



The effects of policy changes on teacher quality, teacher sorting and students' outcomes

Júlia Varga

The research leading to these results has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013) under grant agreement “Growth-Innovation-Competitiveness: Fostering Cohesion in Central and Eastern Europe” (GRNCOH)

Júlia Varga

Institution: CERS - HAS

WP4 Task3 P.4.3.9.

Version – final 12.12.2014.

The effects of policy changes on teacher quality, teacher sorting and students' outcomes

Abstract

This paper investigates the effect of teacher salaries on teacher quality. The first part of the paper gives a comparative overview of changes in teachers' salaries in the CEE countries during the last decade. Results show that teaching is less attractive in most of the CEE countries than in the EU15 countries due to the low relative wages of teachers. The second part of the paper investigates if an overall wage increase could improve the quality of teachers using Hungary's case as a natural experiment. In Hungary there was a 50 percent wage increase for public servants, including teachers in 2002. The paper examines teachers' decisions to leave the profession and how the public sector wage increase in 2002 has affected exiting decisions of teachers. Results show that earnings matter. The different effects of the wage increase for the different groups of teachers highlights that an overall shift up of wages of all teachers cannot improve the quality of teaching. In the case of an overall wage increase the existing teachers would have an incentive to stay with no responsibility to become better teachers. The stock of low-quality teachers can be changed only gradually even if the quality of new recruits to the profession improves.

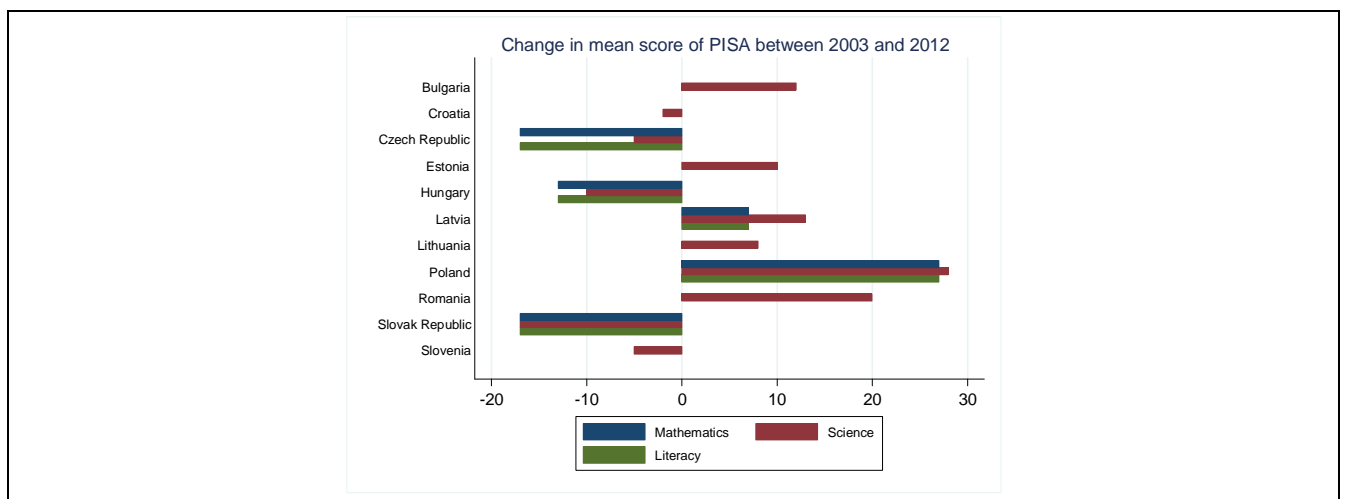
Introduction

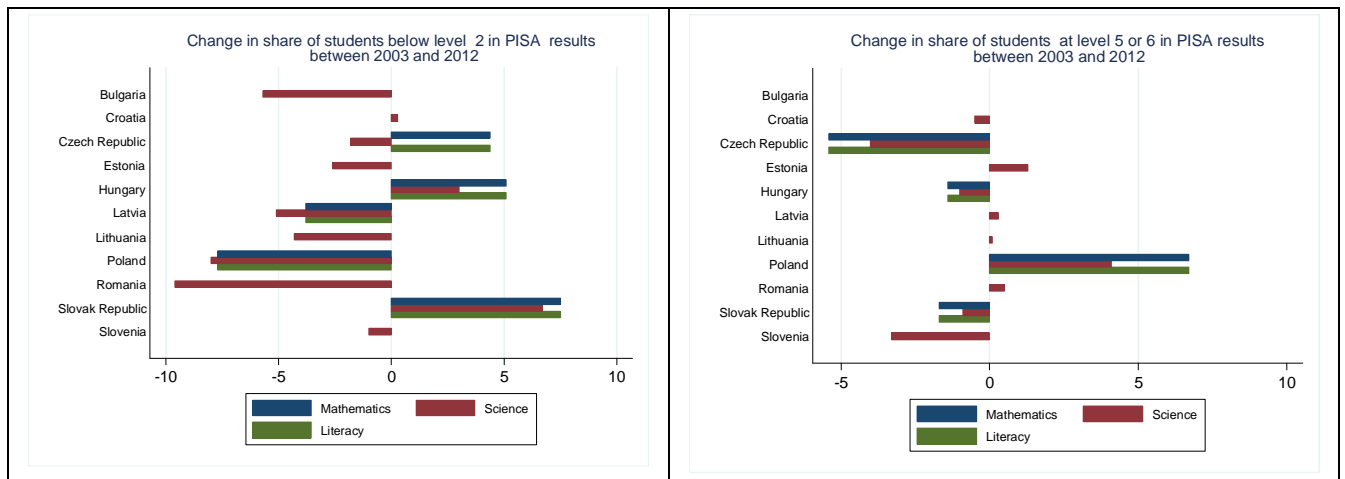
Research evidence suggests that the quality of teachers is a key element to improving student performance it affects student performance more than any other school factors such as class size or per-pupil expenditure. The best-performing education systems recruit their teachers from the top third of each graduate cohort.

Quality of teachers is likely to be higher if their real and relative level of remuneration is higher as higher pay attracts more able graduates into the teaching profession. *Dolton, and Gutierrez (2011)* found that pupil scores rise significantly as teacher salaries rise. The potential casual mechanism to link teachers' pay and student outcomes is that higher pay induces more able individuals into the teaching profession that higher wages make the teaching profession more selective.

International student achievement data indicate weaker basic skills in most of the CEE countries compared to Western and Northern countries, but there are marked differences across CEE countries concerning changes of students' performance. While in some CEE countries (Poland, Latvia) student performance improved in all skill categories – literacy, numeracy, science - in others students' performance deteriorated significantly (Czech Republic, Hungary). The deterioration in the latter group could be observed not only in average results, but on the one hand in growing share of students whose skills are insufficient and on the other hand in decreasing share of students whose achievement is above average (*Figure 1*). One of the obstacles to students skill formation might be the declining quality of teachers in some CEE countries.

Figure 1
Changes in PISA score in CEE countries





Source: Based on OECD PISA data.

A common proposal for improving teacher quality is to increase teachers' salaries. Nevertheless teachers' salaries are the largest cost in school education. Compensation is, therefore, a critical consideration for policy makers seeking to maintain both the quality of teaching and a balanced education budget.

Becoming a teacher is not a result of a single decision, but of a series of subsequent ones. Prospective teachers first have to choose teacher training as a field specialization in their higher education studies, and then, after graduating (or later) they have to decide on entering the teaching profession and continuing therein. The composition of teachers' stock is the result of this series of self-selection processes. Research evidence shows that salaries and alternative employment opportunities influence the attractiveness of teaching (*Santiago, 2004*). Teachers' salaries relative to those in other occupations influence the decision to choose teacher training, to become a teacher after graduation and the decision to remain a teacher.

