To the issue of economic efficiency of public projects in agriculture

Edita ŠILEROVÁ[1], Lucie SEVEROVÁ[1], Stanislav BENDL[2]

[1]Department of Information Technologies, Faculty of Economics and Management, Czech University of Life Sciences, Prague, Czech Republic
[2]School & Social Pedagogy Department, Faculty of Education, Charles University, Prague, Czech Republic

Abstract: It is the task of the economists to assess – under the conditions of the public budgets restrictions – whether the return rate of investments into public projects is sufficient enough in order to justify these projects in comparison to an alternative utilization of the expended resources. Complex e-learning systems, which include both the educational part and the subsequent verification of the students' knowledge, have lately been gaining on popularity in agriculture, in the public ICT projects from the field of education. The objective of the article is to explain the means of expressing economic efficiency of public projects on the example of establishing the Moodle e-learning system.

Key words: knowledge management, ICT, education, test, efficiency, Moodle

Quick development of information and communication technologies allows for their utilization in all areas of human activities. Owing to the emerging new information, it is necessary to regularly extend the amount of the gained knowledge during the study of a given field. It is important to hand new knowledge over to their end users as fast as possible, so that they can make further use of it. The fast-growing role of the information (suitable according to the syntactical and pragmatic standards at its recipient) is a dominant characteristic of the new society (Hron and Macak 2008). Therefore, introducing information and communication technologies and information systems into education is becoming a priority and necessity in the entire school scheme in developed countries and also a priority in the corporate education. The internationalisation of higher education is to a large extent accidental, rather than clearly intended when it comes to its educational content. How to realise the intentions of internationalising higher education in terms of teaching and learning, focusing on the epistemological dimension, seems therefore to be a legitimate and important question (Svensson et al. 2010).

According to the OECD statistics, the number of people with a university degree has increased in the Czech Republic in the last 10 years by 3 percentage points to 14%. However, the citizens of the developed European countries are educated twice as well; an average of 28% of inhabitants with a university diploma can show off there. Not only is this is the quantitative side of the issue of concern, but also the maintenance of the education quality while the number of university-educated people is growing.

If the current proportion of university-educated citizens in the populations of the advanced market economies reaches around 28% (for example Finland already shows even 75% part of tertiary education on completed education of its inhabitants), neither will our economy be able to avoid this important transformation in the area of human resources. The rising number of students in all forms of study at the Faculty of Economics and Management of the Czech University of Life Sciences (ČZU) is related to the above mentioned tendency in the lately transformed economies after the increase of the number of university students and as a consequence also of the higher proportion of university graduates in the entire population. One can, however, ask who is considered a university student by each economy and what is considered as a tertiary education.

Can we reach this change even when the current percentage of expenses on education from GDP is so low? Financial resources are lacking in all sectors of

Supported by the Ministry of Education, Youth and Sports of the Czech Republic (Project No. MSM 6046070906 – Economics of resources of Czech agriculture and their efficient use in frame of multifunctional agri-food systems).

the economy and the possibility of their alternative utilization in other areas of the economy is more than obvious.

With the aim and the importance of education, the theoretical economy has preoccupied this area for several decades. During this time, two basic theoretical trends of the economic theory were defined. The Human Capital theory arose in the sixties of the last century, based on the works by the economists from the Chicago school, represented among others by G. Becker, J. Mincer, or T. Schultz.

Its development was committed to a consistent application of the neoclassical economy as a methodological basis for understanding the human behaviour. Its principles were applied to the effectiveness of the investments into the human capital and especially into education. Economic subjects allocated their resources with the aim of maximizing pure advantage, while taking into consideration the alternative costs, risk and principles used by the neoclassical theory.

As we can see, the theory of human capital states that education is a specific production factor and it is a specific kind of capital (Becker 1993).

As stated by F. Hirsch: "Education is in its economical function filter and factory. The extension of the number of diplomas means by itself a decrease of the number of singular from the individual diplomas" (Hirsch 1976).

Hirsch anticipated the importance of a broad extension of university diplomas and after that, testimonies of the gained degrees of education, which need not be only positive.

Stiglitz (2000) further deals with the question of human resources in terms of the efficiency of their utilization under the conditions of public economy. He belongs to the representatives of the neo-Keynesian trend in economy and emphasizes an efficient use of the government expenses to support economic growth.

