The relevance of teachers' salaries

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1. Abstract

Education is often called an important determinant of economic growth. However buying power for teachers is falling in several countries. This could damage the quality of education. This thesis reviews the most important literature regarding teachers' salaries. According to earlier work raising salary for teachers should lead to better student performance and this research finds that students score better on the PISA test, if the salary for teachers is higher. This could mean that better teachers can be attracted by offering a higher salary. However the PISA test scores may not be a complete measure of the performance of students and because of that and a relatively small dataset more research might be necessary on this topic.

2. Introduction

Research by the OECD shows that when the spending on education grows, there will also be more economic growth. This means that education can be very important for economies (Sleicher, 2006).

If education is one of the pillars of economic growth, it is useful to look at factors that can influence education. Research indicates that teachers might be the most important input for the quality of education (Rivkin et. [al], 2005). However, salaries of teachers are not increasing enough to compensate for the rise of salaries in the non-teaching jobs. Which means the teaching profession becomes less attractive. In some of the past couple of years the salaries of teachers did not increase in some of the OECD countries, this means that the purchasing power of teachers decreased during those years, due to inflation. For example in America teacher salaries were frozen for at least one year or were even decreased between 2008 and 2012 (Rich, 2013), in the Netherlands the buying power of teachers fell with 9 percentage points between 1990 and 2007, while the average buying power increased by 3 percentage (Anonymous, 2007), and on average in the OECD countries salaries for lower secondary school teachers relative to average salary fell between 2000 and 2008 (see Appendix A1). The salary for lower secondary school teachers relative to average salary in those countries was very low already (Appendix A1).

Since the relative attractiveness to become a teacher in terms of salary is decreasing, there might be consequences of this development for the quality of education.

So it is interesting to look what the effects of salary on the quality of teachers is. The research question of this paper will be:

What are the effects of changes in teachers' salaries on the quality of education?

In the next section a literature review will be provided. In the fourth section a theoretical framework will be established and in the fifth section the dataset will be discussed. In the sixth section the research question will be analyzed empirically and in the last section there will be some concluding remarks.

3. **Literature review**

There is a significant amount of literature regarding this topic. It is useful to have a look at this research since it could explain possible effects, which can be found doing empiric analysis.

3.1 Determinants of student performance.

Before analyzing the empirics, it is necessary to know some explanations about the possible effects of teacher salary on the performances of students. Therefore it is useful to know the determinants of the student performance. An often used way to describe the relationship between student performance and its determinants is the educational production function:

$Og = f(F(g), P(g), C(g), T(g), S(g), \alpha)$

where Og is the outcome for a student in grade g; F, P, C, T and S represent vectors of family, peer, community, teacher and school inputs, respectively; α is ability; and the subscript g indicates all of the inputs are cumulative from birth through grade g (Hanushek and Rivkin, 2006). The many current and past factors complicate efforts to estimate the specific effects of a certain factor, due to many interaction effects. For example class size and family income might have an interaction effect. Richer families might be able to send their kids to a school with smaller class sizes. However since both family income and class size might matter, class size might increase the effect of family income on student achievement (Hanushek and Rivkin, 2006).

3.2 Teacher contribution towards student performance and teacher properties.

Since salary is likely to influence the teacher, it is important to know how much the teacher contributes towards the student performance. Brewer, Eide and Goldhaber wrote a paper about this in 2004. They found that school characteristics are less important than family background, however of those school characteristics teacher quality is the single most important determinant of student performance (Brewer, Eide and Goldhaber, 2004). Goldhaber et al. (1999) and Hanushek et al. (2002) both estimated that teacher quality is responsible for about 8 percent in the variation of student achievement. They also found that teacher quality can make a difference in learning growth of students during a year. However Goldhaber et al (1999) also estimated that just a very small part of teacher contribution towards student achievement can be explained using teacher credentials (e.g. experience and level of education). There

have been multiple studies about the determinants of teacher quality. A paper of Greenwald et al. (1996) tells us that experience, academic ability and the degree of a teacher strongly correlate with the student achievements. A study by Hanushek (1989) however does not find strong evidence that experience and teacher education level influence student achievements. Murnane (1975) shows that a teachers' learning curve is steep for the first two years for reading and the first three years for mathematics and after that reaches a plateau. This is also confirmed by a study of Hanushek et al. (2005) which finds that experience effects are concentrated in the first few years of teaching. Especially in the first and to a lesser extent in the second year, teachers tend to perform significantly worse in the classroom. The differences in study outcomes can be explained in a few ways. Possibly some factors contribute more in some contexts than in other contexts (Brewer, Eide and Goldhaber, 2004). Another factor that complicates estimating the teacher effects is the possibility for teachers to choose schools. Especially experienced teachers tend to take advantage of the possibility to move to different schools, with higher student achievement (Hanushek, Kain and Rivkin, 2004). This means results from some studies might not show causal relationships, because there were already better student achievements before more experienced teachers came to the school.

