The Goal, Motivation and Path of Teaching Reform Research of The Time Series Analysis Course

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Abstract: "Time Series Analysis -- Based on R" is a comprehensive course covering advanced mathematics, econometrics, software programming and other disciplines. The programming difficulty of R software and the derivation and understanding of mathematical concepts lay the foundation for the basic difficulty of this course. After years of teaching feedback, students generally think that learning is professional and practical, but the difficulty of mastering and receiving is relatively large. In order to improve the learning atmosphere, eliminate the students' learning pressure, and enhance the interest of the subject, the teaching team of time series analysis adopts the multi-dimensional reform idea. Firstly, the flipped classroom element is added to the teaching of the course to transfer the learning leadership to the hands of the students, so that the students can lead the course to improve their learning progress. Secondly, it added a supporting R language learning course to increase the proportion of practical learning and reduce the teaching difficulty caused by programming problems in practical exercises. Finally, rather boring cases are abandoned, the contents of the case base are enriched, public opinion cases and hot cases are added, so that students can truly feel the charm of knowledge around them and enhance their learning initiative.

1. Introduction

"Time Series Analysis -- Based on R" is a required course for the major of economic statistics. It is set up to adapt to the development of The Times under the Internet economic model. With the application of open-source programming R software, it organically integrates the fundamentals of economic statistics, mathematical statistics, software programming, model building and economic data forecasting.

The traditional teaching model is teacher-led, teaching the basic principles of time series analysis in class, demonstrating the programming process of R software in multimedia classroom, and sorting out the time series model modeling as the main line, which includes the derivation of a large number of mathematical formulas, the memory of programming language, and the linear use of the model, and lacks the flexibility to grasp the modeling ideas. In addition, because the classical teaching case data quoted in the textbook is too old and complicated to catch up with the progress of The Times, it cannot attract students' interest in independent learning and lacks the new concept of student-led education. Therefore, curriculum innovation and reform are urgently needed to solve

these pain points[1].

The complicated theoretical knowledge makes students need to spend a lot of time to understand, understand the mathematical formula itself can be replaced by R software memory, and because they can not find the direction of statistical modeling close to the things around, they can not understand the significance of course learning.

In order to solve the above pain points, the teaching team of the course of Time series Analysis has carried out a step by step reform of the teaching mode. While setting up the theoretical course of "Time Series Analysis -- Based on R", the course of "Basic Training of R Software" is also carried out in the laboratory, so as to ensure that students can master the basic using methods of R software and the basic application of programming language in the process of time series analysis[2].

In the theory class, the timing team first introduced the concept of flipped classroom properly, gradually enhanced the source power of students' independent learning, and encouraged students to find interesting topics and content in daily life for data mining, to focus on discussion and learning in class, and to share their views with each other. Secondly, the time series team has expanded the capacity of the case base, boldly abandoned the classic but far away from the traditional cases, and increased the time series data around students who can feel the changes in time for analysis and learning, so that complex knowledge points become close to life. Thirdly, the time series team adds a new hierarchical learning mechanism, arranging students into learning groups to learn from each other's strengths and weaknesses for teamwork cooperative learning to enhance students' collective sense of honor. It also builds a three-tiered scoring mechanism, namely, self-evaluation, teacher evaluation and inter-group evaluation, which fully mobilize students' "keeping up with the Joneses" in learning. Awaken the students' learning enthusiasm and independent learning ability.

2. Implementation of multi-dimensional reform in the course of time series analysis

2.1 Teaching philosophy

During the teaching period, teachers should combine the characteristics of time series courses to guide students to actively explore knowledge, and carry out heuristic teaching around the modeling process, so as to complete the teaching work and teaching objectives with higher quality, realize the purpose of quality education, cultivate students' independent learning ability and participate in the course learning more actively.

2.2 Achieve the goals

The first level, make full use of the Internet online teaching method. Firstly, it classifies knowledge points by chapters on the network teaching platform, designs, produces and optimizes classroom teaching cases with various teaching methods and methods, enricates the types of teaching cases, avoids the appearance of boring and stale cases, and introduces more hot cases or public opinion cases that are in the forefront of The Times for case teaching analysis. For example, the drunkle-walking case introduced by the timing team, the microblog topic ranking case, the case of who Zhang Wuji really loves, the epidemic trend prediction case and so on were welcomed by students, and the cases with great response were recorded into programming videos or shared programming codes for students to practice and track after class.