MATERIAL AND METHODS

Although the number of students is increasing, the required quality of education has to be maintained. Therefore, it is necessary to be concerned with new alternatives to the current means of teaching and education as well. Establishing new information and communication technologies into the educational process, along with the related new methods of testing, seems to be a suitable solution that can reduce the need for human resources.

The objective of this contribution is to express the possibilities of applying economic mathematical models for the evaluation of economic efficiency of public projects in agriculture, using the example of introducing the Moodle e-learning system. A partial goal of this study is to generalize the experience with verifying knowledge in economic subjects through the use of information and communication technologies.

Main methods used for the scientific investigation in this work were: the method of economic mathematical models (methods of one-criterion decision making – cost-output), description method (description of characteristics and behaviour of the Moodle ICT model), the method of analysis and synthesis (analysis of currently used educational system and verification of knowledge during exams) and partly also other methods.

Use of cost-output methods to evaluate economic efficiency of public projects in agriculture

First group of methods that can be used to evaluate economic efficiency of public projects in agriculture are *methods of one-criterion decision making.* They are also known as input-output methods because they take into account the relationship output/costs.

These methods assume the possibility of using one dominant criterion, to which other criteria can be translated at least ordinally (for example to accomplish their ordering from the best to the worst) or also cardinally (to calculate the utility function). The following one-criterion methods can be distinguished (Ochrana 2001):

– Costs-minimization analysis (CMA),
– Cost-benefit analysis (CBA),
– Cost-effectiveness analysis (CEA),
– Cost-utility analysis (CUA).

The attribute of all these mentioned methods is the analysis of costs. Costs are measured in all methods in value units, but for differently quantified outputs.

The CMA method does not measure outputs, the CBA measures value units, the CEA natural units and in the CUA outputs are measured in the form of usefulness.

One-criterion methods to express efficiency of public projects

– ***Cost-minimization analysis***. It belongs to the relatively simplest methods; there are many possibilities for its use in the public sector, including educational system. While investigating efficiency,

we will not judge the implications of educational process, but it will search for an option with minimum costs. It will be used in case only the aspect of input (costs) is taken up as the selection criterion, and it is assumed that outputs are qualitatively and quantitatively homogeneous and relatively consistent. If it be to the contrary, we are taking the risk of wrong selection.

– ***Cost-benefit analysis.*** It is a method typical by evaluating the results of processes in monetary units, so that it is possible to compare them to the costs. For example, in education it assumes the evaluation of the gained acquirements in money, so that they can be compared to the costs spent on them.

Cost-benefit analysis (analysis of utility) as a basic method to express the efficiency of education can be defined as a set of practical methods of the optimal choice in the area of agricultural sector, respecting the criterion of the maximum net social profitability, whereas all considered costs and utilities are expressed in money, either by direct or indirect means.

Costs represent a set of monetary expenses and non-monetary elements necessary to make use of various resources in order to gain a specific product (in our case education). Restrictions resulting from the governmental regulation measures can be included among the non-monetary elements, as well as "opportunity costs", which express advantages resulting from other uses of the same resource, etc.

Benefits in this concept represent a set of welfare (utilities) of individuals or a group of individuals generated by an educational programme in the form of gaining a specific kind of education and using it in practice. They can be expressed primarily in the monetary or also non-monetary form.

In practice, this method is a very suitable tool of economic decision making, where any increase in utility is regarded as a benefit and any decrease in utility is considered a cost. Decrease in utility is measured by opportunity costs of the evaluated project, by which there is meant the value of a given up alternative action (given up opportunity costs). Given up opportunity costs have the value of the best available alternative.

In CBA, costs and benefits are calculated for the entire life-span of a project, or its implemented investment ventures.

The following general rule holds for accepting an alternative:

$$\sum_{t=0}^{T} \frac{B_t - C_t}{(1+r)^t} > 0$$

where:

t = given time period

T = final time interval, when project ends its economic life-span

B_t = benefit in time period t

C_t = cost in time period t

r = social discount rate

It is implied from the above formula that an investment venture is economically beneficial only if the discounted value of benefits is higher than the discounted costs. Considering monetary evaluation of costs and benefits, the resulting effect of a given investment venture is quantified by the equation:

$$E = \frac{B}{C}$$

where:

E = resulting effect

B = benefit from public project for its entire life-span

C = costs of project implementation and total costs for the entire project's life-span

The highest evaluation is given to the alternative with the highest effect per unit of costs. In practice, it is often impossible to quantify exactly the benefits and costs in monetary units. Nevertheless, their structural enumeration gives the policy decision-makers a different (more complex) point of view for the final alternative choice. Taken exactly, benefits and costs should be evaluated in shadow prices. If it is difficult to do, models of so called imitation markets that allow the derivation of shadow prices are constructed. When analysing costs, it is important to distinguish between direct costs (expressed generally in market prices) and indirect costs that are usually evaluated as alternative costs (given up opportunity costs).

