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Marte Rønning

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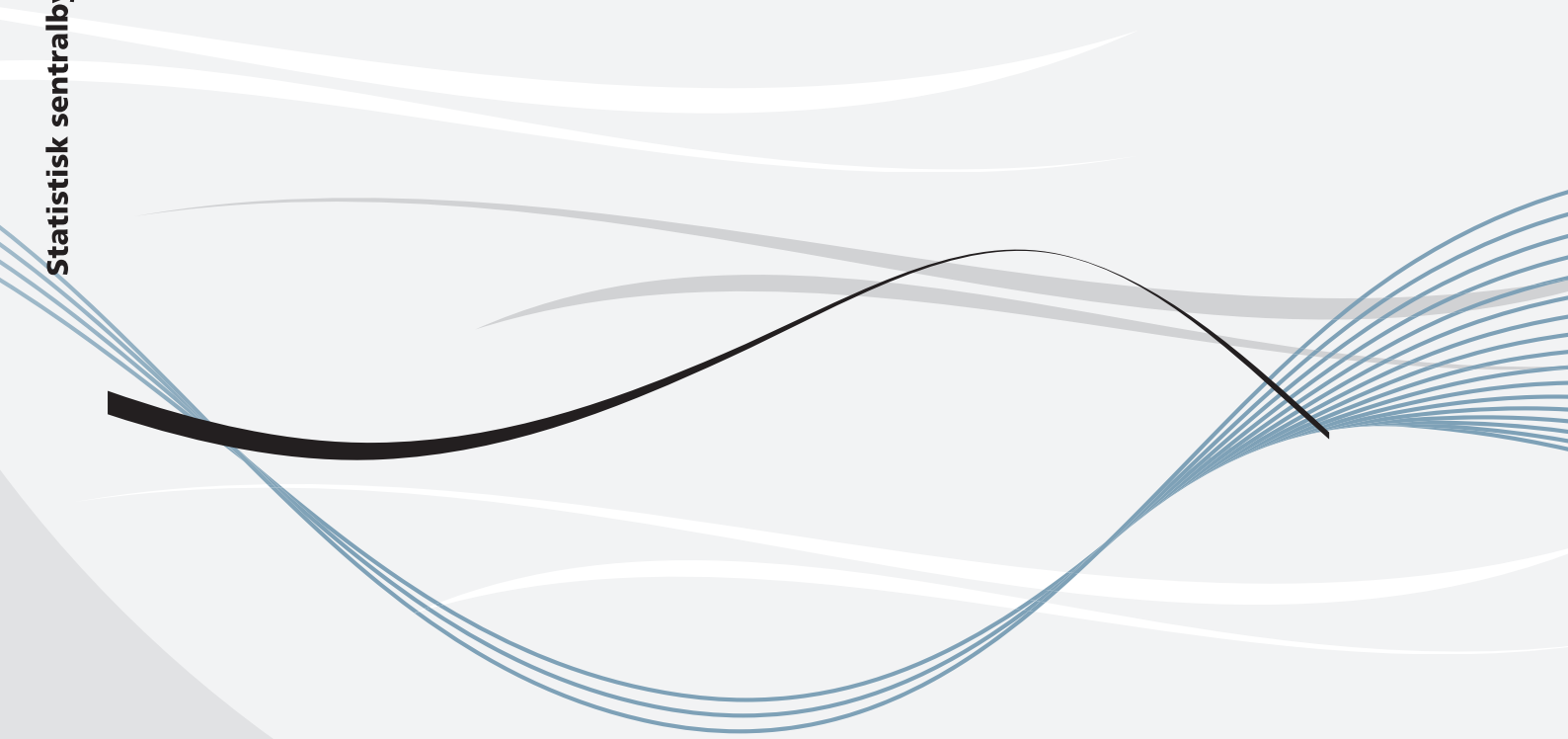

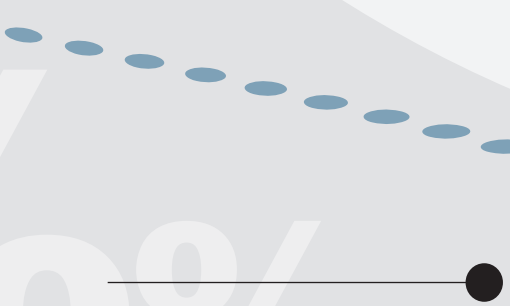

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Abstract:
This paper investigates the effect of working conditions on the amount of teachers'sickness absence in Norway. Exploiting intertemporal variation within teachers who have not changed schools, the findings indicate that teachers lower their amount of sickness absence if the school's resource use increases. Increased workload and permanent employment contract are associated with higher sickness absence. When stratifying on teachers'age, increased workload appears to have a larger impact on old teachers.

