

Econometric Analysis on the Site “Lesson Pulse”

Alexander J. Weissblut

Kherson State University, 1, 40 rokiv Zhovtnya Street, 73000, Kherson, Ukraine

veits@ksu.ks.ua

Abstract. In this article the site “Lesson pulse” is considered, as the tool allowing the teacher to receive the objective information on a course and results of a lesson in a mode online. However adequate interpretation for results of such interrogations is impossible, while we will not separate true students from others. Besides, interpretation for results of interrogations and the decision-making, grounded on it, demands to realize, what exactly this concrete group means by clearness of an explanation, objectivity of the marks etc. For anonymous interrogations it means necessity of correlation and regression analysis for their results and an estimation of the statistical significance of the received results. So it means necessity of econometric analysis.

Keywords. Factor, statistical, econometric, analysis, correlation, decision-making

Key terms. Research, Management, Model, KnowledgeManagementProcess, KnowledgeManagementMethodology, MathematicalModeling

1 Introduction

In this article the site “Lesson pulse” is considered, as the tool allowing the teacher to receive the objective information on a course and results of a lesson in a mode online. It allows for the student or the pupil at any moment to react to a lesson course, having answered one or several questions, for example:

1. Is it interesting to you at a lesson?
2. Is it accessible (clear) an explanation?
3. Are you tired? Whether arranges you the rate of an explanation?
4. There are at you questions to the teacher?
5. Whether the marks are objective?

(Formulations of questions are defined by the teacher). As a result of an average of these responses the site produces on the monitor screen the data about a lesson state, its "pulse" in a mode online. At any moment the teacher can ask to answer all simultaneously such or more profound groups of questions (their examples are given below). So, he can measure the “lesson pulse” just at this moment. Such interrogations

do not demand computer auditorium by all means: they can be carried out on one tablet, and then results can be transferred to a site.

However adequate interpretation for results of such interrogations is impossible, while we will not separate true students, for which educational process is a considerable part of their life, from those, who would prefer to keep far away from it. Besides, interpretation for results of interrogations and the decision-making, grounded on it, demands to realize, what exactly this concrete group means by clearness of an explanation, lesson atmosphere, objectivity of the marks etc. For anonymous interrogations it means necessity of correlation and regression analysis for their results and an estimation of the statistical significance of the received results. So it means necessity of econometric analysis.

1. All groups of questions considered further have been chosen in result of "brainstorming" where students of fourth year study of the Faculty of physics, mathematics and informatics at the Kherson state university acted as experts. This expert interrogation has been constructed by a technique of "six hats of thinking" E. Bono [1], which provides the maximal openness and relaxedness of participants. In all cases the opinion has unanimously been expressed, that the given set of questions is full and fair.
2. Then students of specialities "physics", "mathematics", "informatics" and "program engineering" of the Kherson state university have been interviewed under such essential requisites. The respondents estimate each question from 0 (at firm "no") up to 10 (at firm "yes"). He arbitrarily sets a name of the folder containing his interrogation (i.e. his key). The volunteer – a participant of interrogation – collects all folders in one main folder and sorts them here (i.e. shuffles). Only after that the main folder was transferred to the teacher: this simple and open procedure guaranteed to participants anonymity of interrogation. Alternative and technically simpler variants are answers to the site and to a tablet: the variant choice is defined by a kind of interrogation and level of trust of an audience to the interviewing teacher.
3. Results of interrogation then are transferred to a site "Lesson pulse", which is realized in language PHP and uses database MySQL (see [2]). The queries realizing now on the site give out results of the econometric analysis of interrogation. They include the plural correlation analysis of factors and an estimation of the statistical importance of the received results with use of criteria Student and Fisher (see [3]). The site interface is oriented to the user, generally speaking, nothing knowing about the econometric analysis.

2 The Analysis of Interrogations on Results of Lesson and Feedback

Results of interrogation about lesson and interrogation Feedback are, of course, absolutely various depending on a lesson, a teacher, an audience etc. However the correla-

tion analysis of factors led to similar outcomes (at 20% a significance level by criterion of Student). Everywhere below we use the interrogations of 421 groups (speciality “mathematician”), having typical species (fig. 1).

