SKILLS OF STUDENTS OF THE TECHNICAL UNIVERSITY OF LIBEREC TO USE SELECTED STATISTICAL METHODS IN WRITING THEIR FINAL THESES

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Abstract

This article focuses on summarizing the findings collected within the FRVŠ project number 2218/2011. The project entitled "Improvement and Extension of the Course Statistical Analysis of the Data from Questionnaire Surveys Delivered by E-learning", was delivered by the authors of the article in 2011. FAQs about the usage of different statistical methods which came from students formulating their final papers acted as the impulse to work on such a project. In this article, the authors focus on identifying the frequency of use of statistical methods in the final papers of students at the Faculty of Economics of the TUL in the years 2007 − 2010. They discuss the causes of the low level of knowledge of statistics among the students of the Faculty of Economics at the TUL and their insufficient ability to use statistical methods.

Introduction

This paper results from the findings collected within the FRVŠ project number 2218/2011 which is entitled "Improvement and Extension of the Course Statistical Analysis of the Data from Surveys Delivered by E-learning". Frequently asked questions about the usage of different statistical methods that came from students writing their final papers acted as the impulse to propose such a project. The most frequently asked questions referred to handling data collected in questionnaire surveys. The authors were also interested in how frequently statistical methods are used in the final theses, and in what causes the insufficient use of these methods. At the same time, an increasing number of students asked us to help them apply statistical methods in their final theses. They claimed that the previously completed statistical courses did not answer their questions.

So, the authors focus on frequency and kinds of statistical methods used in the EF TUL students' final theses. At the same time, they try to answer the question why the students are not able to use selected statistical methods.

1 Analysis of the Final Theses of the EF TUL Students in the Years 2007 − 2010

The total number of final theses included in our research is 665. These are the final theses of students graduating from the Faculty of Economics TUL in the years 2007 − 2010. An important fact is that there were only 6 final theses written under the supervision of a member

of the Department of Economic Statistics (one of the departments of the EF TUL) in those years. The truth is the Faculty of Economics TUL has no study programme that would focus only on statistics. Nevertheless, a good knowledge of statistical methods contributes to a good name of every economist. So, what are the findings of our theses analysis?

We have taken into account each EF TUL study programme where, at least, an introduction into basic statistical methods is taught. These basic methods are taught in a specific structure that is divided into 11 parts according to topics taught in the basic courses of statistics. We added one more item among these 11 topics – the item "others". This item contains topics taught within the frame of other statistical courses, e. g. Econometrics or Optimization methods in economics, or methods learnt by self-studies (these methods are not taught at the EF TUL). Our findings are shown in Table 1.

Tab. 1: *Frequency of various statistical methods in the final theses of the EF TUL students in the years 2007 – 2010*

Method from the sphere of	Relative frequency in %
- descriptive statistics	12.8
- probability	0.9
- theory of random variable	0.0
- analysis of variance	2.4
- chi-square test of independence	2.7
- testing of statistical hypotheses	2.3
- theory of statistical estimation	0.0
- regression analysis	0.6
- correlation analysis	1.1
- time series analysis	7.1
- index numbers	0.8
- others	0.5

Note: The sum of the relative frequencies does not equal 1 because theses which do not contain any statistical methods are not mentioned, neither theses where 2 or more methods are used.

Source: Own research based on the sources [2], [3], [4], [5]

The data in Table 1 represent a relative frequency of each statistical method used in the final theses in percentages. We can see that most students are able to use methods of descriptive statistics. These appear in 12.8% of the final theses. A calculation of arithmetic mean, which is a very simple calculation, was also included among these methods. Therefore, this outcome is not surprising for us. The second most frequently used methods are methods from the sphere of time series analysis. They were found in 7.1% of the final theses. A calculation of mean growth coefficient, or, if you like, a mean growth rate was used the most often from the spectrum of these methods. It is also a simple calculation based on a geometric mean calculation. Hence, this value is not a surprise for us either. Other, more complicated methods appear in a very small number of the final theses. The chi-square test of independence was used in 2.7% of the theses, the analysis of variance in 2.4% of the theses, testing of statistical hypotheses in 2.3% of the theses and the correlation analysis in 1.1% of the theses. The students did not use their knowledge of a random variable and statistical estimations at all.

Let us add one more very important piece of information – no statistical method was used in 75.3% of the final theses. One can object that there are topics which do not require using statistical methods. That is true but, it looks (according to the final theses of the EF TUL students) that most of the topics do not require any statistical methods to be applied. Each

final thesis written during the studies at the EF TUL should contain a certain economic evaluation of the findings presented in the theses. And in most cases, it would be advisable to use some statistical methods for this evaluation.