The level of degree seems to matter only if it represents the level of training teachers have in their subject or when teachers are teaching older or more advanced students (Brewer, Eide and Goldhaber, 2004). The fact that a degree does not seem to matter too much is confirmed by research by Hanushek (1997, 2003). There does not seem to be a systematic effect of a master's degree on the quality of a teacher.

3.3 Teacher pay system.

It is also important to know something about the labor market for teachers. In a recent article by Hanushek (2011), the labor market for teachers is described. In normal labor markets workers will receive a salary aligned with their productivity. However in the teaching labor market this is quite different. Salaries are determined by bargaining between teachers' organizations and the employing school districts. Since schools are not prone to going out of business, they do not have a lot of risk when paying a teacher the wrong amount. Besides of that pay does not depend on the quality of instruction of a teacher. Pay for teachers mainly depends on the experience of a teacher and the education of a teacher (Hanushek and Rivkin, 2006).

If this is the case a reform in pay would be necessary, so that quality would go up. An across the board raise is not a good solution in the short run, because it would probably have very little effect in the short run. This is what Ballou and Podgurskey found in 1995. This article will be discussed in the next section of this paper. A possible solution would be to give some sort of incentive pay. Although there has been some experimentation with this incentive pay it is not implemented in most cases since it can also lead to a damaged collegiality and a too narrow focus on certain test scores for which teachers will be rewarded (Dixit, 2002). A study by Hess(2004), also finds a number of problems which should be taken care of in rewarding a teacher. A reward should be large enough to trigger a teacher to work harder and besides of that a teacher should be reasonably able to expect that he gets this bonus. This is basically standard economic reasoning in which the expected value of a bonus should be significant.

3.4 Effects across-the-board raise teachers.

In 1995 Ballou and Podgurskey wrote a paper about the effects of an across-the-board raise for teachers. In the long run the quality of teachers should increase, since the more skilled people will get more incentives to become a teacher. The opportunity costs of becoming a teacher will decrease for those people. Even though higher educated people might not always be better teachers, the overall skill in the pool of applicants to become a teacher will rise after an across-the-board raise. Especially since people with a higher skill level will start deciding to do a course/subject specific training instead of getting a higher degree. This also corresponds with the earlier described article by Goldhaber et al. (2004). However in the short run effects of an across-the-board raise will be less clear. First of all in the short run there might be some budget difficulties, due to the increased costs of teachers, which could lead to layoffs, which are socially not desirable. Second it is not clear whether an increase in salary would have a positive effect and it could even have a negative effect. When teachers can decide by themselves whether they will stay on their job or quit their job, they might be triggered to stay longer on the job than they would without a raise. If the teachers who are on the job now, are not of a high enough quality this raise could cost more than it would yield. Since there will be more applicants and fewer jobs, due to the fact that teachers will remain longer on the job, there will be fewer vacancies available. This means people with higher opportunity costs will be the ones, who will not apply for becoming a teacher. The people with higher opportunity costs are often the persons with the highest skill, who will not apply anymore (Ballou and Podgurskey, 1995). It is also unlikely that current teachers will become more

motivated by a pay raise (Brewer, Eide and Goldhaber, 2004). They will get their salary anyhow, so they are not necessarily motivated to work any harder. However there might be a condition under which an across-the board raise could work. If, in the hiring process, a principal would add a lot of value towards the SAT score of an applicant, there will be smarter teachers (Ballou and Podgurskey, 1995). However this is still a very costly decision, since all teachers will have to get a pay raise. Another way of recruiting smarter teachers, might be a targeted raise. Only the salary for the good teachers will increase. Although this yields about the same results as the principal being more focused on the academic background of a teacher, it is more cost effective since the raise will only have to be paid to the smarter teachers (Ballou and Podgurskey, 1995).