Keywords: Teachers, absence, working conditions

JEL classification: I10, I20, J28

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Address: Marte Rønning, Statistics Norway, Research Department. E-mail: mro@ssb.no

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Sammendrag

Denne artikkelen ser på om mengden sykefravær blant lærere i Norge påvirkes av forhold på arbeidsplassen. Funnene tyder på at det er en negativ sammeneheng mellom sykefravær og skolens ressursbruk. Økt arbeidsmenge og permanent jobbkontrakt er også forbundet med høyere sykefravær. Dersom man stratifiserer på lærernes alder, ser man at økt arbeidsmengede har en større negativ innvirkning på eldre lærere. For å ta hensyn til uobserverbar lærerhetererogentitet utnyttes intertemporal variasjon innen lærere som ikke har byttet skole.

1 Introduction

Sickness absence is expensive for several reasons. The society must pay sickness benefits and replacement; the sick individuals themselves loose work experience and acquired human capital; and having sick colleagues may be destructive for the overall moral on the workplace. In the school sector, sickness absence may have an additional cost. Teacher absence may be costly to the extent that the pupils learn less during their absence (Miller, Murname and Willett, 2008; Clotfelter, Ladd and Vigdor, 2009). Potential channels this may work through are: i) ordinary teachers are substituted by less qualified replacement teachers; ii) the change of the teacher itself may have a disruptive effect on the student's learning environment; iii) in the worse scenario classes may be canceled when a replacement teacher cannot be found.

It is a common understanding in the literature that teacher quality is a crucial input in explaining student outcome, but that observed measures of teacher quality like education and experience turn out to explain very little of the variation in student outcome (see Hanushek, 2002). It is therefore surprising that teacher absence has not been devoted more space. There is a small empirical literature showing that different sick-leave policies and financial incentives may be effective devices to lower teacher absence. These studies are based on US data (Winkler, 1980, Jacobsen, 1989 and Ehrenberg et al., 1991; Clotfelter, Ladd and Vigdor, 2009).[1]

tThe optimal sick leave policy may be a combination of financial incentives and money spent on preventive systems. On the other hand, deriving this optimal strategy is difficult. Notwithstanding, in order to get closer to an efficient policy device, further knowledge of sources that influence absence are essential.

A couple of studies focus on different factors that can explain variation in teachers' sickness absence. The first one is Leuven (2006), who investigates the effects on teacher absence of a Dutch policy that allows employees older than 52 to reduce their working hours by 10 percent at the cost of a 3.5 percent reduction in salary. The aim of this policy is to lower absence among older workers in the Netherlands through subsidized work time reduction. Exploiting longitudinal micro data on all teachers in primary and secondary education in the Netherlands, he finds that male teachers lower their sickness absence in response to this policy. Bradley et al. (2007) analyze so-called social multiplier effects (Manski, 1993). More precisely they investigate whether absence has spillover effects on other teachers' absence. Using a database of matched teachers and schools obtained from the Queensland Govern-

[1] The literature on the effect of financial incentives on sickness absence in other sectors is more elaborated. See for instance Johansson and Palme (2005) and references therein.

ment of Australia they find evidence that teachers' absence depends on the absence of their co-workers.

Another interesting result in both Leuven (2006) and Bradley et al. (2007) is that teachers on temporary employment contracts have lower absence rates than teachers on permanent employment contracts (see also Ichino and Riphahn, 2005). This suggest that less certain employment contracts may have a disciplinary effect in the sense that low sick rates improve the chances of renewed contract and permanent position. These findings are in line with the so-called shirking theory, which says that workers will shirk less and work harder when for instance the punishment is hardened (Barmby et al., 1994; Shapiro, and Stiglitz, 1984).