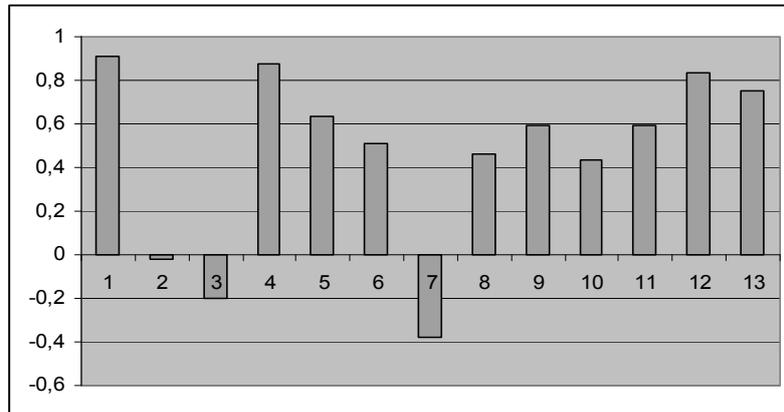


Fig. 1. Histogram for distribution of correlation coefficients Q1

Here is the histogram for distribution of correlation coefficients between answers to a question “Whether the lesson was pleasant to you?” and following factors:

1. Whether it is accessible (clear) an explanation?
2. Whether arranges you the rate of an explanation?
3. Are you tired at a lesson?
4. Lesson atmosphere: is it comfortable, is it pleasant to you at a lesson?
5. Is the statement filled enough by examples?
6. Objectivity of the marks, which have been put down at a lesson.
7. Are you having some questions to the teacher?
8. Do you still want a lesson on this theme?
9. Have you prepared for this lesson?
10. Are you intending to continue studying at home?
11. Accordance of a lesson to tasks of independent (home) work.
12. Is it interesting to you at a lesson?
13. Have you taken out something useful at a lesson or are sorry about spent time?

The most significant factors had appeared (in decreasing order) **1** (0.91), **4** (0.87), **12** (0.83), **13** (0.75) **5** (0.63), **9** and **11** (0.59). Objectivity of marks is only further (0.51) and inverse correlation – 0.39 for **7** specifies that for the majority the good lesson is such after which does not remain questions to the teacher (fig.2).

Here is the histogram for distribution of correlation coefficients between answers to a Feedback question “Whether the teacher is pleasant to you?” and following factors:

1. Whether lessons were pleasant to you?
2. Estimation by student of the knowledge received at lesson.
3. Is it accessible (clear) an explanation?

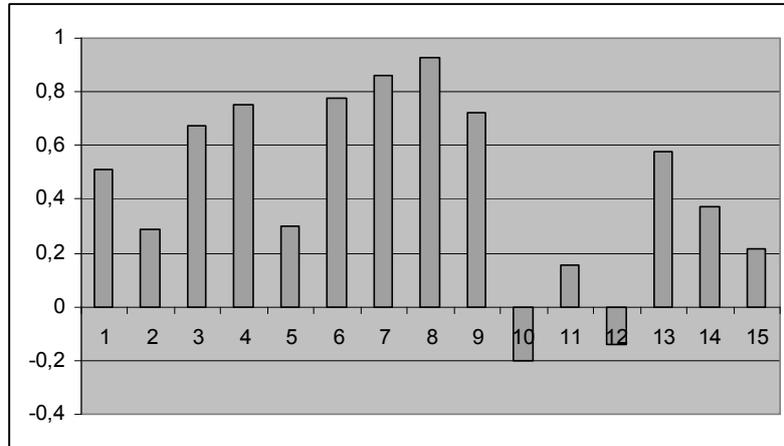


Fig. 2. Histogram for distribution of correlation coefficients Q2

4. How much are accessible (clear) and authentic answers to questions of students?
5. The explanation is filled enough by examples.
6. Using of various approaches at training.
7. Whether the teacher aspires to interest, motivate students?
8. Lessons atmosphere: is it comfortable, is it pleasant to you at a lesson?
9. Availability of the teacher, his inclination to listen to students, to conduct discussions with them.
10. Knowledge of a subject by the teacher.
11. Insistence (regular and frequent enough control of knowledge).
12. Punctuality (comes in time at lessons).
13. Possession of an audience (students do not sleep and do not make too much noise at lessons).
14. Objectivity in estimation of the student by the teacher. Whether criteria of estimation in all subgroups are identical?
15. Accordance of a lesson to control tasks.