If school principals are not very effective in selecting the best possible applicants from a pool the results of a raise for only the good teachers will be less effective though. Since teachers with a higher academic degree do not always seem to be better teachers than the ones lacking this degree (Hanushek, 2011) it is not sure whether an across-the-board raise will directly lead towards better teachers. Since the ones who normally get a higher degree, need to have time to decide and get a course specific degree. This means that an across-the-board-raise can under some circumstances be very expensive and take a lot of time before leading towards better educational quality.

Also the relationship between the teacher quality and salary effects depends for a large part on the correlation between teaching skills and skills rewarded in the non-teaching professions. If the skills, which are important for teaching are the same as the skills for non-teaching professions the effects of salary raise will be large. However, since in reality there are a lot of different skill the effect of salary might be smaller (Hanushek and Rivkin, 2006).

3.5 Teachers' working conditions.

In a study by Hanushek and Rivkin (2007) the effects of salary and working conditions on the quality of a teacher are researched and it is found that salary might not be a good indicator for the quality of teacher. They found that teachers who moved especially had different types of students. So the working conditions of teachers who moved schools changed much more than their salary. This does not mean however that teachers do not care about salary, because all things equal they will of course prefer a higher salary to a lower salary. In a lot of studies there is no clear link between teacher salary and

working conditions on the one hand and teacher quality on the other hand. This might indicate that schools may have problems with measuring the potential quality of candidates for the position of teacher or they do not place great weight on the instructional quality of candidates relative to other characteristics, like for example a degree. A solution for schools with this problem could be to loosen up on the training requirements and on the prescribed schooling and focus much more on the potential effectiveness of teachers. The principals should have stronger incentives to choose the right teachers, because they actually do know who are the better teachers. Hiring should not be based on standard rules, but on the judgment of the principal. Without the incentive pay however they will not risk any accountability in tough decisions when hiring a new teacher (Hanushek and Rivkin, 2007). Another solution might be a total reform of the pay system. More rigorous retention standards for good teachers, more flexibility in pay schedules and promotion opportunities for the good teachers. Since there is a wide variation of skill, even among teachers with the same experience and schooling, pay should be based much more on skill than on degree and experience (Hanushek and Rivkin, 2007).

3.6 Teacher retention.

To completely understand what the effects of salary on the student performance will be, it is important to know a little bit more on the retention of teachers. Stinebricker, Scafidi and Sjoquist performed a research in 2003 about why teachers leave their jobs. This is a very important topic in finding out what the effects of salary are on the student performance, since it is important to retain good teachers. They made a very simple model in which the decision to stay in the teaching market can be influenced by either increasing wage or by increasing non-pecuniary utility (e.g. daycare for children). They found evidence that teachers are not leaving their jobs for higher paying jobs in the non-teaching sector job (Scafidi, Sjoquist and Stinebricker, 2006). According to this research teachers, who are mainly women (OECD, 2012), seem to be more influenced by family reasons and generous leaving policies, like the fact that teachers can return in the same salary grid as they were before they left (Scafidi, Sjoquist and Stinebricker, 2006). However these benefits can outweigh the costs of a lower salary for family persons, it might not outweigh the costs for non-family persons. This is not a surprising finding. The people who actually care a lot about salary are not becoming a teacher, due to the low pay. So the ones that are teachers now are very likely to care more about family reasons than salary, since salary is relatively low. But it is highly questionable whether those family friendly teachers are better educators than the ones that are a little bit less family friendly and more salary minded.

A study by Murnane et al. (1991) found that teachers are most likely to leave their job in the first few years. Secondary school teachers leave their school earlier than elemental school teachers, especially teachers in physics and science. Teachers with the highest standardized scores leave their job the earliest. And teachers with the lowest pay leave most quickly (Murnane et al., 1991). In addition to this research Hanushek, Kain and Rivkin(2004) found that teacher attrition is high in the first few years, then it decreases and it increases again when a teacher is close to retirement.

Dolton and Klauw (1999) performed an econometric study about the attrition of teachers. They found that higher opportunity wages increase the tendency amongst teachers to leave their jobs. They also found that leaving the teaching profession for family reasons is only influenced by the teacher wage and not by outside options. And further they found that teachers with higher education are more likely to leave the teaching profession than the ones with a lower degree (Dolton and Klauw, 1999). This is in line with the fact that they probably have higher opportunity wages and therefore will tend to leave their jobs faster. However it is not clear whether the ones with a higher degree are actually the ones who are the better teachers.