Using longitudinal register data on teacher absence linked to school as well as individual level teacher characteristics, the current paper's contribution to the literature is to analyze the effect of working conditions on teacher sickness absence. The conditions of teachers' work affect the satisfaction they derive from their work, and may be important predictions for the teachers' general well-being. For instance, teachers facing high pupil-teacher ratios may have a more tiresome work day than teachers facing lower pupil-teacher ratios. Similarly, teachers working in schools with many disadvantage students may be more often confronted with stressful and challenging situations. Teachers' workload and contract type are also considered in the model because the literature has found these two variables to be important determinants for teacher absence (Leuven, 2006; Bradley, 2007).[2] The literature on absence in other sectors have found working conditions to be important predictors for absence (e.g. Hemningway et al., 1997; Brown et al., 1999; Ose, 2004).

To identify the effects, I exploit intertemporal variation within teachers who do not move to another schools. In addition to controlling for variation across teachers, this strategy also rules out that the results are driven by teachers who change schools. The results will be reported jointly and separately for male and female teachers which is a common practice in the sickness absence literature. I also stratify on the teacher's age.

The structure of the paper is as follows; section 2 describes the institutional settings; section 3 presents the data; section 4 outlines the empirical approach; the results are presented in section 5; I perform some robustness checks in section 6; and finally section 7 concludes.

[2]Analyzing social multiplier effects as in Bradley (2007) are more complicated and is therefore not a part of this analysis.

Table 1: Summary statistics: Teachers' sickness absence, measured in percent per teacher per year

	Mean	s.d.	N obs	N teachers
All teachers	5.99	14.38	258,903	84,001
Female teachers	6.74	15.03	178,859	58,991
Male teachers	4.31	12.65	80,044	25,010
Teachers younger than 50 (young)	5.28	12.92	172,570	60,828
Teachers older than 50 (old)	7.39	16.84	86,333	12,196

Note: Reported is the amount of medical certificated sickness absence. The table shows statistics for the whole population covering the school years 2000/2001 to 2004/2005.

2 Institutional settings

In the period under investigation, the Norwegian Public Service Pension Fund ("Statens Pensjonkasse") guaranteed teachers 100 percent (monetary) replacement from the first day of incapacity up to one year ("sickness benefit year"). The first 16 days of the absence period was paid by the employer, which for the teachers is the municipality. The Norwegian National Insurance company ("Folketrygden") reimbursed the remaining days (maximum 248 working days) up to an upper limit of 6G's.[3] Average teacher salary in Norway is approximately close to this cap. Employees were allowed to use self-certification for the first three days of absence, but needed a medical certificate for all absence exceeding three days.

After one year, the insured employee either goes back to work again or is transferred to the rehabilitation scheme. Rehabilitation is the step before disability, and its intention is to avoid inflow into disability, either in forms of physical treatment or vocational occupational rehabilitation. The maximum length of stay on the rehabilitation scheme is one year, and the monetary compensation payed by "Folketrygden" is about 67 percent. Older employees may be transferred directly to the disability scheme at the end of the "sickness benefit year" as the probability is low that they will resume work. This is common for employees beyond 60 years.

3 Data

Longitudinal register data on medical certificated sickness absence from Statistics Norway, covering all teachers in Norwegian primary and lower secondary school from 2000/01 to 2004/05 (in total five school years) are linked to school characteristics

[3]In the period under investigation 1G increased from 48 377 NOK in 2000 to 58 139 NOK in 2004. 1 Euro $\simeq$8 NOK.

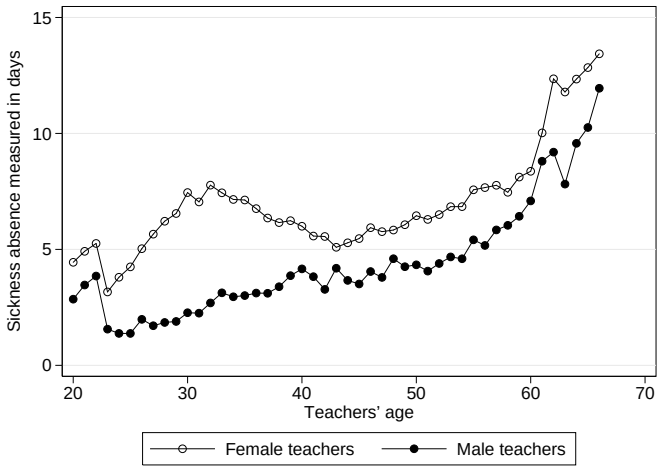

Figure 1: The relationship between teacher's age and sickness absence

from the Norwegian Ministry of Education as well as individual level teacher characteristics also from Statistics Norway. Since a medical certificate is necessary only for absence longer than three days, I do not have information on absence-spells shorter than four days.

