Abstrakt

Education as many other areas of western societies has introduced the output evaluation as a reaction to financial restraints and to increased responsibility at level of individuals or individual institutions. Inputs and processes have become less important than output, and a search for best output indicators has started. During past decades the culture of evaluation has been developed and output characteristics have been improved in many educational systems. Thus, the concept of value added has emerged as a logical step in the process of improving the knowledge about how schools differ in adding new knowledge, skills or competencies to student's learning. Test-based measuring of output was not able to take into account many characteristics – as different student social backgrounds or levels of previous learning – that are crucial for comparing output at all levels, from primary to tertiary education.

During past about forty years value-added modelling has gathered a lot of experience and many empirical data. In some countries it has already moved beyond the research phase to become part of evaluation systems, although research activities continue, focused on various characteristics of models and their specific use. Moreover, countries are in a different position when meeting all necessary conditions for value-added modelling. Many countries have introduced some measure of testing at different stages of educational systems as a way of determining output characteristics which tend to be used for comparing schools. Once such a measuring has been introduced into an educational system, the pressure of improving methodology for comparing schools has been mounting and the question of value-added modelling has been raised.

The aim of the thesis is to consider different aspects of value-added modelling and its use in real conditions of an education system. There are various expectations as far as utilization of value-added outcomes is concerned as the school surroundings and other non-school elements are of diverse nature. Not all parts of the school system can profit from value-added modelling in the same way, and there are many conditions that have to be considered before starting the process of value-added assessment. The thesis deals with questions of a systemic and methodological nature. Five research questions were set in order to focus the attention of the work within quite a broad area of value-added modelling. They focus on (1)

the possibility of value-added modelling at all levels of an education system, (2) comparing the broad and narrow concepts of value-added, (3) the potential of broadening the use of value-added modelling from the domain of cognitive skills further to non-cognitive skills, (4) the use of value-added modelling as an instrument for identification of teacher effectiveness, and (5) the use of data at school level for value-added modelling.

Outcomes of value-added theoretical and empirical research have already produced quite a substantive amount of knowledge which is analysed from the standpoint of the five research questions, using comparative procedures and systemic approach stressing the interaction of many constituent elements, and across different areas and levels of education. The aim is to define an adequate position of value-added modelling in an education system, above all in the area of measuring educational outcomes.

The thesis is structured into 9 chapters. The first chapter, Introduction, brings the topic of value-added into a historical context, specifies the aim of the work and its methodological background. The second chapter deals with the concept of value-added and its definition, then the area of measuring educational outcomes is explored in order to define the role of value-added modelling within it, and also to understand how diverse its context is. Value-added modelling is thus placed among other characteristics that measure the outcomes of education and assess how different functions of educational institutions are achieved. The next, third chapter explores a broader definition of educational outcomes at the tertiary level, including ways of measuring change of personal characteristics.

The fourth chapter is dedicated to methodological questions that cover many conditions and assumptions within which value-added modelling occurs. Some concern the choice of skills and knowledge measured and the mobility of students within their educational trajectory, other apply to statistical conditions like random distribution, steadiness of results, validity and reliability of outcomes of modelling. In the fifth chapter main mathematical models of value-added are presented. The sixth chapter deals with specific features of value-added modelling at primary and secondary levels first, and then at a tertiary level. Also experiences from different countries are presented in this chapter. The seventh chapter deals with the use of value-added modelling and its interactions with various elements of an educational system.

In the chapter eight an empirical model is proposed, comparing two sets of data: PISA data gathered at the beginning of upper secondary school, and data gathered by the project Maturita nanečisto at the end of upper secondary level. To evaluate the model's behaviour

its outcomes are compared with those of two other projects: one using data gathered in Slovak projects, and the other contained in English databases, both testing students at the beginning and at the end of the upper secondary level and both linking data at student level. The ninth chapter discusses results, answering thus the five research questions set by the thesis and concludes the thesis by indicating areas for further research.

Literature covering broad range of topics concerning value-added modelling offers a multiple and multilevel view on many questions and issues. If we look at the value-added modelling not from a perspective of one project or one type of data but from a more general point of view, we arrive at quite consistent answers to many questions concerning value-added models and their use as a part of output educational characteristics.

There exist quite many examples of use of value-added models at all levels of education. Some of them are only research or pilot projects, but some serve as a fully-fledged part of evaluation systems, complementing other characteristics measuring the effectiveness of schools. At the pre-primary level some projects have tried to determine the positive effect of pre-primary education. It has been proven even at the tertiary level when controlling results for socio-economic background of students. The most extensive experiences and data sets are available at the level of primary and secondary education. Implementation of value-added models is followed by a long-term cultivation of know-how relating to all dimensions of modelling. Although the development of value-added modelling at the tertiary level has been parallel with the one at primary and secondary levels, value-added models have been used less frequently than at the secondary level. New momentum can be felt now with the accent on output characteristic of higher education, as witnessed by the OECD project AHELO.