So it appears to be the fact that only for the first few years, salary is an important factor in the decision by teachers to leave their job. After those years foregone earnings in other occupations are much less important than the complementarity of family considerations and school working conditions (Scafidi, Sjoquist and Stinebricker, 2006). However even though teachers might be less sensitive towards changes in salary, salary still influences a large part of the leaving decisions (Dolton and Klauw, 1999 and Murnane et al., 1991). And salary is important for attracting the best teachers, those who are teachers now might care less about their salary, but those who did not become a teacher (but could be great teachers) might be the ones who do care about salary.

4. Theoretical Framework

In this research the following concepts will be used.

Quality of Education

The quality of education will be one of the main concepts in this research. In this research the quality of education will be measured by looking at the performance of students.

Teacher Salary

Since the teacher salary is currently lagging behind the salaries in non-teaching professions there is some fear that this will influence the performance of students. Since people who have to choose their profession might be tempted to choose for a higher salary.

To answer the research question two hypotheses will have to be answered.

1. Raising salary for teachers will improve the performance of students within one year
2. Raising salary for teachers will improve the performance of students within six years
3. Raising salary for teachers will lead to better performance of students

The first hypothesis is formulated to see whether a raise in salary has some sort of motivational effect on teachers. This would lead to better education and thus better student performance. It is necessary to include a lag of a year for salary though, since otherwise it would be possible that salary for teachers is raised due to bad PISA results, instead of higher salaries leading to better PISA results. The second hypothesis is chosen because it is more likely that it will take some time to attract better teachers by raising salary. New teachers need to choose for a teaching professions and have some time to get their degree and some experience. The third hypothesis is chosen to see whether raising salary for teachers will lead to better student performance at all.

5. Data

The data for this research is mainly gathered from the OECD. The rapport “Education at a Glance” by the OECD has a lot of information and statistics on education. The OECD also tests the skills of 15 year olds once every 3 years in the subjects mathematics, science and reading. The test they use is called the PISA test. The data for the average salary within a country is gathered from the IMF website. All data is available for the years 2000-2009 and for teachers in lower secondary school. To test both hypotheses a panel will be used in which there is data from 21-24 OECD countries. For testing the hypotheses the

program Eviews will be used. This dataset does not seem completely reliable for the year 2009 though. Since the growth in starting salary is on average 11,5% and the growth in salary for teachers after 15 years of experience grows with 9,7% from 2008-2009 (OECD, 2010-2011). That is why the teachers' salaries in 2009 will be excluded from the regression to make that remarkable increase in salary not ruin any possible results.

To test the first hypothesis an ordinary least squares panel data regression will be done, with and without fixed-effects. The performance of students, the dependent variable, is measured using the average score of students on the mathematics, science and reading scale. The salary of teachers is measured in various ways to test correctly whether there is any effect of salary on the performance of students. First of all the salary of teachers will be measured as the salary of teachers after 15 years of experience divided by the average salary in a country. This is taken as a ratio because a higher salary will probably not lead to better teachers if the outside options for teachers are very high as well, compared to a country in which teacher salary is relatively low but the average salary in the country is even lower. Also the starting salary divided by the average salary in a country will be used as an explaining variable to test whether the first results are reasonably valid. Finally salary will be measured as the starting salary divided by the average salary in a country and the raise in this salary compensated for the rise in average salary. All results will be tested for confounding variables. Ordinary least squares without fixed-effects however has one major downside. Salary for teachers shows a very high correlation from year to year (Appendix A2), which means that it might show a positive effect, while it is actually a lagged effect. For that reason a fixed-effects model might be more reliable within one year.

In this research the spending per student, GDP per capita, average class size and the amount of teaching hours will be used as control variables. The expectation is that there might be interaction effects of those variables with the salary for teachers. It could be the case that if the average class size is increasing, increasing teacher salary does not matter anymore because even the best teachers cannot inspire students to great performance if the class size is too big. Or maybe teaching salary is only relevant if the amount of teaching hours is big enough. Students might score better in countries where GDP per capita is higher because there is better education there, or parents are higher educated or the working conditions for teachers are better in those countries. The same is true for the spending per students. If those are relatively high it is possible that students perform better because, for example, they have better computers at a school which would might make teacher salary less important.