In the analysis I drop: Teachers who are continuously sick for more than one year as they may not be representative for the average teacher teachers older than 67 as the national retirement age in Norway is 67; teachers on leave in order to avoid mixing sickness absence with being on leave.[4]

Because of the rural settlement pattern in Norway, some very small schools exist. These schools are neither representative and are therefore excluded in the analysis (more precisely I exclude schools with less than 10 pupils). In total, I drop 2,452 teachers. The final sample consists of 84,001 teachers and 258,903 observations (since I observe the same teacher several times, the number of observations is larger than the number of teachers.

3.1 Sickness absence

The yearly average amount of *medical* certificated sickness absence for the time period under investigation is 6 percent, which can be seen in the first row of Table 1. A general finding in the sickness absence literature is that females are more sick than males, and that absence is increasing in age (e.g. Barmby et al., 2002). Norwegian teachers are no exception. In Norway, average sickness absence among

[4] All female employees in Norway are entitled generous maternity leave. 3.6 percent of the female teachers in our data that are not registered as being on leave have children younger than or equal to 1 year. In order not to mix sickness absence with being on maternity leave, these teachers are dropped.

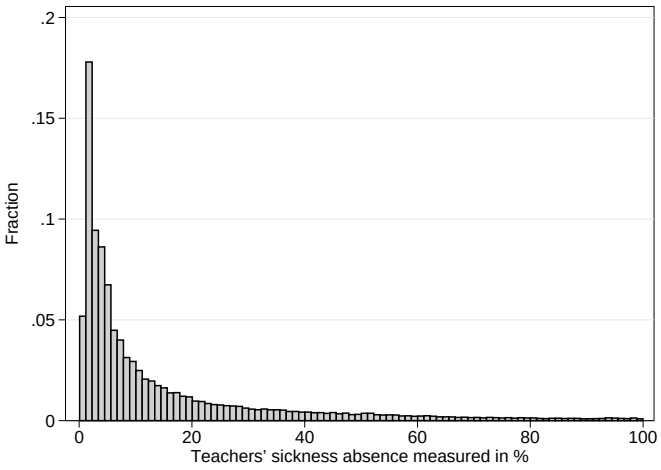

Figure 2: The distribution of average sickness absence per teacher per year, conditional on that the teacher was absent (N = 105,322).

female teachers is about 2.5 percentage points higher than average sickness absence among male teachers. And teachers born before 1950 (50 years old in 2000) are on average 2.1 percentage points more absent than teachers born after 1950. Figure 1 illustrates the relationship between age and sickness absence separately for each gender. For male teachers the relationship seems to be fairly linear until the age of 55, whereas female teachers between 30 and 35 years are more absent than female teachers between 40 and 45 years. A likely explanation for the latter pattern is the age of their own children. Sickness absence among both genders seem to increases rapidly from about 55 years and onwards. Figure 2 shows the distribution of teacher sickness absence conditional on that the teachers have been absent. According to this figure, a majority of these teachers are absent less than 20 percent of the "day's work" due to medical reported sickness absence. Moreover, average sickness absence among teachers in this group is about 15 percent.

3.2 Working conditions

Two measures of the school's resource use are available; "teachers hours per pupil" and "teacher man-year per pupil" (the number of working hours per week multiplied with the number of work weeks per year*)*. Teacher hours measures how much resources that are allocated to teachers' interaction with students, either in the classroom or as extra education to specific students (more teacher hours is synonymous with more resources). Teacher hours is regarded as a very precise measure of the teacher resource use in schools. The relationship between teacher hours per pupil and teacher man-year per pupil is strong. The correlation coefficient is equal to *0.85*

and is also illustrated in figure 1 in Falch et al. (2006). Both resource measures are also strongly related to school size as further shown in Falch et al. (2006), thus it is important to separately control for school size in the model. An alternative measure of the school's resource use would be class size. However, the maximum class size rule terminated the school year 2002/03. As a consequence, data on the number of classes per grade stopped being collected.