2 Reasons of Insufficient Usage of Statistical Methods in Final Theses

When we consider the reasons behind the limited ability of the EF TUL student to use statistical methods in the process of writing their final theses; we can find many. Therefore, we will focus on the essential reasons only.

2.1 Reason No. 1 – Aversion to Mathematics and Similar Courses

It is no secret that the faculties specializing in economics are attractive, first of all, to students who do not like technical courses, especially mathematics. It is a big mistake of many students studying faculties of economics. These students do not have a positive attitude to mathematics and similar courses for various reasons, and, therefore, they try to avoid them. At the Faculty of Economics TUL, they have to pass both the exam in maths, and in statistics. Yet, they do not remember much from the lessons because they try to learn everything by heart, and they do not try to understand the principles of the subjects. This way of studying maths or statistics is not ideal, and it is reflected in the inability to apply correct statistical methods while writing final theses.

2.2 Reason No. 2 – Reduction of the Amount of Statistical Courses Lessons

Another reason might be a reduction of "compulsory" statistics courses in several study specializations. At the Faculty of Economics TUL, we can find 3 study programmes and 7 study specializations within these 3 programmes. Let us talk just about the study specializations. The study specialization called Insurance Management offers statistical courses above the standard. In the frame of a 3-year bachelor study there are 5 statistical courses (Descriptive Statistics I and II, Theory of Probability, Statistics for Insurance I and II). However, this study specialization is usually represented by a very low portion of students – in one class there are usually around 20 students. Moreover, the accreditation of this study specialization in this form is finishing and the new one will be aimed at a different specialization called Financial, Insurance and Social Systems in Public Administration which will replace the study specialization Insurance Management. But this new study specialization does not offer as many statistical courses as the original one.

In the frame of the study specializations Managerial Informatics and Business Administration 2 statistical courses in a 3-year study (Statistics I and II) are taught. And let us add that mathematics is also taught in two semesters. We agree with this structure of study.

The problem is in case of other study specializations. Newly created and accredited specializations have fewer statistical as well as mathematical courses. We are writing about the specializations: Economics and Management of International Trade, Economics and Service Management, and Tourism. Students have just one statistical and one mathematical course during a 3-year study (the specialization Economics and Management of International Trade is an exception – mathematics is taught in two semesters)! The members of the Department of Economic Statistics have modified one-semester course called Statistics to cover everything important from the courses Statistics I and Statistics II. It is evident that the quality of the lessons has declined due to the fact that the teachers try to cover nearly every topic of the two-semester courses in one semester. It is hard work for the teachers as well as the students. The response is that the students would like to study statistics in two semesters.

We cannot be surprised that the students are not able to identify what methods they should use in their final theses. They receive too much information in too short a time.

If we look at the two-year follow-up master programmes, we can find 3 study programmes, each of them with 1 study specialization. The specialization Insurance Management has the highest number of statistical courses. 2 statistical courses are taught in 2 years (Selected Chapters of Statistics, Econometrics). Especially the course Selected Chapters of Statistics is a subject that could provide significant data for writing final theses. We consider this number of statistical courses to be sufficient.

The two above mentioned courses are also among the compulsory courses offered to the specialization Managerial Informatics. It is strange that even this specialization provides 2 compulsory statistical courses (Status A) while the specialization Business Administration offers these courses only among compulsorily facultative courses (Status B). Yet, the statistical methods would bring more benefits to this specialization than to Managerial Informatics in the process of writing final theses. We found out that the students of Managerial Informatics use statistical methods in their final theses the least.

As mentioned above the specialization Business Administration did not offer any statistical courses under the title Status A (compulsory) in its two-year follow-up study. Econometrics and Selected Chapters of Statistics were included in Status B (compulsorily facultative). Most students were not able to attend these courses because of lack of capacity. We considered this situation to be unbearable. Therefore, we tried to enforce a new accreditation of Business Administration and insert a statistical course with the Status A there. We were successful. Our new course with Status A is called Statistical Analysis of the Data from Questionnaire Surveys and it will be taught in the first year of the follow-up study. Even though, it is the only statistical course we hope it is a great asset and it will improve the quality of final theses.

2.3 Reason No. 3 – The Final Thesis Supervisor Does not Require Statistical Evaluation

Another important reason why students do not use statistical methods in their final theses is more often is that fact that their supervisors do not require their usage to sum up the findings of the theses. Sometimes the reason is the fact that the thesis supervisor usually does not use these methods in his/her research, so he/she has no need to see it in his/her students´ theses. Another reason is lack of time – many final thesis supervisors supervise more graduating students than it is optimal. Then, they are unable to give them as much advice as they need. It happened in the past that a final thesis supervisor from a different department advised his student to consult these issues with someone from the Department of Economic Statistics. But such recommendations are still rare.

