Exploration on the Curriculum Reform of Postgraduate Econometrics Driven by Big Data

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ABSTRACT

In the era of big data, econometrics serves as a core course for the cultivation of postgraduate statistics students, yet its traditional teaching mode can hardly meet the training requirements for data science talents in the new era. Driven by big data technology and machine learning methods, this paper explores the paths of curriculum reform from three dimensions, namely the reconstruction of curriculum system, the innovation of teaching mode and the strengthening of practical teaching, in response to the problems in course teaching such as outdated content, low student participation and insufficient transformation of competition achievements. By constructing a four-in-one teaching mode, integrating interdisciplinary knowledge and the elements of curriculum ideological and political education, and establishing a transformation mechanism for the achievements of statistical modeling competitions, this paper realizes the deep integration of course teaching with the big data era, disciplinary competitions and talent demands, thus providing practical references for the reform of similar courses in universities.

KEYWORDS: Big Data; Postgraduate Education; Econometrics; Curriculum Reform; Teaching Mode.

1. INTRODUCTION

The deep integration of big data technology and digital economy has made data resources the core driving force for promoting transformation in all fields of economy and society. As a core discipline for the quantitative analysis of economic phenomena, Econometrics has witnessed an all-round innovation in its research methods and application scope. As a core course for the cultivation of postgraduate statistics students, it serves as a key link connecting basic statistical theories with the analysis of practical economic problems, and plays an irreplaceable role in cultivating students' abilities of quantitative analysis, economic modeling and data-driven decision-making.

At present, China's postgraduate education is in a critical period of transformation from scale expansion to quality improvement. The new round of scientific and technological revolution and industrial transformation puts forward compound, application-oriented and innovative requirements for high-end data science talents. Such talents are required to not only master solid theoretical and methodological knowledge of Econometrics, but also possess interdisciplinary abilities such as big data processing and machine learning application, and be able to discern the variable correlations and data laws in complex economic scenarios. The diverse data forms and complex variable relationships brought by big data provide rich materials for econometric research, and also put forward higher requirements for teaching content and methods; machine learning technology offers new solutions for causal inference and data processing in Econometrics, becoming an important starting point for curriculum reform.

However, the postgraduate Econometrics teaching in most domestic universities still follows the traditional mode, and the limitations of teaching content, methods and practical links have become increasingly prominent, which makes it difficult to meet the training needs for compound data science talents. Combined with the teaching practice of Beijing Wuzi University, this paper explores the curriculum reform paths driven by big data technology, aiming to improve teaching quality, cultivate high-level application-oriented data science talents meeting the demands of the times, and provide references for the reform of similar courses in universities.

2. Main Problems in Econometrics Teaching

The traditional postgraduate Econometrics teaching mode is constructed based on the classic econometric analysis system, which is obviously disconnected from the talent demands and technological development in the big data era. Based on the investigation of teaching practice, the core problems are mainly reflected in three aspects, which seriously restrict the teaching effect of the course and the cultivation of students' comprehensive abilities.

2.1. Outdated Teaching Content and Insufficient Interdisciplinary Integration and Pre-course Connection

The teaching content centers on classic econometric methods, focusing on the derivation and application of theories such as linear regression and panel data models. It lacks the integration of cutting-edge technologies in the big data era and is disconnected from the actual industrial demands. Machine learning algorithms and Python/R big data programming are not incorporated into the teaching system, making it difficult for students to master the analysis methods of high-dimensional and unstructured data; most teaching cases are classic theoretical cases without the support of big data cases in real economic scenarios, which prevents students from effectively combining theoretical methods with economic reality. Meanwhile, the course lacks systematic connection with pre-course courses such as Probability Theory and Mathematical Statistics. Some students have insufficient pre-knowledge reserves, forming a knowledge gap in learning, which directly affects the orderly progress of course teaching.

2.2. Single Teaching Method and Weak Students' Learning Initiative and Innovative Thinking

Traditional teaching is centered on teachers' lectures and theoretical derivation, featuring one-way knowledge transmission. Students are in a passive acceptance position and lack space for active thinking and practical exploration. Classroom interaction is insufficient, and students only focus on the derivation

of theoretical formulas and mechanical operation of software, making it difficult for them to understand the economic logic behind econometric methods. The cultivation of abilities in independent modeling and practical problem-solving is seriously absent. At the same time, the teaching does not carry out training on model selection, improvement and verification combined with different economic scenarios, and lacks guidance on students' innovative thinking, leading to students' weak knowledge application ability, low learning interest and classroom participation, and difficulty in realizing the leap from knowledge acceptance to ability transformation.

2.3. Weak Practical Teaching, Insufficient Competition Achievement Transformation and Lack of Ideological and Political Integration