Use of investment productivity method

Another method that can be used in the choice of the investment type alternatives is the **investment productivity method** (Ochrana 2001). When using this method, we need to determine the costs of a given project and its benefits. Opportunity costs are also included in the costs. After determining costs and social benefits, a net current value of a given project (for example educational) is established in the final step.

The principle of the method of investment return rate determination for a public action is the comparison of price and utilities from a given investment, whereas such an interest rate is searched, with which the current value of monetary incomes

from the implemented project is equal to the capital expenses on its implementation. Therefore, we determine the internal income percentage (return rate of an investment venture), that is, we solve the following equation with regard to the interest rate as an unknown variable:

$$C = \sum_{n=1}^{T} \frac{B_n}{(1+r)^n}$$

where:

C = overall costs of educational project (purchase investment costs)

B_n = benefit B in year n

r = (unknown) interest rate, with which the current value of monetary incomes from the implemented project is equal to capital expenses on its implementation

T = life-span of educational project

For example, if we propose various educational projects and want to determine (estimate) their return rates, our C value will constitute the overall costs of the education of an individual, including the given up opportunity costs (costs in the form of lost wages a student could have earned, calculated for the time the student is trained in school). Utilities (benefits) B are then given by the difference between the student's estimated income after implementation of the educational project and the income he/she would earn if the project was not implemented. Benefits are related to productive age.

Using this method requires distinguishing between the social return rate, which we use when evaluating public projects – that is the planned actions (analysis ex ante), and the individual return rate, which expresses the individual costs and benefits. This method is used to construct the education demand curve. It is therefore crucial that young adults begin to learn about finance during their adolescence in order to have the best possible chance for a successful transition to adulthood (Shim et al. 2010).

– ***Cost-effectiveness analysis.*** It is suitable especially for monitoring efficiency in the public sector where institutions work on the basis of the mass services system. These are for example educational institutions or financial institutions, when the evaluation of their effects in monetary units is complicated. The basic criterion question is how to achieve the given goal by the cheapest means. Outputs of an institution can then be quantified in non-monetary units, for example the implications of education in educational programmes are measured in natural units (i.e. the number of graduated students), whereas the outputs of different quantity (different numbers of students) are compared, however, they are of the same character. Moreover, these outputs are considered desirable.
– ***Cost-utility analysis.*** The CUA method can also be used to analyse efficiency in the public sector. It is based on monitoring the comparisons of gains in inputs (incremental project costs) and outputs. It can be used for instance to evaluate the efficiency of health and environmental programmes. Benefits are measured in so-called life expectancy units that are corrected by the quality of life.

This method is used the most in the health services, but its principle can be applied to education as well. Implications of alternatives are measured in the adjusted natural units which allows respecting the fact that the same output units do not always express the same benefit rate for an individual and for the society. The qualitative side of output is also taken into consideration by this method.

RESULTS AND DISCUSSION

Using the Moodle e-learning system as an example of public project

Under current conditions, the Moodle is considered the most progressive ICT e-learning system at the Czech University of Life Sciences. Owing to its advantages, it was adapted not only for education, but also for testing the students' knowledge in economic subjects.

The Moodle is a software package designed to support both the daily and distance education by the means of online courses available on websites (Moodle.cz 2010). It is complex e-learning software that offers to the universities a whole range of functions with the possibility to suit them to the needs of the given school. The Moodle allows for example inserting a syllabus into a course, using registration keys for courses, inserting files into a course, dividing students into groups according to the teacher, handing in homework thanks to the web interface, inserting student questionnaires, filing in attendance, establishing a forum, and finally it also offers creation of tests and the subsequent generation of tests to students within a written exam.

