that mathematical models are not the only scientific method to explain the laws of economic development, but they are one of the indispensable scientific methods.

### 4.2. Focus on Teaching the History of World Economy

The teaching importance of the 'International Economics' course at the undergraduate level should not focus on the 'rote memorization' of mathematical models, such as model assumptions, model calculations, model derivations, and memorization of model conclusions, but on the development of students 'economic intuition'. The role of mathematical models should be to help students understand international economic relations, understand the development context and historical background of international economic theory, rather than simply impart knowledge points. Sun Xinqin et al [14] also pointed out that before Chinese college students receive higher education, the education they receive is mainly 'exam-oriented education', which lacks social experience and value discrimination ability. Therefore, if Economics courses are based on the rigid teaching of theoretical knowledge, not only is it unhelpful to train students' thinking ability, but it may also cause students to tend to 'selfish' values. Based on this, the domestic curriculum teaching method needs to be reformed urgently, which requires teachers to fully combine the actual economic problems with the historical economic development background, the academic development background of economics research and the knowledge points of curriculum teaching.

### 4.3. The Collaborative Reformation is Needed

In the UK, the University of Bristol has led the establishment of a corresponding collaborative organization - 'The Economics Network', which aims to promote the overall

improvement of the teaching quality of Economics in the UK. So far, the organization has been established for 20 years and will be held every two years. The Developments in Economics Education Conference is held every two years and provides training services for new teachers.

Similarly, China can also refer to the establishment of a similar inter-university collaborative organization for undergraduate education in International Economics. Only by promoting the reform of the assessment methods of the International Economics course in China, can the reform of the teaching methods and teaching contents of the course be effectively promoted.

## Acknowledgment

This paper is supported by the Teaching and Research Project of Anhui University of Finance and Economics (acszjyyb2021053).

## References

- [1] Edited by Feng Delian. International Economics (Fourth Edition) [M]. Renmin University of China Press, 2019: 2-3.
- [2] Samuelson. Economics [M]. People's Posts and Telecommunications Press; 2008:10-11.
- [3] Gu Huiying. Discussion on Mathematics Teaching in Western Economics [J]. Journal of Inner Mongolia Normal University (Educational Science Edition), 2017,30(08):132-134.
- [4] Yin, Ningwei. Cultivation objectives--the key to the reform of undergraduate talent training mode [J]. Journal of Inner Mongolia Normal University (Education Science Edition), 2012,25(03):10-13.
- [5] Karl Jaspers. The Idea of the University [M]. Shanghai People's Publishing House; 2007.
- [6] Qian Yingyi. Economics education in American universities [J]. Journal of Northeast University of Finance and Economics, 2003(02):54-60.
- [7] Mo Jiafeng. Talent cultivation model of MIT economics department: characteristics and inspiration [J]. Higher Education Review, 2017,5(01):63-74.
- [8] Wang Pingxiang. Research on talent cultivation objectives of research-oriented undergraduate education [D]. Huazhong University of Science and Technology. 2018.
- [9] Drake Bock. Returning to the Way of the University [M]. East China Normal University Press; 2008.
- [10] Jin Yuelin. Theory of Knowledge [M]. Renmin University of China Press, 2010:8-9.
- [11] Mankiw. Principles of Economics (Seventh Edition) [M]. Peking University Press, 2015: 15-16.
- [12] Maurice Klein. Mathematics in Western Culture [M]. Commercial Press; 2020:35-37.
- [13] Qian Yingyi. Analysis of Modern Economics [J]. China Economic Report, 2019(03):132-143.
- [14] Sun Xinqin, Shi Jianjun, Zhang Taiqiu. Values Guidance in Western Economics Teaching [J]. Higher Education Research, 2007(03): 82-86.