Nevertheless concerning the role of the attractiveness of higher-paying alternative occupations in teacher attrition research findings are mixed. A part of the studies found that there is a connection between teacher attrition and teachers' relative wages. *Murnan and Olsen (1989)* show that higher wages have an important influence on how long teachers stay in teaching. Similar results were presented by *Podgursky et al. (2004)*; *Imazeki (2005)*; *Krieg (2006)*; *Ondrich et al. (2008)*; *Dolton-van der Klaauw (1995)* and (1999); and *Chevalier et al. (2002)*. Other studies found that very few teachers who leave teaching take jobs that pay more than their prior salaries as teachers. *Scafidi et al. (2006)*; *Frijters et al, (2004)*; and *Vandenberghe (2000)* found that a large share of teachers who leave teaching relinquish employment entirely or earn less pay in other occupations within the public sector. Other studies show that working conditions are as important in teachers' leaving decisions as relative salaries (*Hanushek et al. (2001)*). *Stinebrickner (1998)* found that the role of family circumstances, such as maternity and marriage is decisive in teachers' leaving decisions. *Gilpin (2011)* found that the wage differential between a teaching and a non-teaching occupation matters only for inexperienced teachers - teachers with less than six years of teaching experience - while the work environment affects the leaving decisions of both experienced and inexperienced teachers.

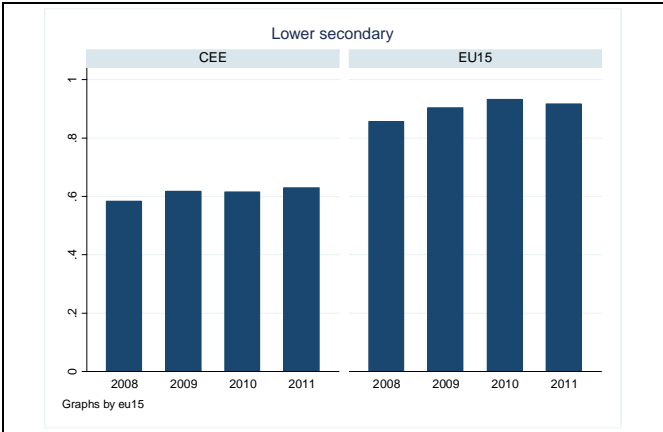
The first part of this paper compares changes in teachers’ salaries in the CEE countries and summarizes how these changes have affected the observable characteristics of teachers. The second part of the paper examines the question how overall wage increases could affect teacher turnover. This part of the paper uses Hungary’s case as a natural experiment. In Hungary, there was a 50 percent wage increase for public servants, including teachers in 2002, but in the subsequent years teachers’ relative salaries have declined again. We investigated if the overall wage increase had different effects for the different groups of teachers.

1. Teacher salaries in CEE countries

In most CEE countries¹, teacher salaries are low in comparison with other graduate salaries and the difference between teacher salaries and other graduate salaries is much larger than in the EU15 countries (*Figure 2*).

Figure 2

Average teacher salaries compared to average graduate salaries a by country groups 2008-2011²



Source: Based on OECD data

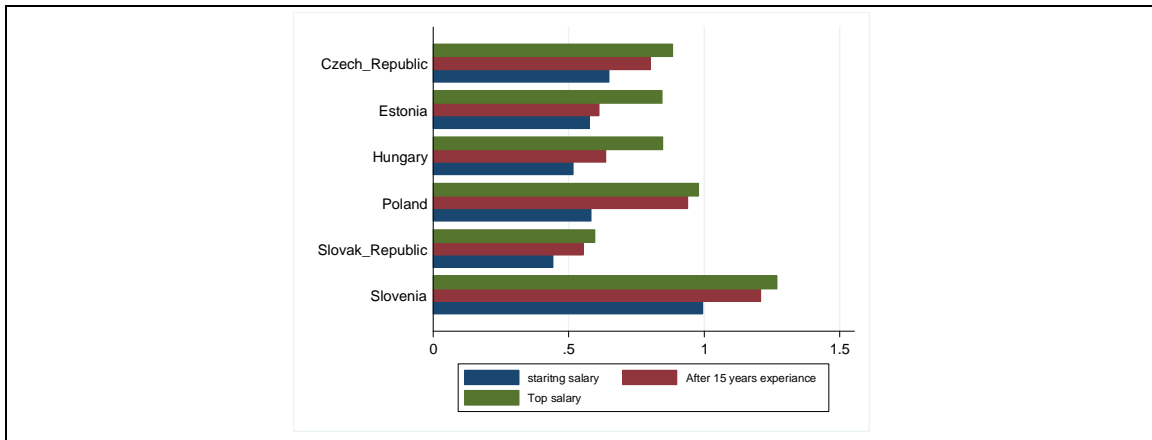
Among CEE countries for we have data teachers’ relative position is the best on in Slovenia and Poland, where teacher salaries compared to other graduate salaries is close or above the EU15 average. Teachers are in the worst situation concerning their relative wages in Slovakia (*Figure 3*).

¹ We have comparative data for the EU15 countries and from the CEE countries for the Czech Republic, Estonia, Hungary, Poland, Slovakia and Slovenia.

² The comparative analysis is based on data of the OECD *Education at a Glance* publications which contains data separately for primary, lower secondary and upper secondary education. In most cases, when there are no marked differences between primary, lower secondary and upper secondary education we present data on lower secondary education.

Figure 3

Average teacher salaries in CEE countries compared to average graduate salaries (lower secondary education) 2011



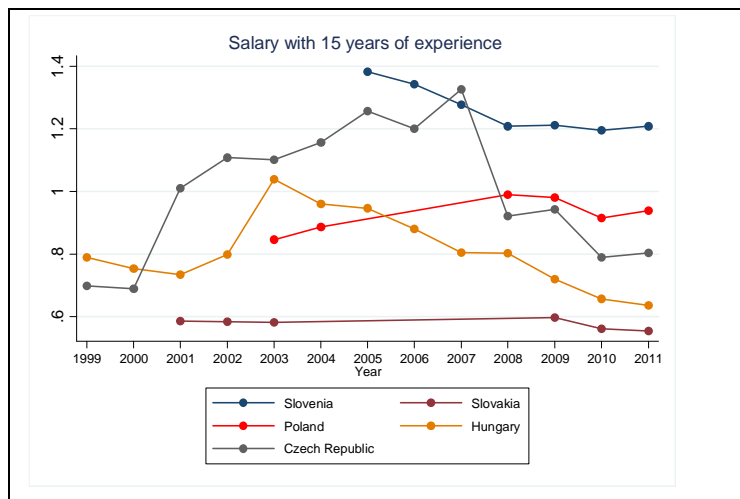
Source: Based on OECD data

Not only the level of relative teacher salaries is low, but there had been a marked decrease in relative teacher salaries also in the CEE countries after 2008 at all education levels with the exception of Poland and Slovenia. Although international comparable statistics on teacher salaries relative to earnings for tertiary educated workers are available only for recent years, so long-run changes cannot be tracked in this respect data are available for longer periods on teacher salaries relative to per capita GDP. *Figure 4* shows the ratio of teachers' (with 15 years of experience) to per capita GDP between 1999 and 2011 in the CCE countries.

In some countries, teacher wages exhibited a cyclical pattern the period of sustained decline was followed by a dramatic increase which was followed again by a substantial decline (Hungary, Czech Republic). In Poland since 2000, the government adopted a program of teacher wage increases and the average teacher wage in Poland was increasing gradually during the subsequent years (*Figure 3*).