Conclusion

In conclusion, let us summarize the most important findings of our survey. Most final theses of the EF TUL students graduating in the years 2007 – 2010 do not include statistical methods. These theses represent 75.3% of the final theses. This number indicates that either the EF TUL students are not able to use statistical methods or they do not like them. There are, of course, some topics which do not require any statistical methods. But, it is just a small sample, certainly not 75%. We have tried to identify the most important reasons which lead to this conclusion. They are: unpopularity of statistics and mathematics among students, reduction of the number of statistical courses lessons at the Faculty of Economics TUL, and impossibility or inability of final thesis supervisors to motivate their students to use statistical methods.

In addition, it is necessary to think of how this unsatisfactory situation could be solved. The members of the Department of Economic Statistics (KSY) are willing to consult the final theses supervised at other departments if a student wishes to consult the evaluation of his final thesis results with the help of statistical methods. We have been successful to enforce one compulsory statistical course into the follow-up study of the main study specialization Business Administration. The members of the Department of Economic Statistics have been systematically working on supporting study materials for statistical courses, which could lead to the fact that students will not have to focus on taking notes, but more on understanding the information covered during the lessons. Let us hope that these steps will result in better final theses with correctly implemented statistical methods.

Acknowledgements

Literature

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SCHOPNOSTI STUDENTŮ TECHNICKÉ UNIVERZITY V LIBERCI POUŽÍVAT VYBRANÉ STATISTICKÉ METODY PŘI PSANÍ ZÁVĚREČNÝCH PRACÍ

Tento článek se zaměřuje na shrnutí zjištění provedených v rámci projektu FRVŠ 2218/2011 s názvem Zkvalitnění a rozšíření výuky předmětu Statistický rozbor dat z dotazníkových šetření formou e-learningu, který byl řešen autorkami článku v roce 2011. Impulsem k práci na projektu byly časté dotazy studentů, píšících závěrečné práce, na používání různých statistických metod. V tomto článku se autorky zaměřily na zjištění četnosti použití statistických metod v závěrečných pracích studentů Ekonomické fakulty TUL v letech 2007 – 2010 a zamýšlejí se nad příčinami nízké úrovně znalostí statistiky a malé schopnosti používání statistických metod studenty EF TUL.

DIE FÄHIGKEIT DER STUDENTEN DER TECHNISCHE UNIVERSITÄT IN LIBEREC, BEI DER ERSTELLUNG VON ABSCHLUSSARBEITEN AUSGEWÄHLTE STATISTISCHE METHODEN ANZUWENDEN

Das Ziel dieses Artikels besteht darin, all die Feststellungen zusammenzufassen, welche im Rahmen des Projektes FRVŠ 2218/2011 mit der Bezeichnung „Qualitätssteigerung und Erweiterung des Unterrichts des Faches statistische Analyse durch Umfragen ermittelter Daten in Form von E-Learning" erzielt wurden. Dieses Projekt wurde von den Autorinnen dieses Artikels im Jahre 2011 durchgeführt. Den Impuls zu dieser Arbeit gaben zahlreiche Fragen von Studenten, die an ihrer Abschlussarbeit arbeiteten, nach der Anwendung verschiedener statistischer Methoden. In diesem Artikel konzentrieren sich die Autorinnen auf die Feststellung der Häufigkeit der Anwendung statistischer Methoden in den Abschlussarbeiten der Studenten der Ökonomischen Fakultät der TUL in den Jahren 2007 bis 2010 und stellen Überlegungen an über die Ursachen des niedrigen Niveaus der Statistikkenntnisse sowie der geringen Fähigkeit der Studenten der ökonomischen Fakultät der TUL, statistische Methoden anzuwenden.

UMIEJĘTNOŚCI STUDENTÓW UNIWERSYTETU TECHNICZNEGO W LIBERCU STOSOWAC WYBRANE STATYSTYCZNE METODY PRZY PISANIU PRAC DYPLOMOWYCH

Ten artykuł skupia się na podsumowaniu ustalen dokonanych w ciągu projektu FRVŠ 2218/2011 pod tytulem „Poprawa i powiększenie edukacji statystyczną danych z badan ankietowych w postaci e-learning", który został rozwiązany autorkami artykulu w roku 2011. Bodźcem do pracy na projektu były często zadawane pytania od studentów, piszących prace dyplomowe o zastosowaniu rożnych metod statystycznych. W tym artykule autorki się koncentrują nad częstotliwością stosowania metod statystycznych w pracach dyplomowych przez studentów Wydziału Ekonomii Uniwersytetu Technicznego w Libercu w latach 2007 – 2010 i zamierzają nad przyczynami niskiego poziomu umiejętności statystycznych i również małych zdolności korzystania studentów Wydziału Ekonomii Uniwersytetu Technicznego w Libercu z metod statystycznych.