At the second level, offline teaching can mobilize independent learning ability. A study group is arranged in class. The study group starts with the research direction that the team is interested in and carries out follow-up research from data mining, index building, model building, prediction and analysis. The group is given time to publish results in class and students are given a leading position in class. In the usual published results, the reform is carried out by three parts of the combined

scoring, that is, teachers scoring, self-scoring and inter-group scoring, to stimulate the motivation of students to complete the learning task. The main task of teachers has changed from cramming teaching to guided teaching, guiding students to learn the ability to find and solve problems, improving students' professional quality, allowing students to spontaneously consult relevant materials after class, and solving fuzzy problems in the sequential course.

The third level, with the help of modern educational technology active classroom atmosphere. Seek high-quality teaching videos and audio from online education platforms such as China MOOCs and play them in class. Adopt modern education methods to optimize teaching quality, mobilize students' attention to classroom content and deepen their memory points for course content.

2.3 Specific implementation Details

In the early stage of course preparation, both teachers and students should be involved so as to better complete the teaching activities and ensure that students can master the professional knowledge of time series smoothly. From the perspective of teachers, first of all, in the design of teaching PPT, due to the particularity of time series course, there are a lot of formula reasoning and calculation in PPT.

Therefore, in the design process, the principle or usage of each step of calculation should be well demonstrated, and the knowledge point and calculation process should be organically combined together, so that students can be clear at a glance when learning. It is also convenient for students to learn after class; Secondly, the online platform is used to establish a questionnaire to understand the problems and weaknesses encountered by students in the learning process, flexibly change the teaching content and focus, and keep the communication smooth in the learning wechat group or qq group, so as to facilitate the photographing and uploading of exercises in the whole learning process, the in-class test or the communication of important and difficult problems. Before class, teachers should upload electronic textbooks and teaching AIDS in advance, so that students can prepare for it in advance.

From the perspective of students, we should timely log in to various online education platforms, check our learning tasks, do a good job of review and preview, and cooperate with the implementation of teachers' work to achieve the effect of twice the result with half the effort.

In the course of teaching, due to the difficulty and comprehensiveness of the time series analysis course, teachers should pay attention to the phenomenon of students falling behind at any time, timely raise questions for students to think and answer, cite more cases in teaching, avoid boring formula reasoning, pay more attention to computer practice, avoid closed doors, give more opportunities for students to perform, and avoid dumb learning. At the level of students, they should know the difficulty of the course and be mentally prepared. They should not only learn the course knowledge, but also expand the study of recommended reading materials, cherish the opportunity of classroom performance, exercise their language expression ability, and check the knowledge while showing their investigation content. I know the difference between self-assessment scores, teacher evaluation and inter-group evaluation, and want to learn from each other in a probing way and take the essence of other groups for self-improvement.

In the extension link after class, the learning time in class is still limited, so a good extension link after class will strengthen the memory of knowledge points. On the one hand, based on the situation of the questionnaire, the homework after class is set for students to complete on the Internet platform; on the other hand, the summary of the course content and the series of knowledge points should be done well. Chapter knowledge and knowledge series between chapters are also very necessary, which can arouse students' memory in the way of mind map[3]. The figure 1 shows the mind map of knowledge points in the time series divided course:

Figure content (mind map):