Figure 4

Ratio of teacher salaries to per capita GDP – lower secondary education



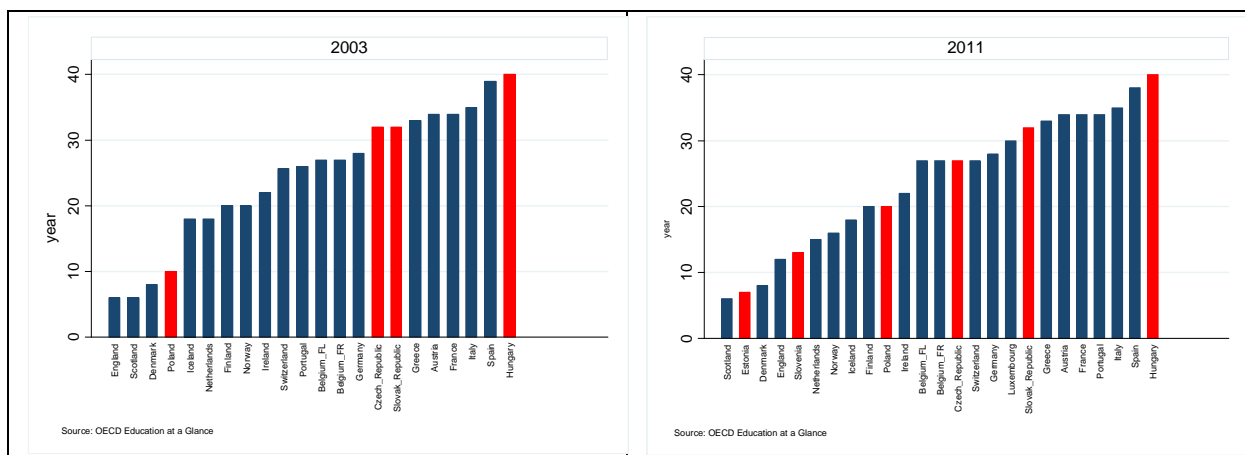
Source: Based on OECD data

We do not have comparative data for the preceding years, but we know that the demand was increasing for higher education graduates since the beginning of the transition to a market economy in all CEE countries. It seems very likely that teacher salaries could not keep up with the growing wages of higher education graduates outside teaching even before 1999.

Salary structures vary substantially across countries that may also have an influence on the attractiveness of teaching. A teacher's decision to enter or remain in teaching depends not only on starting salary but on the potential of salaries to increase over time. *Figure 5* shows how the years to top teacher salary changed between 2003 and 2011. There are differences how long it takes a teacher to reach the top salary. Among the CEE countries in Estonia, Slovenia and Poland it takes below average years while in the Czech Republic and Slovakia above average years. In Hungary, it takes the longest time within the EU.

Figure 5

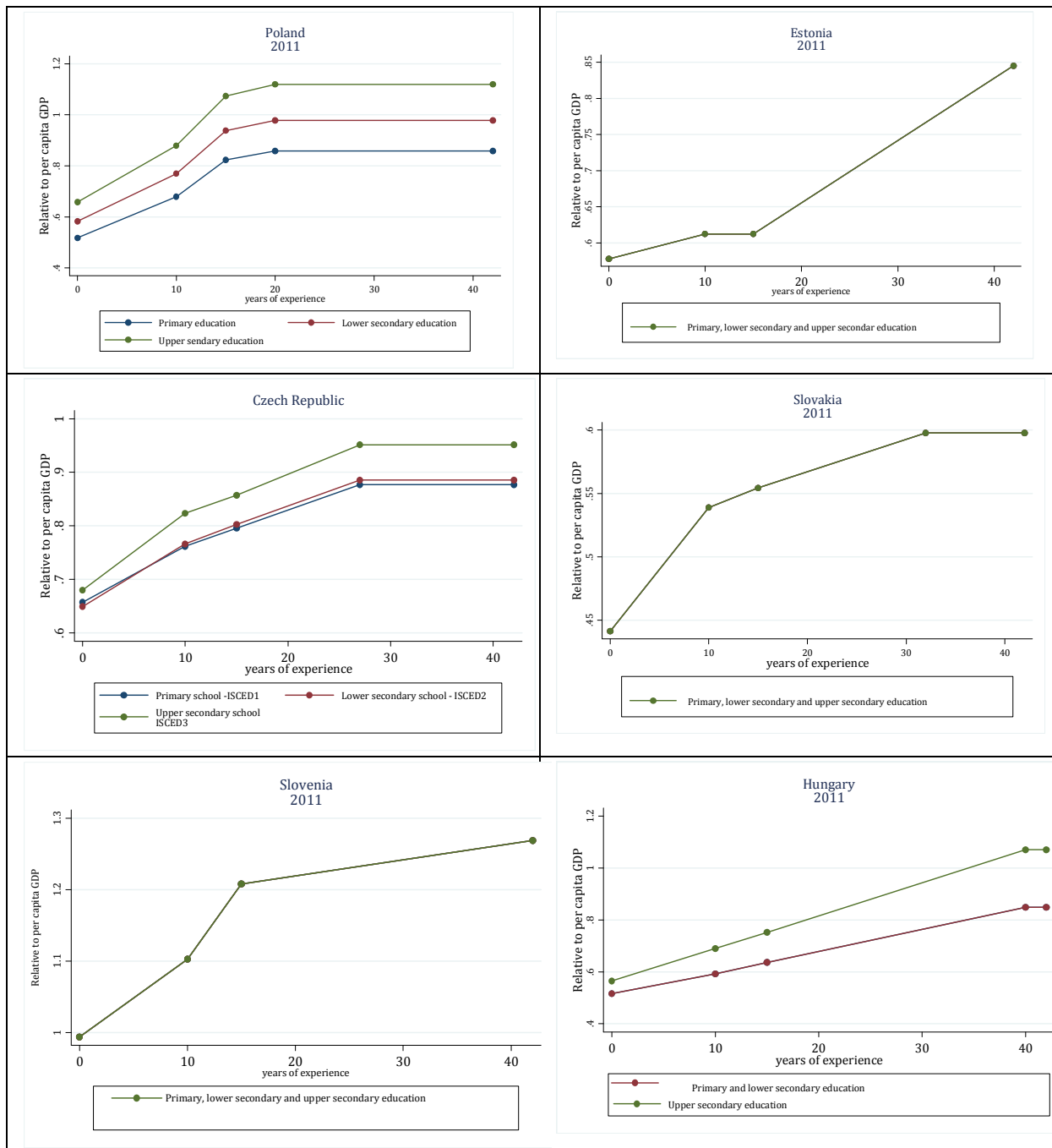
Years to top teachers 'salary



From OECD data we know starting salaries, salaries with 15 years of experience, top salaries, the years to top salaries and in some cases salaries with ten years of experience. Based on these data we constructed age-earning profiles of teachers. All earnings are compared to per capita GDP for comparative purposes. Figure 6 displays the age earning profile of teachers in the CEE countries. There are large differences in the salary structure. In Slovenia, starting salaries are high and then in the first 15 years salaries rise very progressively. The salary structure of Poland and Slovakia is also progressive, but the starting salaries are very low in Slovakia while average in Poland. The Estonian and Hungarian salary structure is flat in comparison to the other countries during the first 15 years of experience but later in Estonia wages rise progressively while in Hungary only moderately.