The most significant factors appear (in decreasing order) **8** (0.92), **7** (0.85), **6** (0.775), **4** (0.75), **9** (0.72), **3** (0.675), **13** (0.58).

Only further with factor of correlation 0.51 follows 1 - whether lessons were pleasant to you. And major factors of estimations of the teacher and lesson are considerably differing. Further the histogram of differences between factors of correlation for questions “Whether the teacher is pleasant to you?” and “Whether lessons were pleasant to you?” is resulted.

The factors much more essential at an estimation of a teacher, than a lesson are 6 (using of various approaches at training) and 7 (whether the teacher aspires to interest, motivate students). On the contrary, at an estimation of a lesson it is much more essential factors 14 (accordance of a lesson to control tasks) and 10 – insistence (regular and frequent enough control of knowledge): probably, according to students, insistence it is good for lesson and it is not so good for the teacher.

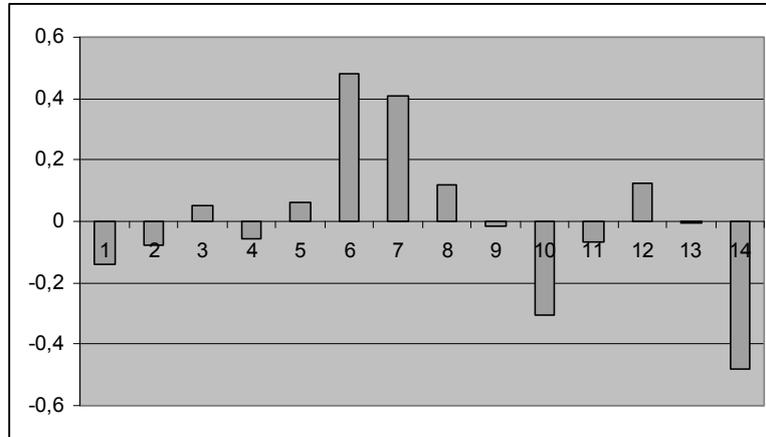


Fig. 3. Histogram for distribution of correlation coefficients Q3

Certainly, the correlation matrix contains decomposition on factors also for each of 15 questions. So it is found out that 5 (the explanation is filled enough by examples) is most closely connected with 15 (accordance of a lesson to control tasks); 3 (are you tired at a lesson) with 7 (presence of questions to the teacher); 13 (possession of an audience) with 14 (objectivity in estimation of the student).

It is interesting to compare 12 (is it interesting to you at a lesson) with 13 (have you taken out something useful at a lesson) from interrogation about results of the lesson (fig.4).

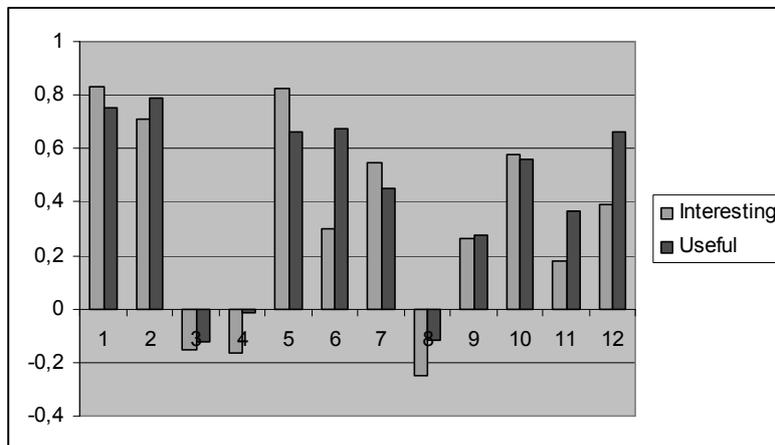


Fig. 4. Histogram for distribution of correlation coefficients Q4

As we see, from the student’s point of view, it is interesting and it is useful is not the same. So 4 (lesson atmosphere) correlates with the factor interesting much more, while factor 5 (is the statement filled enough by examples) with 11 (accordance of a lesson to tasks of independent (home) work).

3 The Analysis of Interrogations about the Factors Influencing a Lesson

Unlike interrogations about results of lesson and Feedback results of interrogations about factors of influence on a lesson course are close enough in different groups. The histogram for distribution of interrogation requisites on the relation to lesson (in 421 group) is below (fig. 5).