- Time series of observed values
  - Stationary time series
    - Pure random time series → No research value
    - Not purely random time series → Have research value → Modeling
      - AR
      - MA
      - ARMA
      - Predict
  - Non-stationary time series
    - Deterministic time series analysis
      - Decompose
        - Decompose of time series
        - Decomposition of deterministic factors
      - Analysis
        - Analysis of trends
        - Seasonal effect analysis
        - Comprehensive analysis
    - Random time series analysis
      - Modeling
        - ARIMA
        - Residual autoregressive model
        - Conditional heteroscedasticity model
          - ARCH
          - GARCH
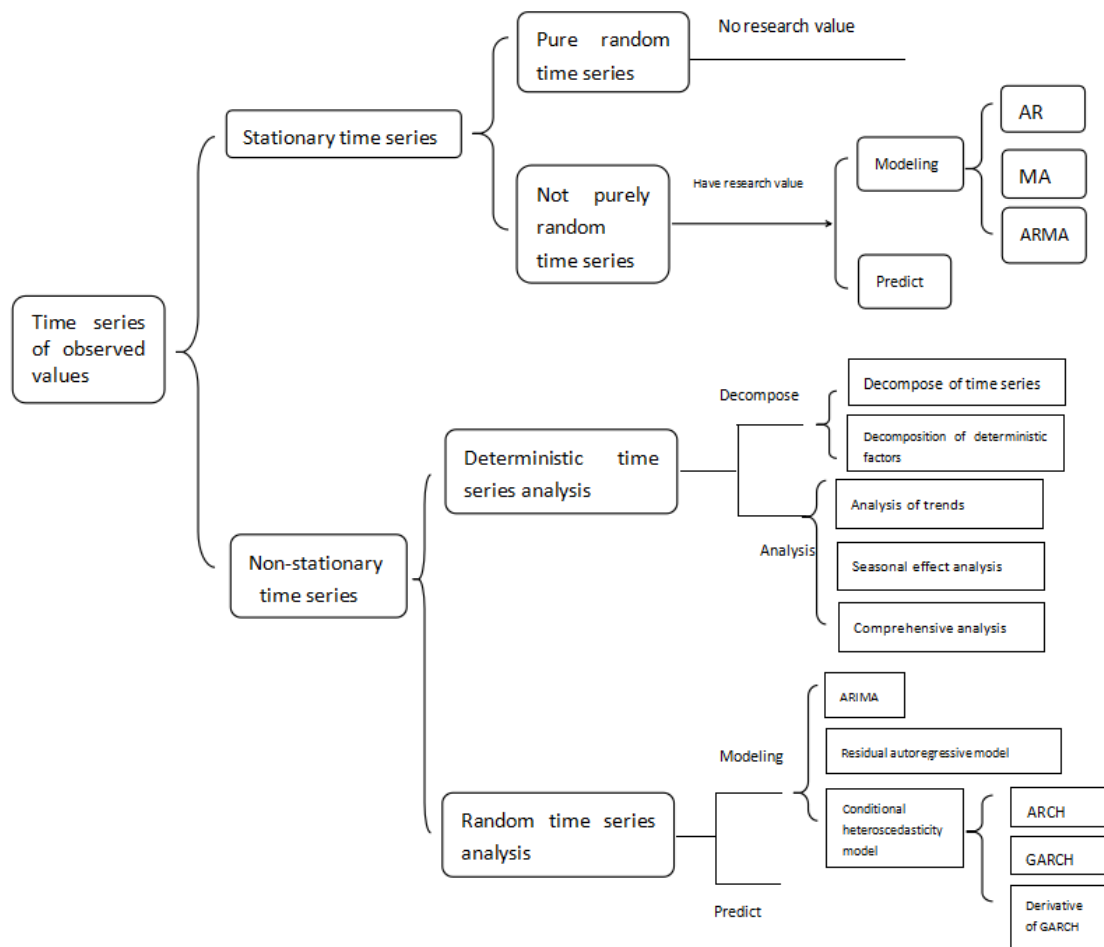   - Derivative of GARCH
      - Predict

Figure 1: Mind map of knowledge points in time series.

3. Effectiveness and value of multi-dimensional reform of Time Series Analysis

According to the results of the three rounds of teaching, the average score of the first year is 93, the second year is 95, and the third year is 97. The reporting level of the practical training has been effectively improved in data collection, data preprocessing, data modeling and model analysis report writing, and the enthusiasm of students to participate has also increased significantly. Especially in the third year after the introduction of the inter-group evaluation mechanism, the proportion of creative scores in the report has been significantly increased.

It can be seen that the inclusion of self-evaluation, mutual evaluation and teacher-student evaluation has increased students' interest in participating in flipped classroom, breaking the boredom of bending their heads to do data analysis in the past, and significantly improving their participation in expressing their analysis results. With the addition of public opinion cases and hot cases, students have expanded their eyes on data collection[4]. Instead of just focusing on data analysis and practice in books as in previous years, they focus on the direction they are interested in, and make use of the knowledge they have learned to conduct data investigation or data crawling. In addition, they prefer to express their methods of obtaining data in class discussion[5]. As well as the purpose and significance of the selection of research objects to increase the atmosphere of the classroom;

Therefore, the reform of appropriately integrating flipped classroom and enriching case teaching types is constructive and helpful to stimulate students' interest in learning. It turns difficult learning

tasks into interesting subjective learning and more reflects the student-centered teaching design concept. In the future, it is necessary to continuously improve the types of cases and increase the concentration of flipped classroom. Let the students gradually form the study habit of leading the class, not only in the level of knowledge will let the students grasp more firmly, but also exercise the students' teamwork ability and expression ability, both of which can be cultivated. Very valuable for promotion.

4. Conclusion

To sum up, because the course of time series analysis is difficult, comprehensive and practical, it is necessary to find out the problems in teaching in previous years and do homework in time. Under the guarantee of teaching difficulty and requirements, it is necessary to increase the interest of the course. Most of the courses are guided by case teaching, so that students know more about the significance of learning and where the knowledge learned can be applied. Based on practicability, we can actively explore the time series around us and find out the law contained therein, so as to obtain the sense of achievement in learning and promote students' ability of independent learning. Teachers should also run through the important knowledge points in time, help students to comb through the knowledge points, analyze and explain the difficult knowledge, extend the knowledge points after class, help students master the frontier knowledge of the subject, and guide the students' knowledge level to develop outward-oriented.

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