Figure 6

Age-earnings profile of teachers in the CEE countries (salaries in proportion of GDP per capita by experience), 2011



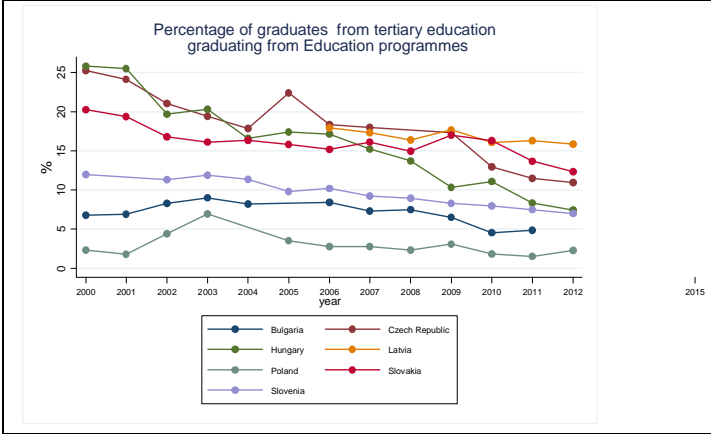
Source: 2014. Based on OECD data

Not only relative wages, but expansion of higher education also weakened the attractiveness of teaching in CEE countries. Before the transition, the number of students admitted to higher education was very limited in all CEE countries, but after the transition the number of admitted students to higher education has increased steadily. As a consequence for prospective students, the alternative possibilities of higher education courses to teacher training have increased. Figure 7

shows the percentage of graduates from tertiary education graduating from Education programmes. Despite the constant rise in the number of students graduating from higher education the share of graduates from education programs, decreased almost in all CEE countries.

Figure 7

Percentage of graduates from tertiary education graduating from Education programs

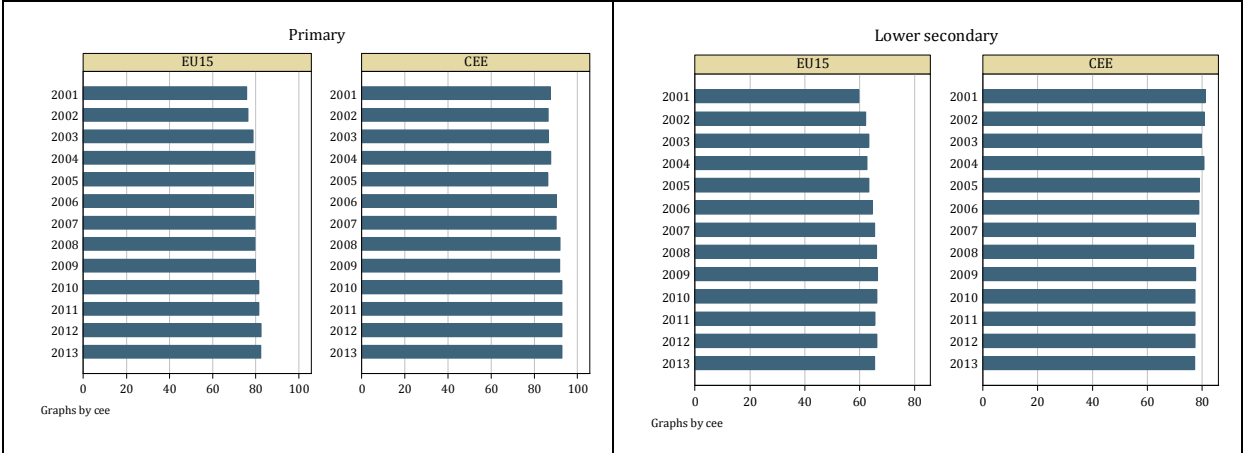


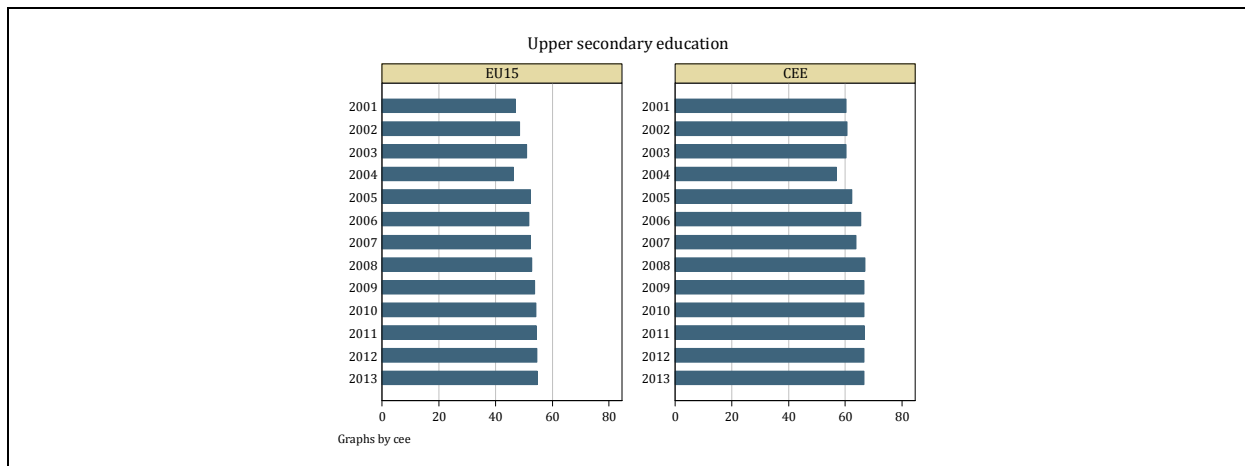
Source: Based on UNESCO data

The majority of teachers are female both in the EU15 and the CEE countries, but the percentage of female teachers differs considerably between the EU15 and CEE countries. The share of woman among teachers is higher in the CEE countries than in the EU15 at all education levels (Figure 8) Presumably these differences are partly due to the differences in the relative position of teachers.

Figure 8

Share of female teachers in the EU15 and CEE countries, percent, 2001-2013





Teacher salaries in the CEE countries are low and has been falling in the last decade in most of the CEE countries. Teachers' relative wages are likely to affect not only the number of people who are willing to teach, but also their characteristics. The growing feminization of teaching can be attributed, in part, to the relative decline of teacher salaries over the long term. It seems likely that due to the rapid expansion of alternative employment opportunities for women, the composition of the female teaching workforce has also changed.

The next section of the paper investigates if an overall wage increase could improve the quality of teachers in the short-run.

2. The effect of earnings on teachers' attrition

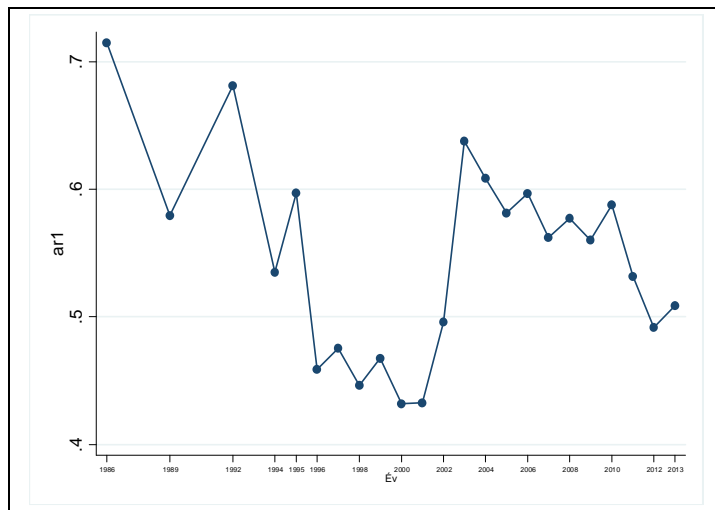
This chapter investigates the role of earnings and earnings in alternative occupations in decisions of teachers to leave the profession. A special focus of the analysis is how an overall wage increase alters teachers' decisions to leave the profession using Hungary's case as a natural experiment.