The second hypothesis will be tested mostly without fixed-effects. This is due to the fact that there are only two time periods over which a fixed-effects model can be used in this database and the relatively small amount of countries. This means that a fixed-effects model will not be very useful. It will be used however to test whether the results of the regression without fixed-effects are reasonable. Of course those results will be checked for control variables.

The last hypothesis can be answered, due to the low variance of salary for teachers.

6. Results

6.1 Hypothesis 1

The first regression to test hypothesis one will be a regression with the PISA score as explained variable and the salary for teachers after 15 years of experience, compensated for income differences between countries, as the explaining variable. This regression shows there is a significant positive effect of salary, with a lag of one year, on the average PISA score (Model A, table A). The R-Squared is very low. Only 21.2% of the variance is explained by the salary. The low R-squared is not too important, since the goal of this paper is only to understand the effects of salary on the quality of education, but it shows there might be confounding variables. In this case we also add a lag of one year for size, teaching hours and the spending on education per student, since the average class size, the amount of teaching hours and spending per student might be influenced by the PISA results. This one does not show a significant effect of salary on the PISA score anymore (Model B, Table A). This regression however does not make a lot of sense, since increasing the average class size would lead towards better PISA scores. The average class size however shows a very high positive correlation with the salary for teachers (Appendix A2). This shows that countries in which the average class size is higher pay significantly higher than other countries. This means it is necessary to remove the class size variable since it might show a false effect on the performance of students. Doing this leads to a positive effect of the salary for teachers on the performance of students (Model C, table A). Starting salary shows the same conclusion as the salary for teachers after 15 years of experience (Model D, table A).

Table A. Coefficients and significance of variables for hypothesis 1. Dependent variable: PISA score.

	Model A	Model B	Model C	Model D	Fixed-Effects model A	Fixed-Effects model B
C	474.2335**	447.0164**	470.0514**	480.4224**	526.1063**	502.0305**
Salary after 15 years of experience for teachers/average salary both 1 year ago	49.91672**	29.37867	53.62354**		-37.49342	
Average class size 1 year ago		1.404927*				
GDP per capita		0.000137	0.000435			
Spend		-0.000242	-0.001734			
Teaching hours 1 year ago		0.002908	0.002795			
Starting salary for teachers/average salary with a lag of 1 year				53.99472**		3.909822

*Significant at 10% significance level

**Significant at 5% significance level

However due to the low variation in the salary for teachers it might be a better idea to look at a fixed-effects model with the PISA score as dependent variable and the salary for teachers as explaining variable. Doing so leads to the conclusion that salary does not show an immediate significant effect anymore on the performance of students (Fixed-effects model A, table A).

Doing the same for starting salary leads to the same conclusion, salary does not show a significant effect on the performance of students within one year (Fixed-effects model B, table A).

Looking at the results for the salary after 15 years of experience, without fixed-effects, gives a little bit of reason to test further. Especially since there could be a valid explanation why raising this salary would directly increase student performance. If the salary after 15 years of experience would be increased, new teachers might be more motivated to do their best since they do not want to be fired or they will stay in the teaching profession instead of leaving for another profession (since most leaving teachers leave their

profession in the first few years). Although the fixed-effects model did not show a significant positive effect of this salary after 15 years of education, another variable which could be tested for a more decisive answer is the growth rate in salary for new teachers, during the first 15 years of their career. Of course this variable also needs to be compensated for the salary growth of people who are not in a teaching profession.

Doing this leads to a negative coefficient for the relative growth of salary (Appendix A3). However this coefficient is not significant. Not only the coefficient is not significant, the whole model is insignificant at a 10% significance level. The R-squared is lower than 1% so unfortunately this model is not useful.

Based on all those regressions, it is not likely that increasing salary will directly lead towards better PISA scores. Using ordinary least squares without fixed-effects, would lead to the conclusion that raising salary would immediately increase the performance of students. However this is probably due to the low variance in the teachers' salaries. Using a fixed-effects model shows that increasing salary is not likely to improve the performance of students within a year, which is a little bit more reliable. Based on those results hypothesis one can be rejected.

6.2 Hypothesis 2

Perhaps more interesting would be to look at the results over six years, since at that moment new potential teachers could have responded to a salary raise or decrease and thus the performance of students could have gone up or down.