There are also other outcomes of education, not only knowledge and skills that until now have been mostly used in test-oriented growth models of student learning. There are many more output characteristics that represent effects of education. However, until now they have been used separately, today value-added models are restricted to comparing knowledge tested in two or more moments of time. Yet it is possible to determine the effectiveness of tertiary education by comparing the labour market positions and earnings of graduates with some input information at the beginning of their study, for instance test results at the end of the upper secondary level or at the start of tertiary level, and/or fees paid to a tertiary institution. Although results of such exercises are more of a research nature, they show that comparing some input and output measures can significantly change

the ranking of institutions made only on the basis of input parameters. Another possibility concerns participation of students in educational activities of schools, mostly tertiary institutions. Analyses show that large differences exist in the way how institutions stimulate and motivate their students to take part in other activities connected with education. In this context many characteristics of a non-cognitive nature show how students´ attitudes have changed (attitude towards teachers, intellectual interests, study habits, self-confidence in mathematics and science, also in verbal skills, career prospects, family support, financial security, attitudes towards society, acceptance of counselling in different areas of academic life). Scanty studies comparing commitment of students with their test results show only a loose relation between self-reported commitment and measured cognitive skills. Summing the extended concept of value-added modelling, there is plenty of room for further research and work endeavouring to create a more complex picture of the impact of educational institutions on student's learning and development.

The same applies to including specific non-cognitive outcomes of student learning into growth models that would reflect changes in personal development. Results of some research studies show that schools differ significantly in developing personal characteristics of students. Accordingly, these characteristics have a strong school dimension to be explored by analysing school factors and by comparing with other schools why the growth achieved in some schools is higher then elsewhere. One of the factors that need more attention includes concentration of today's school on intellectual development that is problematic with students having lower level of intellectual abilities. Also assessing the growth of skills is entirely limited to subjects based on intellectual abilities, and this has far-reaching consequences. Part of students – mostly at primary or lower secondary levels not differentiated yet – can not experience success in these subjects (that is in most so-called important subjects). Other subjects where they could apply their manual or handicraft skills are considered as just additional or marginal, without testing. As according to some important findings the development of personal characteristics is related to performance at school, students who attain better results in cognitive areas also progress better in their personal development. Students that cannot experience success at school tend to resign, which not only considerably lowers their motivation and aspirations but also affects their personal development. Such a situation is incompatible with achieving aims of education and equality of outcomes. A formative character of value-added outcomes could be helpful in re-focusing assessment on both cognitive and non-cognitive skills, and in improving conditions that would ensure equity of outcomes for all students.

Some value-added models aimed at estimating the effectiveness of a teacher. However, conditions given by non-random distribution of students and teachers are difficult to be handled by any model no matter how complex. Two different teachers cannot be compared by teaching the same topic to the same students, and when a random distribution of parameters is not guaranteed, it is difficult to compensate it by other contextual factors. Many studies confirm that it is not possible to estimate the effect of a single teacher on learning and results of students with sufficient reliability. Also the outcomes of value-added modelling as far as teachers are concerned are positive in fulfilling a signal function of teacher's performance, other information is needed to complete the picture. For example, outcomes of value-added modelling can be helpful to direct more accurately the support that teacher might need in the form of continuing education.

An empirical model was used to review the possibility of using results at the school level to estimate the value-added. Research studies have brought evidence that a simple model at an elemental level produces similar results as complex models. Simple models require collecting less data and are less vulnerable to unexpected or not distinct influence of many contextual parameters. On the other side complex models can ensure higher stability of results as different parameters can help to align random influences that can deflect results in case of simple models. As data on two consequent levels of education were available (from the project PISA for students at the entry and from the project Maturita nanečisto at the end of upper secondary education), a simple model of value-added was developed in order to find out if such data would allow comparative analyses. Results of this model were compared with two other value-added projects. The first one used Slovak data from the project Monitor at the beginning and data from the State Maturita at the end of the upper secondary education, the second one used some available English data. Characteristics of the Czech model were comparable with Slovak and English models only when grammar schools (gymnasium) results were used. Once also results of apprentice schools were included, the character of the model changed as the entrance results of their students at the beginning of upper secondary education were much worse than results of other students, and also the dataset contained less schools. A longer period and more repeated results for the same schools would be needed to ensure the stability of results and to better estimate the usefulness of such data for value-added models. The model was enriched by data on employment of graduates of these schools and also by data on their transition to tertiary education. Correlations of both parameters (unemployment and transition to tertiary education) with value-added were at quite a high level and thus confirmed that results of the

value-added model were reasonable. However, more longitudinal data would be needed to increase the knowledge of behaviour of such models using data at the school level.

The model has shown in particular (in the light of the coming State Maturita exam) how different can be the interpretation of results of grammar schools measured only at the end of upper secondary education compared to the one considering both the entry and the end of upper secondary education: only 40 % of grammar schools have kept their position in one of the five groups of schools which were ranked originally only according to their results at the end of upper secondary education, when second ranking according to the rate of change of their performance between the beginning and the end of upper secondary education has been applied. Thus, for determining the effectiveness of individual schools it is essential whether it is only based upon one time moment or the growth is taken into account. Bearing in mind that the State Maturita exam is about to start very soon, the phenomenon of value-added has to be studied some years in advance. From the point of view of tertiary institutions the State Maturita will provide the required entry information. The modelling of value-added for bachelor´s and master's degrees could be based on experience of the Collegiate Learning Assessment programme (CLA) that measures value-added in American colleges and universities. Also the OECD international project AHELO will base its value-added on the CLA. Assessing value-added is a complex process that includes interactions with many elements and settings of the education system. If value-added indicators should become part of the evaluation system, all necessary relations need to be considered.