In Hungary on 2002 September the base salary of teachers was increased uniformly by 50 percent as part of an overall public sector wage increase. As a consequence, average real salaries of teachers increased by 20.5 per cent. Nevertheless in the subsequent years the wage increase of teachers slowed down, and then stopped, and the relative earnings of teachers began to deteriorate.

Before the transition teachers earned about 70 percent of other graduate salaries in Hungary. After 1989, there was a dramatic decrease in the relative wages of teachers that was temporarily tempered by wage increases in some years: in 1992 and 1995. At the lowest point, in 1999–2000, the relative wages of teachers slightly exceeded 40 percent of average graduate salaries. After the 2001 and 2002 year wage increase the wage lag of teachers ameliorated to a 1989 year level, but following that point the lag worsened once again from year to year (Figure 9).

Figure 9

Average teacher salaries as a percentage of other graduate salaries, 1986–2013



Source: Based on data of Hungarian Wage-tariff Surveys of the Hungarian National Employment Service

There are marked differences in the relative position of teachers by educational level, years of experience and gender. The lag is larger for men than for women, larger for those teachers who have a master's degree than for those who have a bachelor degree. The relative wage lag for the youngest and oldest teachers is much smaller than for those who have 10-15 years of experience. In the first 10-15 years of experience, there are widening differentials. The reason for this is that the salary schedule of teachers is quite different from the structure of compensation in the non-teaching labour market - the teachers' pay scale rewards only degree level and experience.

2.1. Data and methods

The base data-set used for the analysis is a merged dataset collecting information from the Hungarian Pension Directorate (ONYF), the Health Insurance Fund (OEP), the Treasury (MÁK) and the Public Employment Service (ÁFSZ). The sample was created by a fifty percent random draw from the Hungarian population aged 5-74 in January 2002. Each individual in the sample is followed from January 2002 until December 2008 or exit from the social security system (for reasons of death or permanent emigration). Out of the base dataset a "teacher" subsample was created. All individuals who were in a teaching job for at least one month between January 2002 and December 2008 were included in the teacher subsample. We have data for 57,546 individuals. The unit of observation is the monthly status of individuals, and the maximum number of observations for an individual is 84 months. Our data contains information on demographics (age, gender), educational attainment (for those with at least one unemployment spell), employment status, occupation code, wages for the occupation codes, and transfer receipt.

For analysing, the effect of wages and the 2002 wage increase on teacher decision to leave the profession duration models were used. Duration models estimate the conditional probability that a teacher leaves the profession given that she/he has not left it prior to the month of investigation.

First, binary choice Cox proportional hazard models (leaving the teaching profession or not) were used, then competing risk models that distinguish exits to another occupation and exits to a non-working state. In the Cox model the base hazard is non-parametric, no form is pre-specified for the baseline hazard, the hazards are proportional to each other, and do not depend on time, but time-dependent covariates also can be incorporated to the analysis. Censored data are handled in the Cox model: both left truncated data, that for those who work as teachers in the first observation there is no information as to how long have they worked as a teacher and the model also handles the right censored data, that we only know that the event of interest had not happened for an individual during the time that was the subject of the study, but we do not have information if it happened later.

In the Cox-model, the risk given covariates are the product of the baseline hazard and a relative risk:

$$\lambda[t, x(t)] = \lambda_0(t)e^{x(t)'\beta(t)},$$

Where λ_0 stands for the base hazard; t for time; x for the observable characteristics of the individual. The Cox-model can allow for time-varying covariates $x(t)$. The model also handles time-dependent effects, where the coefficients are a parametric function of time $\beta(t)$, so the effects of covariates are not proportional.

A number of those who leave teaching do not go on to another job, but intentionally or non-intentionally arrive at a non-employment state: become inactive, go on to child-care pension, retire, become unemployed, etc. As the determinants of these decisions might be different from the determinants of going to non-teaching job teacher attrition was also analysed with the help of a competing risk model (*Fine–Gray, 1999*) which distinguishes exits to a non-teaching job (*NT*), and exits out of active status (*NF*). Competing risks are present when those who are working as teachers are at risk of more than one mutually exclusive event, and the occurrence of one of these will prevent any other event from happening. In our case the individual either goes on to a non-teaching job or becomes inactive or unemployed. Competing risk models define a separate hazard function for each event: going to a non-teaching job $\lambda_{NT(t)}$ and becoming inactive or unemployed $\lambda_{NF(t)}$. The total hazard of leaving teaching is the sum of the sub- hazards.

The effect of the single, high level wage increase of public servants was analysed with the help of models where the independent variables contained dummy variables which indicated the year of the observation using 2002, on the one hand, as the reference category. On the other hand as the Cox-model makes it possible to split the data by episodes and check whether the effect of the covariates differs by episodes this method was used as well. The effect of the wage increase was also investigated using episode splitting. The public servants' wage increase came into force in September 2002. The data from January to August 2002 describe the state before the wage increase and the data from September 2002 the state after the wage increase. Thus, the data were split into two

episodes and checked to determine if the effect of given covariates differed before and after September 2002

Independent variables in the analysis were: gender, age-group dummies in the models that used the whole sample, and region of residence. Regional effect may reflect different effects: the differences in local labour markets, differences in the work environment, and differences in the quality of education caused by, for instance, differences in pupils' composition or other factors. Further independent variables in the models were if the individual had worked as a teacher in primary or secondary education. The effect of wages was measured by the (log) wages of the individual at January 2002 constant prices. In addition, the monthly unemployment rate of the region of the individual's residence was also included. Finally, a dummy variable indicated if the month was September. School years begin in September and prior to that there is a long summer holiday, so it might be worthwhile to delay an exit from teaching until September and use the full the summer holiday.

2.3. Teachers' attrition

Figure 10 shows the empirical Kaplan–Meier survival functions by gender and age-groups.³ The figure shows in the observed months the share of teachers who are still working as teachers. The figure for the whole sample shows that for those teachers who began teaching between 2002 January and 2008 December the unconditional exit rate was quite steady between 2002 and 2008. Exit rates of men and women were similar between January 2002 and September 2002, but thereafter the exit rates of men were higher than the exit rates of women.

There are marked differences after September 2002. Only half of the teachers who were younger than 30 years old and older than 51–60 years old remained in teaching by December 2008. Survival was the greatest among teachers who were 41-51 years old. Exit rates of the young and old teachers were slightly higher by January 2008 than for middle-aged teachers, but thereafter exit rates of the young and old teachers accelerated. The smallest survival can be observed among young teachers.

³ Censored cases are not regarded as exits.