The first regression, which could help to verify/reject the second hypothesis is a regression with the average PISA score as the explained variable and the salary after 15 years of experience for a teacher, compensated for income differences between countries, as explaining variable. The explaining variable is lagged with 6 years. This leads to a significant positive effect of salary (Model A, table B). The R-Squared is better than the R-Squared when looking for an immediate effect of salary. 27,8% Of the variance in the PISA score is explained by the salary, with a lag of 6 years. Again it is necessary to test whether there is any confounding variable. Adding control variables however, only makes the model worse (Model B, table B). Salary still shows a positive significant effect and the other control variables do not show any

Table B. Coefficients and significance of variables for hypothesis 2. Dependent variable: PISA score.

	Model A	Model B	Model C	Model D**	Fixed-Effects model A	Fixed-Effects model B
C	472.9877*	469.1337*	479.1548*	479.8599*	510.1113	497.1844*
Salary after 15 years of experience for teachers/average salary both 6 years ago	51.16046*	54.63251*				10.55480*
Starting salary for teachers/average salary both 6 years ago			56.09482*	65.33258*	-15.30994*	
Spendings on education per student with a lag of 1 years		-0.002693		-0.003468		
GDP per capita		0.000693		0.000696		
Teaching hours with a lag of 1 year		0.002455		0.002795		

*Significant at a 5% significance level

**Insignificant model at 10% significance level

effect. The adjusted R-Squared is much lower than in the first model to verify or reject the second hypothesis, while R-Squared is only a little bit higher. This means that the first model is able to explain about as much with less variables and is thus a better model. Those control variables are not disturbing any effects of a higher salary ratio six years before student performance is measured. Adding a coefficient for salary five years before the test is taken (or even more lags), would make the significant effect of salary six years before the PISA test is taken (appendix A4). However again the model with more lags is not a better model, due to the low variance in the salary for teachers. According to model A in table B, increasing the salary ratio by 0,1 leads to an improvement in the average PISA test score by 5,12.

Even though this regression shows a significant positive result, which cannot be explained using other variables, it is still necessary to test whether a raise in the ratio for starting salary would give the same result. Using starting salary as explaining variable is not able to explain as much of the variance as the salary after 15 years of experience would do, but it gives the same significant result of salary as the

earlier regression did (Model C, table B). According to this regression, raising this salary ratio with 0.1 would lead to an increase in the average PISA score by 5,61. Adding all the available control variables would lead to an insignificant model (Model D, table B), so the conclusion for starting salary is the same as for the salary for teachers after 15 years of experience. There seems to be a positive significant effect of teachers' salary on the performance of student.

Using a fixed-effects model does not give any clearness in this case. Especially since the amount of observations is very small given only 2 time periods, there is no significant effect of the starting salary 6 years before the test on the results (Fixed-Effects model A, table B). There does not seem to be a significant effect of the salary for teachers after 15 years of experience, with a lag of 6 years, anymore either (Fixed-Effects model B, Table B).

Answering hypothesis two with those tests is not really easy, since using a fixed-effects model is not really useful anymore. Looking at the results of the fixed effects model, there does not seem to be a significant effect within six years for salary. However the ordinary least squares model does show a significant positive effect and there could be a valid explanation why this would be true. But due to the low variance within the teachers' salaries it is not possible to draw a conclusion from these results.

6.3 Hypothesis 3

Although it is not perfectly possible to say when raising salary will influence the performance of students, it is possible to say that it does improve the performance of students. Because the salary for teachers (compensated for income differences between countries) shows very little variance, it is highly likely that it improves the performance of students at least in the long run. All the ordinary least squares regressions show a positive effect of salary. So raising salary will lead to better performance of students in at least the long run. So hypothesis three can be accepted.

7. Conclusion

In this research it is tried to explain the relevance of teachers' salaries in education. Theoretically it is clear why they matter. If salary is raised a teaching position becomes more attractive and people who are more skilled are more likely to become a teacher. Even if it is true that teachers are more family minded people at this moment, raising salary is likely to improve the quality because people who are a little bit less family minded might now become a teacher and there is no reason to believe that those are worse teachers than family minded people. There are some downsides of raising salary as well though. First of all it might be very costly to raise salary for teachers and it might take some time before this raise in salary will have a positive effect on the performance of students. Research by Ballou and Podgurskey (1995) offers one explanation for this. Most research finds no motivational effect of raising salary and this research does not find a motivational effect of salary either. Besides it will take at least five to six years to get better teachers by raising salary, because they need to get their degree and some experience. And there should be room for new teachers. If the people who are teaching now are not fired for better teachers, which is quite likely since it is often not possible to simply fire teachers because there are better teachers available, it might even take longer than six years. Unfortunately this research is not able to show how long it will take for a raise in salary to improve the performance of students, due to the relatively short dataset. It does show however that it is quite likely that raising salary will improve the performance of students and that this raise in performance is probably not due to some motivational effect.