Econometrics is a highly application-oriented course, and practical teaching is the key to connecting theory with reality. However, the current practical teaching has the problems of formalization, superficialization and disconnection. The proportion of practical class hours is low, and most practical tasks are single software operation exercises, lacking comprehensive and exploratory big data analysis practice, which makes it difficult for students to exercise their abilities of modeling and analyzing complex economic problems; there is insufficient linkage between teaching and high-level competitions such as the National College Students' Statistical Modeling Competition, the practical and innovative training value of competitions is not fully exerted, and the guiding and incentive effects are missing; the exploration and integration of curriculum ideological and political education in practical teaching are insufficient, and ideological and political elements such as patriotism, industry responsibility and scientific spirit are not combined with practical tasks, failing to achieve the goal of collaborative education of knowledge imparting and value guidance.
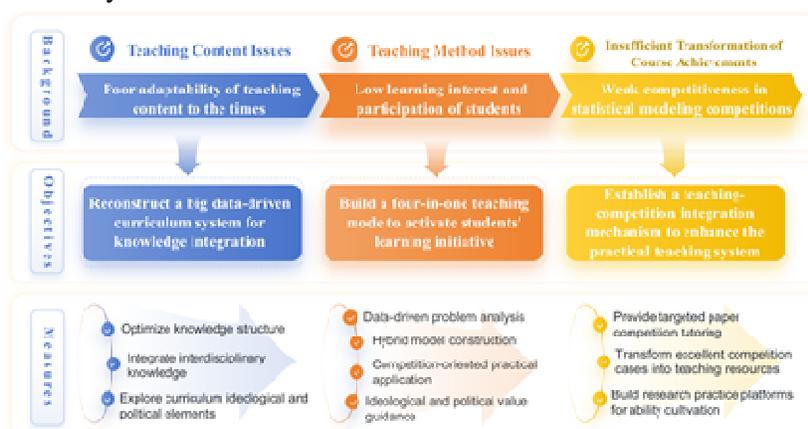

Figure 1. Research Framework of Postgraduate Econometrics Curriculum Reform Driven by Big Data

3. Approaches to the Teaching Reform of Econometrics

Aiming at the core problems in postgraduate Econometrics teaching, driven by big data technology and machine learning methods and combined with the teaching practice of Beijing Wuzi University, this paper puts forward reform approaches from three dimensions: curriculum system reconstruction, teaching mode innovation and practical teaching enhancement, and constructs a course teaching system adapted to the demands of the big data era to improve the quality and efficiency of course teaching.

3.1. Reconstruct the Big Data-driven Curriculum System to Realize Knowledge Integration and Ideological and Political Empowerment

Break the traditional knowledge boundaries and construct a big data-driven curriculum system featuring pre-course connection, interdisciplinary integration and ideological and political empowerment. First, optimize the knowledge structure, draw a course knowledge map, identify the weak links of pre-course knowledge, set up a pre-course knowledge remediation module, consolidate core contents such as panel data and hypothesis testing, and make up for the knowledge gap; streamline and optimize the traditional teaching content in combination with the needs of big data analysis, weaken tedious mathematical derivation, and strengthen the economic connotation and application scenarios of methods. Second, integrate interdisciplinary knowledge, construct an interdisciplinary teaching framework of Econometrics + Machine Learning, add cutting-edge modules such as econometric analysis of high-dimensional data and big data processing programming, introduce methods such as random forest and deep learning, and explain their integrated application with classic econometric methods in causal inference and variable screening; update the teaching case database and introduce real big data economic cases. Third, explore ideological and political elements, construct a teaching system combining professional content with ideological and political cases from three dimensions of national strategy, industrial development and scientific spirit, integrate modeling cases related to the Double Carbon Goal, rural revitalization and the Belt and Road Initiative into teaching, emphasize the authenticity of data and the rigor of analysis, and cultivate students' patriotism and industry responsibility.

3.2. Innovate the Four-in-One Teaching Mode to Activate Students' Learning Initiative and Innovative Thinking

Break through the traditional teacher-centered teaching mode and construct an innovative four-in-one teaching mode featuring data-driven exploration, model construction, practical application and value guidance. In the data-driven link, take real economic big data in fields such as logistics, consumption and trade as the starting point, guide students to explore economic problems through data cleaning and descriptive statistics, and establish a data-based and problem-oriented analytical thinking; in the model construction link, focus on the economic problems put forward by students, guide them to independently build models by integrating classic econometric and machine learning methods, and teachers provide targeted guidance from three aspects: method selection, model setting and test optimization; in the practical application link, relying on the National College Students' Statistical Modeling Competition, divide students into project groups of 1 to 3 people to complete the whole process of practice from problem proposal, model construction and data analysis to thesis writing, and teachers provide special tutoring and organize classroom achievement exchanges; in the value guidance link, integrate curriculum ideological and political education into the whole teaching process, guide students to pay attention to national strategies and industrial development in project research, and realize the simultaneous cultivation of professional ability and patriotism.

3.3. Strengthen the Practical Teaching System and Establish a Transformation Mechanism for Achievements between Teaching and Competitions

First, increase practical class hours and design a three-level progressive practical task featuring data-driven exploration, model construction, practical application and value guidance for each teaching module. The basic level focuses on basic applications such as R panel modeling and Python data cleaning, the comprehensive level focuses on the integrated application of econometrics and machine learning, and the innovative level carries out in-depth analysis of real economic problems. Second, establish a competition coordination mechanism, integrate competition requirements and excellent cases into teaching, and provide special tutoring through on-campus teaching to improve the quality of competition papers. Third, promote the feedback of competition achievements to teaching, sort out excellent competition works, and extract innovative methods to convert them into teaching cases. Fourth, build a scientific research practice platform, rely on teachers' scientific research projects, encourage students to join interdisciplinary scientific research projects and undertake tasks such as data cleaning and model construction, and teachers carry out regular

scientific research guidance to cultivate students' scientific research awareness and academic ability.

4. Conclusion

In the era of big data, the curriculum reform of postgraduate Econometrics is an inevitable choice to adapt to the training needs for data science talents and improve the quality of postgraduate education. Combined with the practice of Beijing Wuzi University, this paper puts forward big data-driven reform paths from three dimensions: curriculum system, teaching mode and practical teaching. By constructing a characteristic curriculum system, a four-in-one teaching mode and a closed-loop practical system, this paper realizes the deep integration of the course with big data technology, discipline competitions, national strategies and industrial demands, and improves the teaching effect and quality.

Acknowledgments

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