Figure 10
Kaplan–Meier empirical survival (remaining in the teaching profession) functions by gender and age-
groups

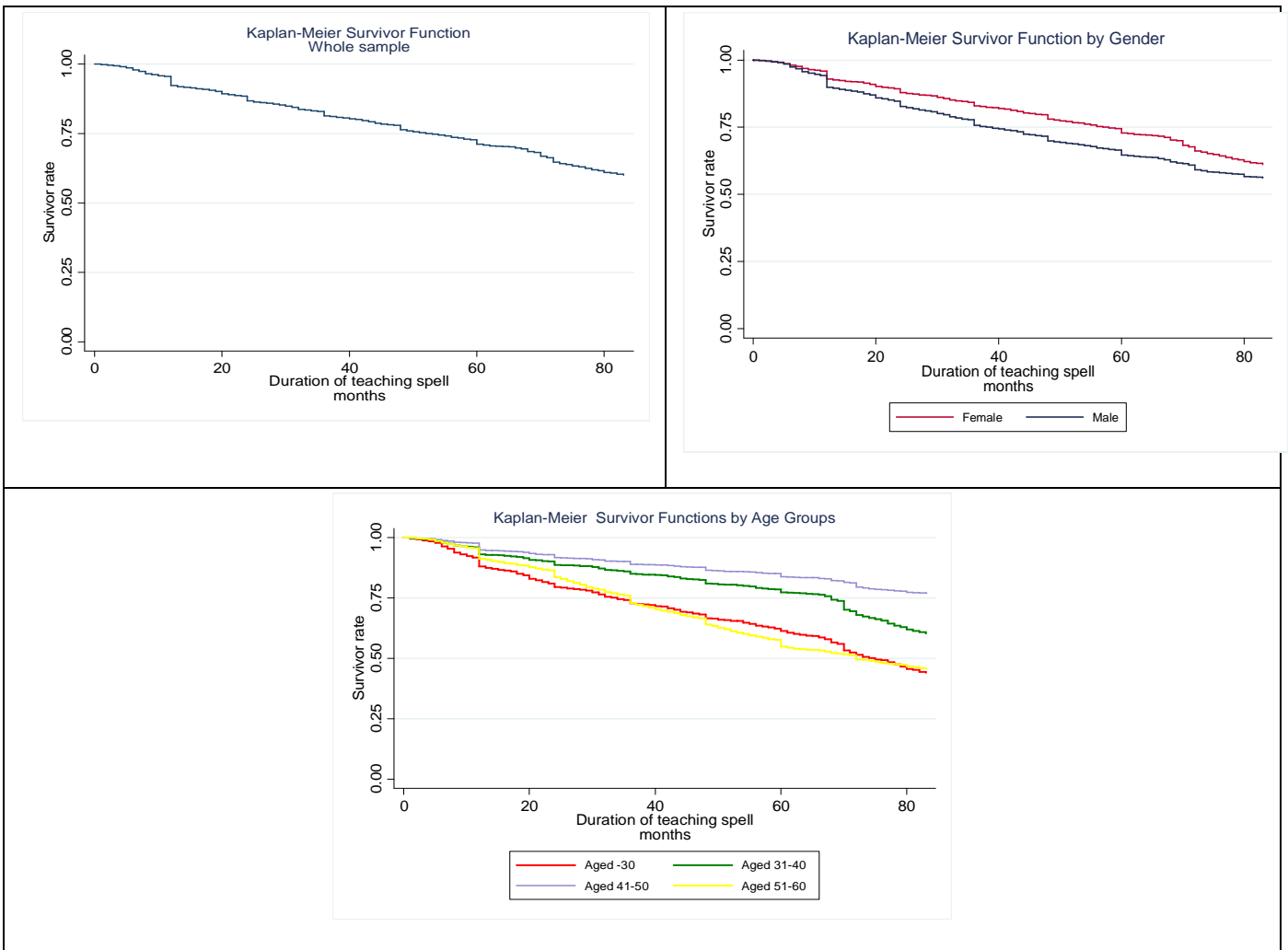


Table 1 shows average monthly earnings of current and former teachers one month after former teachers had left teaching at constant prices. Average earnings of former teachers are smaller one month after leaving teaching than the average earnings of those who remain in teaching posts because a large proportion of former teachers become inactive, go on to childcare pension or retire. Average earnings of former teachers who remain active and are working in a non-teaching job is higher than earnings of current teachers

Table 1**Average monthly earnings of current and former teachers (in constant prices - 2002 January HUF)**

	All	-30 years old	31-40 years old	41-50 years old	51-60 years old	61- years old
Current teachers	149,818	106,531	130,229	169,783	192,820	159,807
All former teachers	123,480	84,294	104,286	151,043	172,909	107,529
Former teachers who remain working	152,031	113,220	138,516	170,804	181,320	104,384
Former teachers who are on child-care pension	47,348	47,030	46,858	37,013	–	–
Former teachers who are non-employed for other reasons	48,977	49,931	46,900	39,003	39,4712	43,890

There are differences by age groups. Inexperienced, young, former teachers, those who are younger than 30 and those who are 31-40 years of age earn more on average than those who remain in teaching. Average earning gain of former teachers is not too high at 6-7 per cent. Older teachers do not achieve any earnings gain from attrition. There is no difference between the earnings of former and current teachers for those who are 41-50 years of age. Earnings of former teachers who are older than 50 are even lower than the earnings of their counterparts who remain in teaching.

To get a fuller picture of the determinants of teachers attrition it is worthwhile to summarize where teachers work after having left teaching. According to the results of earlier research (*Gilpin, 2011*) a large part of the teachers who leave teaching stay in the education sector in an administrative or non-teaching job. Our data contains information on the occupation codes of former teachers, and it is also possible from the data to identify the sector of employment of former teachers. *Table 2* shows by age-group if former teachers are working in the education sector or outside the education sector. *Table 3* shows the distribution of former teachers who are working outside the education sector by occupation group.

Table 2**Distribution of former teachers by sector of employment after attrition (per cent)**

	Whole sample	-30 years old	31-40 years old	41-50 years old	51-60 years old
Working outside the education sector in non-teaching job	51,77	70,57	51,24	37,52	39,89
Working in the education sector in non-teaching job	48,23	29,43	48,76	62,48	60,11
All	100,00	100,00	100,00	100,00	100,00

Table 3**Distribution of former teachers who left education sector by occupation group (per cent)**

	Whole sample	-30 years old	31-40 years old	41-50 years old	51-60 years old
--	-----------------	---------------	--------------------	--------------------	--------------------

Managers	33,1	11,6	32,0	50,6	47,9
Other professionals	29,7	31,9	32,3	25,5	28,6
Clerical support workers	29,9	43,9	25,4	15,8	17,1
Service and sales workers	3,9	7,9	5,5	3,7	1,1
Elementary occupations	3,4	4,7	4,8	4,4	5,3
All	100,00	100,00	100,00	100,00	100,00

The majority of teachers who leave teaching remain in the education sector, but there are large differences between age-groups. More than 70 percent of former teachers who are younger than 30 years of age leave the education sector and more than half of the 31-40 year old group who exit teaching go to work outside the education sector. On the contrary more than 60 per cent of older teachers remain in the education sector in non-teaching jobs. That is older teachers leave teaching for other possibilities within the education sector - administrative or management jobs. Only one-third of former teachers who are older than 41 find a job outside the education sector.

The table indicates that inexperienced former teachers who exited the education sector work not only in other professional jobs, but they also go to other employment for higher earnings. 44 per cent of former teachers who are younger than 30 years of age work as office or administrative support and about 8 percent as service and sales workers. The majority of 31–40 year old former teachers work as managers or professionals, a quarter of them become clerical support workers, and 5 per cent of them go to service and sales jobs. More than half of the former teachers who are older than 41 become managers, a quarter of them go to other professional jobs, and 16-17 percent of them obtain employment as clerical support. About 5 percent of former teachers work in elementary occupations in all age groups of former teachers.