Those results give some reasons to increase the salary for teachers experience. However it might not be sufficient to actually start investing in salary for teachers. Especially since it is not perfectly clear how long it will take for a raise in salary to increase the performance of students. For this reason it is a good idea to perform some more research about the time it will take for a salary raise to have any effect on the performance of students. Besides it should be known what exactly will be the benefits of raising salary. It might raise the performance of students, but if it is more expensive than it will actually pay out it might still not be worth it. There is a lot of research about the relationship between the quality of education and the economic growth already, but it could be interesting to also look at the relationship between a raise in teachers' salaries and the economic growth to know whether it is worth it to invest in education by raising teachers' salaries. If it is not worth it looking at incentive payments might be a possibility to improve the quality of education.

8. References

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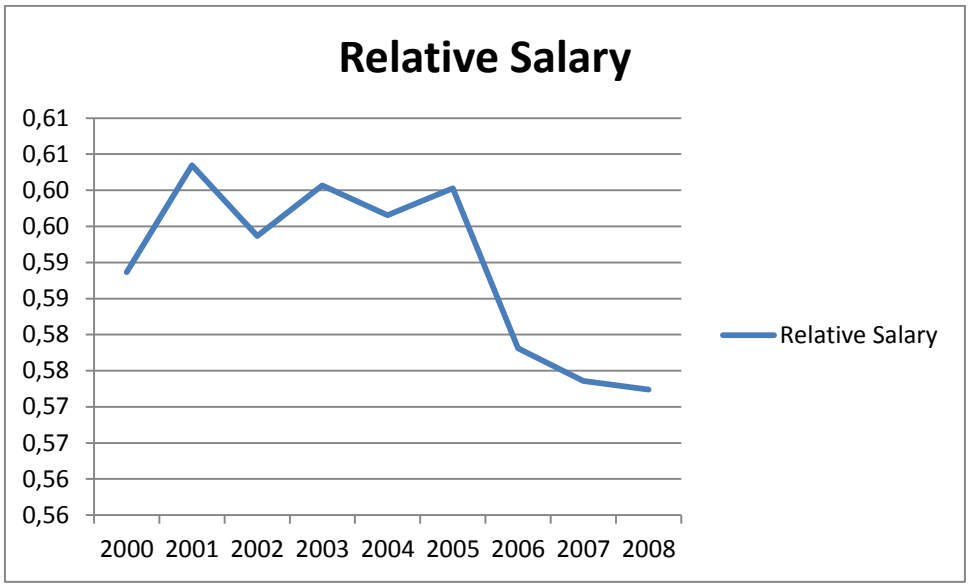
9. Appendix

A1. Salary for lower secondary education teachers after 15 years of experience divided by average salary in a country (OECD, 2004-2011) and (IMF, 2013)



A2. Correlation between various variables

Coefficients + p-value	Dependent variable	Salary after 15 years of experience/average salary	Salary after 15 years of experience/average salary 1 year ago		
Independent Variable					
Salary after 15 years of experience/average salary 1 year ago		0.993268 (0.000)*			
Average class size 1 year ago			0.025113 (0.000)*		

*Significant at any significance level

Appendix A3.

Dependent variable: PISA score

Coefficient and P-value	
Raise in salary for teachers 1 year ago/Raise in average salary 1 year ago	-0.103863 (0.9278)
C	503.7191 (0.000)
F-Statistic	0.927764

Appendix A4.

Dependent variable: PISA score

Coefficient and P-value	
Salary for teachers after 15 years of experience/Average salary both 4 years ago	56.62539 (0.5783)
Salary for teachers after 15 years of experience/Average salary both 5 years ago	-50.36033 (0.6735)
Salary for teachers after 15 years of experience/Average salary both 6 years ago	46.75575 (0.4544)
C	471.4556 (0.000)