The Moodle is a freely-distributable software with an open code. It works on the operation systems Unix, Linux, Windows, Mac OS X, Netware and on any other system that supports the PHP. Data are saved in the database MySQL, PostgreSQL, MS SQL or Oracle. The basis of the system is a web server with the installed Apache software that translates the PHP code and its output is a site in the HTML language,

which is being sent via internet to the terminus of a user. Web server communicates with the database server, where the data are saved and loaded. The main advantage of this system is in its availability. It is possible to log in to the Moodle from anywhere with a computer and an internet access. This is also the reason for the system's most typical use for students enrolled in the distance education. The teacher can communicate with his/her students in the form of public announcements within a given course, by establishing a forum or by sending private messages. Besides the syllabus of a given subject itself and the relevant basic information, the course can be upgraded by many other study materials including lectures and sample examples. This all lowers the regular commuting demands to school (for both students and teachers) and the individual communication with students via e-mail is dropped. Second significant advantage of the Moodle system is its modifiability. The Moodle is bought by universities as an open source; an administrator skilled in the HTML and PHP programming can add new functions to the system or adjust the existing functions.

The Moodle distinguishes a hierarchical structure of users. Programming engineers have the highest rights; they have access to the web and database servers. They can change the entire structure of the Moodle system, add or remove control modules or change records in the database through the phpMyAdmin interface. Next group are the administrators at the highest level who have access to the administrator interface, where they can set up new categories of courses and mostly assign rights to lower administrators and to other users. Lower administrators called the GAELPs (Guarantor of Electronic Support) have the administrator rights at the level of department. Their task is to add new courses that are being offered by the given department in the current semester, and subsequently to assign teachers to these courses. Teachers then get rights for editing and are expected to prepare a well-arranged high quality course.

While this course preparation may seem to teachers as redundant (in connection with the standard education based on the attendance to lectures and tutorials), using the Moodle as a tool to check the students' knowledge makes their work more automatic and therefore easier. In terms of preparation and application of tests, the teacher's role is narrowed down to the problem of creating the exam database. The Moodle itself generates tests for students from this database and evaluates them. A pronounced advantage of the Moodle is the variability in creating the exam questions. The Moodle offers a wide range of different types of problems. The most widely used type of problem is a multiple choice question, whereas it is possible to set how many percent of the total points for the question a student gets for using the individual answers. For instance, for calculating exercises, a practical type of problem are questions allowing the student to write down a specific numerical result as the answer. The creator of the question enters as its parameter an interval, in which the given result is considered correct. Often used are also the fill-in questions, where students are asked to write down an expression or a whole sentence. The percentual determination of a portion of the total number of points for questions based on the quality of an answer finds its use just in such cases. A disadvantage is the fact that it is not possible to use negative points. However, this imperfection of the Moodle can be eliminated by shifting the whole grading scale. For example, if we wanted to allow students to leave questions without answers in a test (basically the answer "I do not know"), we would set zero points for such answers in the system of negative points. In the Moodle system, we need to set half the number of points for these answers and we must shift the grading scale from its half.

Results of students' tests are saved by the Moodle in a database and they can be retrieved from there at any time. The system also allows exporting a complete list of results into an Excel sheet for statistical purposes. The Moodle calculates the average of the test results by itself and for some questions; it gives a statistic of successfulness of the specific answers for this given question.

Preparation of checking students' knowledge by the means of ICT

Based on a carried out analysis of the extent of the subject matter being taught, a number of qualified teachers assigned to testing, as well as the extent of working hours and the spare capacity of classrooms available for our department, the following findings were made:

– The extent of the subject matter being taught is approximately equivalent to a standard course accredited with the faculty classification 1 A, similarly to all faculties at the University of Economics in Prague (VŠE). The extent of subject matter therefore cannot be reduced. On the other hand, the number of classes and of the home preparation of students – within the scope of one semester – is equivalent to half the hour-capacity at VŠE.
– Computer tests are as demanding as we ourselves set them; the technology only makes our work easier.

When it is not possible to translate everything from the curriculum into computer (programme) form, we can check that portion of knowledge in an oral exam.