2.4. The effect of wage increase

Table 4 reports the results of the binary choice Cox-model split for two episodes. (Descriptive statistics are reported in Annex Table 1). The table shows the sub-hazard rates. The first part of the table reports the results of the base model. The second part of the table shows the results of the estimations where the variables in the equation were split into two episodes (months 0-9 and months 10-84), to check if there was a difference in the probability of attrition before and after the public servants' wage increase. That is, it was checked to see if the probability of attrition differed during the first eight months of the observations and during the subsequent months for teachers with certain characteristics (belonging to different age-groups; teachers teaching in secondary education as compared to teachers teaching in primary schools; male teachers as compared to female teachers). A hazard ratio greater than one implies an increased probability of attrition while a ratio less than one implies a decreased probability.⁴

⁴ For instance in the base model the hazard ratio of men is 1.142 indicating that the probability of leaving for men is 14.2 percent higher than for women. Similarly a one percentage point increase in the regional unemployment rate will decrease attrition by 7.4 percent (the hazard rate is 0.926).

Table 4**Binary choice Cox proportional hazard models (Leaving teaching profession or not) split to episodes**

	Hazard rate
<i>Base model</i>	
Gender (Male)	1,142 ^{***}
Teaching in secondary school	1,043 [*]
Monthly unemployment rate in the region	0,926 ^{***}
(log) real salary	0,693 ^{***}
September	0,096 ^{***}
- 30 years old	2,282 ^{***}
31-40 years old	1,599 ^{***}
51-60 years old	3,373 ^{***}
Older than 60 years	12,438 ^{***}
<i>tvc (variables in tvc equation interacted with _t<9)</i>	
Gender (Male)	1,219 ^{**}
Teaching in secondary school	1,219 ^{**}
- 30 years old	1,255 ^{***}
31-40 years old	n. s.
51-60 years old	0,433 ^{***}

*** Significant at the 1 percent level ** Significant at the 5 percent level *Significant at the 10 percent level n.s. not significant

Other controls: Regions Reference category: Female, teaching in primary or lower secondary education, region Southern Transdanubia, another month than September, 41-40 years old

Results of the base model show that the lower the salary of the teacher the higher the probability of attrition. Teachers who are younger than 30 leave the profession with more than twice the probability as that of teachers who are 41–50 years of age. Teachers who are 41-50 years of age remain in teaching with the highest probability compared to the other age groups. The high probability of attrition for the 51–60 years of age group and teachers who are older than 60 is due to retirement.

The results of the interactions with duration show that the effect of gender is different in months 0-9 and 10-84. The estimate shows a 21.9 percent larger effect in the second, post wage increase period for men and a 21.9 percent larger effect for teachers teaching in secondary schools. There is no evidence that the effect is different for the 31–40 year old teachers in the two periods. Young, inexperienced teachers left teaching with 25.5 percent larger probability after September 2002 than before compared to teachers belonging to the reference group - those in the 41–50 years of age group . The probability of attrition of older, 51–60 years of age teachers decreased by 56 percent after the wage increase.

Table 5 summarizes the results of the separate competing risk models for age-groups that analysed the effect of the 2002 year wage increase with the help of dummy variables which indicated in which year was the month under observation. The reference year was 2002. The competing risk models which consider the effect of wages on multiple causes of attrition were going to a non-teaching job and becoming inactive or unemployed.

Table 5**The effect of wage increase – Competing risk models (subhazard rates).**

Risks: Working in a non-teaching job/ Inactive or unemployed

	-30 years old		31-40 years old		41-50 years old		51-60 years old	
	<i>Working in non-teaching job</i>	<i>Inactive or unemployed</i>	<i>Working in non-teaching job</i>	<i>Inactive or unemployed</i>	<i>Working in non-teaching job</i>	<i>Inactive or unemployed</i>	<i>Working in non-teaching job</i>	<i>Inactive or unemployed</i>
Gender (Male)	1,511 ^{***}	0,700 ^{***}	2,031 ^{***}	0,397 ^{***}	1,707 ^{***}	n. s.	1,241 ^{***}	0,734 ^{***}
Log real salaries	0,745 ^{***}	0,670 ^{***}	0,847 ^{***}	0,660 ^{***}	0,597 ^{***}	0,464 ^{***}	0,773 ^{***}	0,788 ^{***}
2003	0,777 ^{**}	n. s.	0,760 ^{**}	n. s.	0,561 ^{***}	1,674 ^{***}	0,920	0,864
2004	n. s.	2,355 ^{***}	n. s.	n. s.	0,594 ^{***}	1,769 ^{***}	0,711 ^{***}	0,682 ^{***}
2005	n. s.	3,739 ^{***}	n. s.	1,736 ^{***}	0,591 ^{***}	2,171 ^{***}	0,676 ^{***}	0,595 ^{***}
2006	n. s.	3,581 ^{***}	n. s.	1,884 ^{***}	0,728 ^{**}	2,256 ^{***}	0,681 ^{***}	0,234 ^{***}
2007	1,667 ^{***}	7,157 ^{***}	1,518 ^{***}	6,791 ^{***}	n. s.	5,271 ^{***}	n. s.	0,182 ^{***}
2008	1,392 ^{***}	8,258 ^{***}		10,060 ^{***}	n. s.	4,532 ^{***}	n. s.	0,229 ^{***}

^{***} Significant at the 1 percent level ^{**} Significant at the 5 percent level ^{*} Significant at the 10 percent level n.s. Not significant

Other control variables in the model: teaching in secondary school, monthly unemployment rate in the region, September. Reference category: female, teaching in primary school, region Southern Transdanubia, another month than September, year 2002.

Low salaries increase the probability of moving to another job or becoming inactive. As for the effect of the public servants' wage increase: in 2003 young teachers (younger than 30), and those teachers in the 31–40 years of age group left teaching for a non-teaching job with a lower probability than in 2002. The results show no difference in the probability of attrition after 2004, compared to 2002. After 2007 young teachers left teaching with a greater probability than in 2002. The probability of becoming inactive increased after 2004 both for teachers under 30 and teachers between 31-40 years of age. Teachers who are younger than 30 became, with twice as much probability, inactive or unemployed in 2004 than in 2002, and with an eightfold larger probability in 2008. For the 31–40-year-old teachers, the probability of becoming unemployed is tenfold greater in 2008 than in 2002. The effect of the wage increase lasted longer for older teachers and was stronger than for the young. The probability of going to a non-teaching job decreased for older teachers after the wage increase. Both the 41–50-year-old teachers and the 51–60-year-old teachers exited teaching for another job with lower probability from 2003 to 2006 than in 2002. The effect was the strongest for the 41–50-year-old teachers. They exited teaching with a 40–45 percent smaller probability than in 2002. The probability of becoming inactive had been decreasing for the 41-50-year-old teachers from 2003. The older, 51–60-year-old teachers had become inactive with a much lower probability after 2002 than in 2002.

The public sector wage increase had reduced the probability of going to a non-teaching job for young teachers only for one year. The effect lasted longer for older teachers. After the wage increase, young teachers for some years went to another job and became inactive with larger probability than before the wage increase. On the contrary, older, 51–60-year-old teachers had not only gone to another job with smaller probability, but they had also become inactive with a smaller probability

after the wage increase. Older teachers were the group of teachers that were retained in teaching by the wage increase.

Conclusions

The paper first provided an overview of teacher salaries in the CEE countries. Teaching seems to be the most attractive in Poland and Slovenia regarding relative salaries and salary structure of teachers. In Slovakia and Hungary the relative position is below average. It seems likely that the relative wage in teaching on average determine the ability of teachers and thus teacher quality. The second part of the paper investigated the role of wages in teacher turnover and if an overall wage increase could improve the quality of teachers. Results show that earnings matter. Higher wages reduce the probability of exiting teacher profession, to go to another occupation or to non-employment. The public sector wage increase has decreased the probability of leaving the teacher profession for inexperienced teachers but only temporarily: after one or two years as relative wages began to worsen again the effect disappeared. For experienced teachers, the wage increase found to reduce attrition permanently.