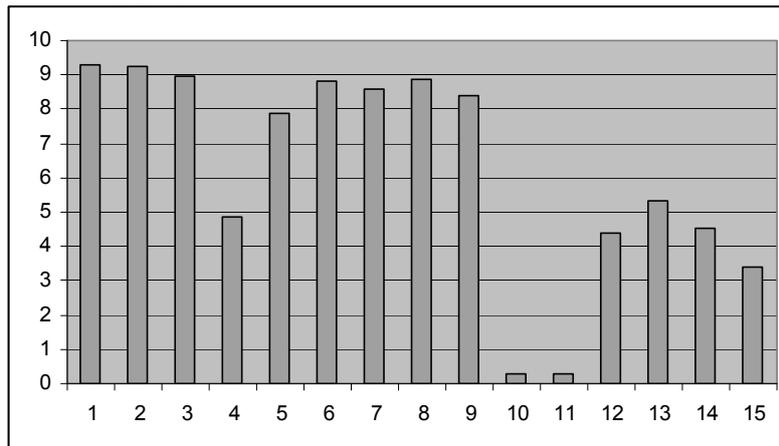


Fig. 5. Histogram for distribution of correlation coefficients Q5

Here:

1. Is study pleasant to you? Is it interesting to you?
2. Whether you believe that education is “road to the future”?
3. Is your speciality pleasant to you?
4. Is the program of training for your speciality satisfying you?
5. Whether satisfies you teaching level at the university?
6. Whether on own will you have chosen university and a speciality?
7. Would you like to change the speciality or to receive additional higher education?
8. Whether your attendance of lessons is regular?
9. Do you regularly prepare homework?
10. Whether there were at you conflicts to teachers?
11. Were you afraid of an exception of university?
12. Do you wish to take part in scientific work, in Olympiads on your speciality?
13. Whether often to you fellow students address for the help in lessons?
14. Do you wish to enter postgraduate study after training end?
15. What’s the time you spend for preparation for lessons (on the average hours per day)?

And further similar results of interrogation on external factors (fig. 6):

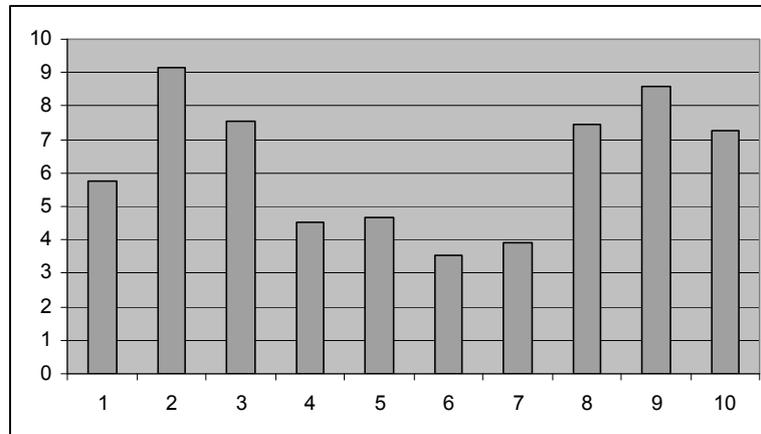


Fig. 6. Histogram for distribution of correlation coefficients Q6

Here:

1. Close dialogue with teachers.
2. Accessibility of the Internet at university.
3. Readiness of an auditorium for a lesson (working capacity of projectors, computers, the software; comfort of an auditorium).
4. Presence of enough points for the centralized feeding.
5. Accessibility of contacts to the future employers.
6. Accessibility of summer improvement.
7. Participation in scientific work.
8. Teaching level at the university.

In a correlation matrix under all these factors there are only few factors which correlations are close to 1. These are factors:

1. Whether your attendance of lessons is regular with factors
 - (a) do you regularly prepare homework (0.87)
 - (b) teaching level at the university (0.84)
 - (c) participation in scientific work (0.63)
 - (d) have you prepared for this lesson (0.59)
 - (e) accessibility of summer improvement (– 0.5)
2. Do you regularly prepare homework with factors
 - (a) whether your attendance of lessons is regular (0.87)
 - (b) teaching level at the university (0.815)
 - (c) have you prepared for this lesson (0.66)
 - (d) participation in scientific work (0.56)
 - (e) accessibility of summer improvement (– 0.52)