– The system of checking the students' knowledge in exams has already been introduced by other departments with convincingly positive results. The experience from developed countries confirms that it is possible to prepare a test from the economic theory; for example in the USA, at the Oregon State University (Corvallis), this type of testing knowledge in the subject of economics was established already 8 years ago. It was hardly the first university in the USA to do so.
– In the subject of microeconomics, a trial test was created which not only covers the whole curriculum, but also distributes it into 13 basic chapters. From these 13 chapters, randomly generated by computer, there are 8 quiz questions, 3 problems and 2 graphs for solution. Each of the trial problems in the text is evaluated by 8 points for 4 answers, whereas the individual questions are asked in the form of expected answers: yes – no – I do not know, and are worth 2 points. The following partial problem can serve as an example:

  Yields from variable input:
  (a) refer to a long period
  – not correct
  (b) are decreasing in a situation when production is growing faster than input
  – not correct
  (c) are decreasing in a situation when production is growing slower than input
  – correct
  (d) refer to a short period
  – correct
– The speed of the system and the related time saving. Students get to know their result immediately after finishing the computer test and therefore they do not wait a long time for the announcement of results. This better reflects the validity of performance in an oral exam with the actual knowledge. Computer itself delivers the result: did not pass, passed with a specific classification and the percentage portion of correct answers. An examining teacher is then doing the real intellectual work he/she is designated for; the activity that develops and stimulates the student during an exam.

If we evaluate the mentioned by the information technologies compiled tests, we can say that in terms of the content and extent of subject matter in a given course, using this form of test seems to be adequate, corresponding to its content.

Example of a given test formulation and analysis of impact of ICT introduction:

Comparison of test results from macroeconomics in two monitored school years 2006/2007 and 2007/2008 illustrates the difference between testing students by the classical written exams and the modern use of information and communication technologies in distance study. The exam took place in summer semester (Table 1).

In 2006/2007, the total number of 307 students signed up for the subject of macroeconomics in the distance study; 216 of these students came to take the exam. An overall average of 2.86 in this subject was determined after using the possibility of three attempts to complete the examination.

In 2007/2008, the total number of 330 students signed up for the subject of macroeconomics in the distance study; 196 of these students came to take the exam. An overall average of 3.25 in this subject was determined after using the possibility of three attempts to complete the examination.

As it is clear from comparing the two above mentioned average grades – 2.86 before introducing the information and communication technologies into checking the students' knowledge, and 3.25 after in-

Table 1. Classification before and after use of ICT

Classification	1st attempt		2nd attempt		3rd attempt	
	written 2006/07	computer 2007/08	written 2006/07	computer 2007/08	written 2006/07	computer 2007/08
1	7	0	0	0	0	0
2	34	19	17	10	4	4
3	66	47	37	25	13	9
4	109	130	28	60	2	29
Total number of students	216	196				

troducing these technologies – a substantial difference in classification was detected, which can confirm the previous reflections on a higher objectivity of testing students by the ICT. Similar examination results were reported in the following school year.

Time saving is reached in the terms of the number of university teachers involved in testing students, especially while correcting tests, when a substantial part of teachers used to be busy with this manual work. The transition to new testing of knowledge thus does not have additional demands on premises; on the contrary, it allows to effectively use the computer labs during the exam period.

Likewise, it is possible to positively evaluate also the experience with introducing this form of test at other pedagogical workplaces. The experience from universities in developed countries, especially the USA, points to an overall deficiency of some European countries not only in implementing the ICT, but also in their application to practical activities. Up to a 15-year delay of the EU countries behind the USA is estimated. We need to reverse this unfavourable trend, even in our mentioned application. However, we require more dynamic empirical investigations in the higher education research of the particular policy trajectories where the focus is on the dilemmas facing decision makers as they respond to the local and more international influences (King 2010).

Evaluation of economic efficiency of the ICT Moodle project

In terms of evaluating the choice of the given Moodle system in relation to other offers (especially to the earlier verified system Unitest), it is possible to use the mentioned cost-output methods to evaluate economic efficiency of public projects for the decision about the purchase of an ICT system.

But which of the cost-output methods to evaluate economic efficiency of a given ICT project is optimal in terms of utilization (decision-making)?

The first method, the Cost-minimization analysis, can definitely be eliminated, because deciding only in terms of the level of costs on a project is not possible in this case.

Cost-benefit analysis is a method typical by evaluating results of processes in monetary units, so that they can be compared to costs. However, time saving for university teachers is not supposed to lead to a decrease in their numbers, because their activities include other (intellectual) pedagogical duties as well. Moreover, it is important to also consider the qualitative elements of the ICT system, for example the possibility to lecture through it, to connect the out-of-Prague centres and others, which – when using this method – would be necessary to express (evaluate) by shadow prices.