The different effects of the wage increase for the different groups of teachers highlights that an overall shift up of wages of all teachers cannot improve the quality of teaching immediately. The stock of low-quality teachers can be changed only gradually even if the quality of new recruits to the profession improves. In the case of an overall wage increase the existing teachers would have an incentive to stay with no responsibility to become better teachers.

References

- Chevalier, A.–Dolton, P. J.–McIntosh S. (2001): Recruiting and Retaining teachers in the UK: An Analysis of Graduate Occupation Choice from the 1960s to the 1990s. Centre for Economics of Education, London.
- Coviello, V. and M. Boggess. 2004. Cumulative incidence estimation in the presence of competing risks. *The Stata Journal*. 4: 103–112.
- Dolton P. J. (1990): The Economics of UK Teacher Supply: the Graduate's Decision. *Economic Journal*, 100. 91–104. o.
- Dolton, P., & van der Klaauw, W. (1995). Leaving teaching in the UK: A duration analysis. *The Economic Journal*, 105(429), 431–444.
- Dolton, P., & van der Klaauw, W. (1999). The turnover of teachers: A competing risks explanation. *Review of Economics and Statistics*, 81(3),543–550.
- Fine, J. and R. Gray. 1999. A proportional hazards model for the subdistribution of a competing risk. *Journal of the American Statistical Association*. 94: 496–509.
- Frijters, .P. - Shields, M.I A. & Wheatley Price, S., (2004): "To Teach or Not to Teach? Panel Data Evidence on the Quitting Decision," IZA Discussion Papers 1164, Institute for the Study of Labor (IZA).

Gilpin, G.A. (2011) Reevaluating the effect of non-teaching wages on teacher attrition *Economics of Education Review* 30 (2011) 598–616

Hanushek, E.A, J.F. Kain, and S.G. Rivkin, "Why Public Schools Lose Teachers," National Bureau of Economic Research Paper 8599, (2001).

Imazeki, J. (2005). Teacher salaries and teacher attrition. *Economics of Education Review*, 24(4), 431–449.

Krieg, J. M. (2006). Teacher quality and attrition. *Economics of Education Review*, 25(1), 3–27

Murnane, R., & Olsen, R. (1989). The effect of salaries and opportunity costs on duration in teaching: Evidence from michigan. *The Review of Economics and Statistics*, 71(2), 347–352

Ondrich, J., Pas, E., & Yinger, J. (2008). The determinants of teacher attrition in upstate New York. *Public Finance Review*, 36(1), 112–144.

Podgursky, M. - Monroe, R., - Watson, D. (2004). The academic quality of public school teachers: an analysis of entry and exit behavior. *Economics of Education Review*, 3(5), 507–518.

Scafidi, B. – Sjoquist, D.L. - Stinebrickner, T.D. (2006): "Do Teachers Really Leave for Higher Paying Jobs in Alternative Occupations?," *The B.E. Journal of Economic Analysis & Policy*, Berkeley Electronic Press, vol. 0(1),

Stinebrickner, T.R, (1998) An Empirical Investigation of Teacher Attrition, *Economics of Education Review*, Vol.17, No 2, pp. 127-136.

Vandenberghe, V. (2000), Leaving teaching in the French-Speaking Community of Belgium: a duration analysis, *Education Economics*, 8(3), pp. 221-239.

Wolter, S. C.–Denzler, S. (2003): Wage Elasticity of the Teacher Supply in Switzerland. IZA Discussion Paper, No. 733.

Annexes

Table A1

Descriptive statistics

Variable	Whole sample		At most 30 years old		31-40 years old		41-50 years old		51-60 years old		Older than 61 years old	
	Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation
Gender (Male=1)	0.2223	0.4158	0.2223	0.4158	0.1998	0.3998	0.1995	0.3996	0.2594	0.4383	0.6027	0.4893
Upper secondary school teacher	11.7445	0.6380	0.3603	0.4800	0.3245	0.4682	0.2763	0.4471	0.3777	0.4848	0.5761	0.4941
Budapest	0.1742	0.3793	0.1618	0.3683	0.1688	0.3746	0.1787	0.3831	0.1896	0.3920	0.2232	0.41644
Northern Hungary	0.1311	0.3375	0.1315	0.3380	0.1307	0.3367	0.1308	0.3372	0.1324	0.3390	0.1267	0.3326
Northern Great Plain	0.1426	0.3497	0.1641	0.3704	0.1388	0.3458	0.1337	0.3403	0.1370	0.3438	0.1192	0.3240
Southern Great Plain	0.1330	0.3396	0.1419	0.3490	0.1398	0.3466	0.1262	0.3321	0.1209	0.3261	0.1294	0.3357
Central Hungary	0.1152	0.3193	0.1030	0.3040	0.1243	0.3299	0.1208	0.3259	0.1094	0.3122	0.1020	0.3026
Central Transdanubial	0.1117	0.3150	0.1087	0.3112	0.1089	0.3115	0.1118	0.3152	0.1196	0.3245	0.1146	0.3185
Western Transdanubia	0.1018	0.3024	0.0959	0.2945	0.1016	0.3021	0.1070	0.3091	0.1017	0.3023	0.0900	0.2862
Average monthly unemployment rate in theregion	0.0899	0.2860	0.0925	0.2898	0.0873	0.2822	0.0906	0.2870	0.0889	0.2847	0.0945	0.2926
Relative salary	0.3244	0.4680	9.397	5.0703	9.1548	5.1203	9.0499	5.1379	9.1760	5.229	9.3411	5.4558
Relatív pedagógus jövdelem	0.7892	0.3306	11.3709	0.6840	11.5825	0.6659	11.9541	0.4521	12.0826	0.4744	11.6465	1.05136
(log) real salary	0.9810	0.3804	0.7164	0.3470	0.7218	0.3464	0.8601	0.2981	0.8527	0.2985	0.6579	0.4469
September	0.0785	0.2690	0.8988	0.4212	0.9256	0.4103	1.0466	0.3283	1.0422	0.3317	0.9763	0.6132
Year 2003	0.1526	0.3596	0.1661	0.3721	0.1408	0.3479	0.1411	0.3482	0.1105	0.3135	0.0223	0.1478
Year 2004	0.1569	0.3637	0.1646	0.3708	0.1414	0.3484	0.1436	0.3507	0.1269	0.3329	0.0507	0.2199
Year 2005	0.1585	0.3652	0.15319	0.3601	0.1428	0.3498	0.1432	0.3502	0.1438	0.3508	0.0993	0.2991
Year 2006	0.1587	0.3654	0.1365	0.3434	0.1444	0.3515	0.1437	0.3508	0.1595	0.3661	0.1494	0.3565
Year 2007	0.1592	0.3658	0.1167	0.3210	0.1455	0.3526	0.1442	0.3513	0.1763	0.3810	0.2737	0.4458

Year 2008	0.0659	0.2481	0.0982	0.2976	0.1454	0.3525	0.1456	0.3527	0.1864	0.3831	0.3972	0.4893
Younger than 30 years old	0.2360	0.4246										
30-40 years old	0.2859	.4518										
41-50 years old	0.2785	.4482										
51-60 years old	0.1709	.3764										
Older than 61 years older	0.0147	.1204										
Number of months observed	3667307		1600668		1995088		1942236		1225382		124073	
Number of individuals observed			13184		29948		29059		18720		1079	
Number of observations with exiting teacher profession	20300		4017		7947		4099		6984		503	