3. Teaching level at the university with factors

- (a) whether your attendance of lessons is regular (0.843)
- (b) do you regularly prepare homework (0.815)
- (c) whether on own will you have chosen university and a speciality (0.65)
- (d) have you prepared for this lesson (0.59)
- (e) participation in scientific work (0.56)
- (f) accessibility of summer improvement (– 0.55)

Besides them correlation factors above 0.7 appear still only twice: between factors *whether there were at you conflicts to teachers* and *were you afraid of an exception of university* (0.85); and between factors *participation in scientific work* and *is the program of training for your speciality satisfying you* (0.74). Occurrence in such line the factor *teaching level at the university* is, probably, the best compliment for Faculty of physics, mathematics and informatics of the Kherson state university for all its history. Our main task is to use the mental orientation, fixed thus in the correlation analysis of factors, for separating true students, for which educational process is a considerable part of their life, from those, who would prefer to keep far away from it. Using already cited data and the following table 1

Table 1. Correlation analysis of factors

Factor	Average value	Root-mean-square deviations
Teaching level at the university	702	2.17
Regularly attendance of lessons	8.85	2.3
Regularly prepare homework	8.4	2.6

We choose as a differentiating sign between groups the factor *regularly prepare homework*. In this case mutual correlations of defining sign are closer to 1; and the dispersion is more, that testifies about more variability of respondents under this factor. Besides, among others selected it more corresponds to such sign on common sense.

4 Results of Interrogations about Lesson and Feedback on Subgroups

To the selected differentiating sign among 20 respondents of group 421 the 12 participants is allocated, who for a question *do you regularly prepare homework* have answered with 10 or 9 points. The additional subgroup consists of 8 respondents. Whether there correspond such subgroups to required division into true students and the others? Below there is the histogram for average results of interrogation about lesson on the allocated subgroups (fig. 7).

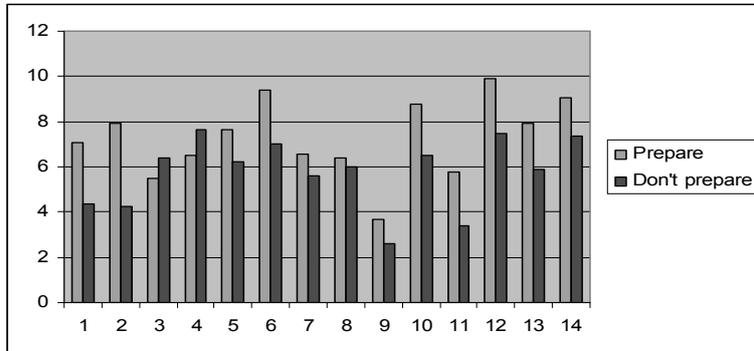


Fig. 7. Histogram for distribution of correlation coefficients Q7

So, the factors considerably different in subgroups (in decreasing order of modules of differences between average values in subgroups) are:

- 2 Whether it is accessible (clear) an explanation? $(7.92 - 4.25 = 3.67)$
- 1 Whether the lesson was pleasant to you? $(7.1 - 4.38 = 2.72)$
- 12 Accordance of a lesson to tasks of independent (home) work. $(9.91 - 7.5 = 2.41)$
- 6 Is the statement filled enough by examples? $(9.41 - 7 = 2.41)$
- 10 Have you prepared for this lesson? $(8.75 - 6.5 = 2.25)$
- 13 Is it interesting to you at a lesson? $(7.92 - 5.87 = 2.05)$
- 14 Have you taken out something useful at a lesson? $(9.1 - 7.4 = 1.7)$
- 5 Lesson atmosphere $(7.66 - 1.25 = 1.41)$
- 9 Do you still want a lesson on this theme? $(3.66 - 2.65 = 1.01)$

The averages of additional group are more only twice, there are:

- 4 Are you tired at a lesson? $(6.5 - 7.62 = -1.12)$
- 3 Whether arranges you the rate of an explanation? $(5.5 - 6.37 = -0.87)$

Last result is strange at first sight, but steady for all groups and it is easy to explain this phenomenon psychologically: as less adjusted the student for study, the more he would like acceleration, faster course of time.

Further there are similar results for interrogation Feedback (fig. 8).