Evaluating the choice of an ICT system by the *Cost-effectiveness analysis* considers the fact that pricing an effect in monetary units is complicated; the implications are measured in natural units. A possibility to test students also in the CUA centres would also contribute to the convenience of the Moodle system. However, a possibility to communicate with students through the system is not included in the evaluation here.

The *Cost-utility analysis* allows to consider even the qualitative side of an output; the implications of alternatives are measured in the modified natural units, which takes into account the different extent of utility for a student and an institution. Therefore, this method would seem optimal in the light of choosing an ICT system for a specific institution. However, it does not have the possibility to financially evaluate the output, meaning that students are gaining a better education thanks to the Moodle system, and they can later use this education financially. Time saving for the teacher can be considered the main contribution of the ICT. Assuming that he/she was examining 4 days a week during the exam period of 14 weeks, his/her utilization ratio was 0.8. There is a time saving by more than one half for the teacher after the implementation of the ICT, with an approximate utility coefficient of 0.3. The difference between the coefficients 0.8 and 0.3 is then 0.5, which is equivalent to half the working time of a teacher, and he/she can devote this time to other scientific and publication work. Furthermore, the waiting time of students for the exam results was shortened to about one half, which is on the contrary a qualitative contribution for the student.

As evident, in the institutional practice we most often encounter decision-making by the Cost-benefit analysis, which is the same way of thinking as every human who decides for university education do. However, public institutions also have to consider the social benefit, which is well known in agricultural practice, for instance in the form of government grants and similar public interventions.

CONCLUSIONS

The increasing number of university students, that is supposed to allow for the qualitative growth of human resources in the developed countries, is reflected also in the conditions of agricultural universities in

the Czech Republic. However, with the given financial resources, the current pedagogical-experimental capacities of university departments do not keep up with the quick yearly increase in the number of students. Introducing information and communication technologies into the pedagogical process seems to be a solution to this situation; computers save time of both teachers and students, allow a more intensive use of premises, make the exam administration easier.

The implementation of this new system is positively viewed not only by teachers but also by students – for them, it eliminates primarily the long and stressful waiting for the result of a written exam. From their point of view, however, such a system represents a higher risk of the computer network failure, the random selection of more complicated questions in one test version and so on. "Risk can be viewed as a difference between the real future state and expected future state. This difference arose due to the change of risk factors, which translated utility of subjects" (Šrédl 2010). Accepting the mentioned ICT system (Moodle) can thus be recommended for the practical application at other pedagogical workplaces in agriculture, where it can spare efforts with checking the students' knowledge in the form of written tests. The Moodle system can also be recommended for the study of company courses and testing the knowledge of company workers. The flexibility of study of the individual employees is becoming a big contribution – both the course itself and the possibility to take a test (checking knowledge) is available to the employees at a time suitable for them.

REFERENCES

Becker G.S. (1993): Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education. University of Chicago Press, Chicago.

Hirsch F. (1976): Social Limits to Growth. Harvard University Press, Cambridge, Massachusetts.

Hron J., Macák T. (2008): Determination of management capacity. Agricultural Economics – Czech, *54*: 49–51.

King R. (2010): Policy internationalization, national variety and governance: global models and network power in higher education states. Higher Education, *60*: 583–594.

Moodle.cz [online]. Available at http://moodle.cz> (accessed 2010-05-13).

Ochrana F. (2001): Veřejný sektor a efektivní rozhodování (Public Sector and Effective Decision Making). Management Press, Praha.

Shim S., Barber B.L., Card N.A., Xiao J.J., Serido J. (2010): Financial socialization of first-year college students: the roles of parents, work, and education. Journal of Youth and Adolescence, *39*: 1457–470.

Stiglitz J.E. (2000): Economics of the Public Sector, W.W. Norton, New York.

Svensson L., Wihlborg M. (2010): Internationalising the content of higher education: the need for a curriculum perspective. Higher Education, *60*: 595–613.

Šrédl K. (2010): Behaviour of subjects on risk markets. Agricultural Economics – Czech, *56*: 224–230.

Arrived on 5th October 2010

Contact address:

Edita Šilerová, Lucie Severová, Czech University of Life Sciences Prague, Kamýcká 129, 165 21 Prague 6, Czech Republic

Stanislav Bendl, Charles University in Prague, M. D. Rettigové 4, 116 39 Prague 1, Czech Republic

e-mail: silerova@pef.czu.cz, severova@pef.czu.cz, stanislav.bendl@pedf.cuni.cz