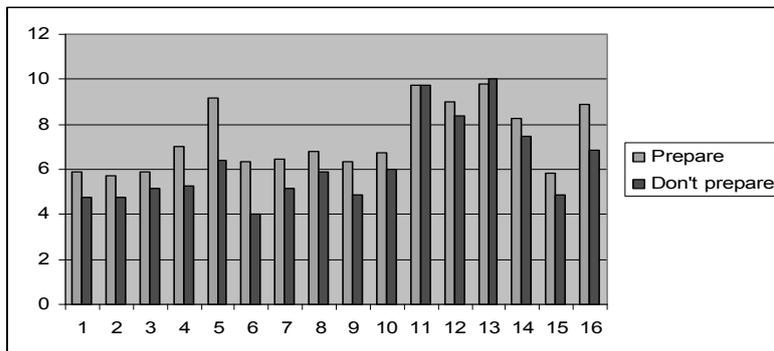


Fig. 8. Histogram for distribution of correlation coefficients Q8

Here the factors considerably different in subgroups are:

- 5 The explanation is filled enough by examples (9.17 – 6.37 = 2.8)
- 6 Using of various approaches at training (6.36 – 4 = 2.36)
- 16 Accordance of a lesson to control tasks (8.9 – 6.87 = 2.03)
- 4 How much are accessible (clear) and authentic answers? (7 – 5.25 = 1.75)
- 9 Lesson atmosphere (6.36 – 4.85 = 1.51)

The obtained data corresponds to a hypothesis about required division into groups, anyway they don’t contradict it.

5 The Latent Division in Group

The site “Lesson pulse” offers also division of group into classes with a given value of mutual correlation: between two respondents from one class it is possible to find a chain of respondents of this class so, that the correlations of answers between consecutive respondents of this chain not less than the given value. Such division into subgroups allows finding out distinctions in the group, which is not appreciable directly.

At mental interrogation about factors of influence on lesson and the set minimum level of mutual correlation 0,6 in test group 421 splitting into 3 classes has turned out: from 4, from 5 and from basic subgroup of 11 respondents. Let’s compare averages of the basic class to averages of the first and second subgroups under those factors in which appreciable differences have come to light.

1. Is the program of training for your speciality satisfying you?
2. Would you like to change the speciality or to receive additional higher education?
3. Do you wish to take part in scientific work, in Olympiads on your speciality?
4. Do you wish to enter postgraduate study after training end?
5. Participation in scientific work.
6. Readiness of an auditorium for a lesson.
7. Accessibility of summer improvement.
8. Accessibility of contacts to the future employers.

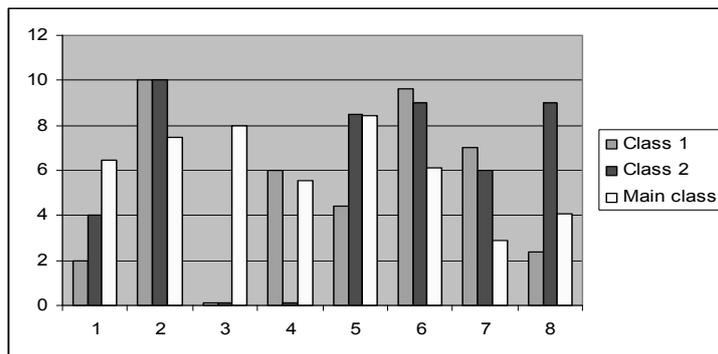


Fig. 9. Histogram for distribution of correlation coefficients Q9

Respondents from classes 1 and 2 much less than the basic group are satisfied by the program of training of the speciality (point 1). They would like to change the speciality or to receive additional higher education essentially more than the basic group (point 2). Their difference is the sharpest comes to light in point 3: unlike the basic group they at all do not wish to take part in scientific work or in the Olympiads on the speciality. So, apparently, the speciality for them has lost now appeal. Respondents from a class 2 does not interest in the postgraduate study (point 4), however they do not against scientific work (point 5). The main thing, they have the most interest in contacts to employers (point 8). Apparently, it is search of the application out of the speciality. Respondents from a class 1 are focused differently: they have a little interest in scientific work and employers (points 5 and 8), but they wish to enter postgraduate study (point 4).

References

1. De Bono, E.: *Six Thinking Hats*. Penguins Books (1997)
2. PHP Book, <http://www.phpreferencebook.com> (2012)
3. Hansen, B. E.: *Econometrics*. Textbook, <http://www.ssc.wisc.edu> (2012)