To measure the student composition in the school, I include students with special needs and minority students. These two variables are derived from calculating the fraction of students within a school who are entitled to extra lessons or instructions with education personnel and the fraction of students who are given extra lessons in Norwegian. It is important to emphasize that conditional on schools' resource use (which also capture extra resources used on special education to both Norwegian students with special needs and minority students), minority and disadvantage students are not confounded with extra money allocated to the school to compensate a unfavorable student composition.The variables measuring the school's resource use and student composition are both measured at the school level.

Teachers in Norway usually start their teaching career on a temporary employment contract. A permanent employment contract is obtained in subsequent year(s) depending primarely on availability of vacant positions, but also teaching performance. The latter contract type involves that the teacher is granted a job in the school district. In accordance with previous findings (Bradley et al., 2007; Leuven, 2006; Ichino and Riphahn, 2005) I expect absence to raise if a permanent employment contract is given to the teacher. Being on temporary employment contract is assumed to have a disciplinary effect because it is an element of uncertainty connected to whether the contract is extended the next school year.

The number of a teacher's weekly working hours are regulated by the work contract. However no strict guidance is imposed, involving that before the start of each school year the teachers can negotiate their own working hours with the principal to a certain degree. In line with the finding in Leuven (2006), decreased number of working hours is predicted to lower absence. A reduced working week involves more leisure time which can be used on other recreational activities that may be health promotive.

3.3 Demographic and socio-economic variables

In addition to gender and age, it is a common practice in the absence literature to control for education and income (e.g. Røed and Fevang, 2006; Askildsen et al.,

2005; Leuven, 2006; Ose, 2004; Winkler, 1980).[5] Askildsen et al. (2005) also control for marital status and own children. They find that absence is higher for separated and divorced employees, whereas no strong significant effects relating to the number of small children are found. The latter variable is meant to capture that small children cannot stay home alone when they are sick. The fact that it is insignificant may be due to that their absence data lack information on spells shorter than 14 days. Nevertheless, I acknowledge that the family situation may be an important determinant for absence and control for both marital status, the age of own children (indicator variable that equals one if the teacher has own children younger than 12 years) as well as number of own children. Finally, to take into account that the relationship between age and sickness absence is non linear, I choose to control for a quartic age function which is assumed to capture all smooth variation.

3.4 Descriptive statistics

Table 1 provides descriptive statistics for all the explanatory variables used in this paper covering the whole period under investigation. The average Norwegian teacher is 44 years old, has a workload of 90 percent and earns about 26 000 NOK per month. She teaches in a school consisting of 284 pupils where 6 and 5 percent of the students are minority or special need students. Average teacher hours per pupil and average teacher man-year per pupil is 75 and 8.8. Furthermore, 70 percent of the teachers are females, 65 percent have a permanent work contract, less than 5 percent do not have sufficient education to be certified, 65 percent are married and have on average 1.9 children and 32 percent have own children younger than 12 years. 55 percent of the Norwegian teachers work in pure primary schools (1-7 grade), 24 percent work in pure lower secondary schools (8-10 grade), whereas the remaining 21 percent work in combined schools (1-10 grade).

[5] Teachers salary is to a large extend centrally decided and equal across teachers who share the same education and experience. Moreover, since it is a function of experience and education in a nonlinear and interacting way its effect is difficult to interpret. From the school year 2001/02 some local discretion in the teacher's wage bargaining were also introduced.

Table 2: Summary statistics: Explanatory variables

	Mean	*s.d.*
WORKING CONDITIONS		
Minority students (measured in percent)	5.91	10.17
Students with special needs (measured in percent)	4.57	3.85
Man-year per pupil	8.78	2.60
Teacher hours per pupil	75.04	20.15
School size (number of pupils)	283.73	142.64
Primary school	0.55	0.51
Lower secondary school	0.24	0.43
Combined school	0.21	0.41
Workload (measured in percent)	90.14	18.79
Contract type		
.-Permanent position	0.65	0.48
- Temporary position	0.15	0.36
- Missing information	0.20	0.40
INDIVIDUAL CONTROL VARIABLES		
Female	0.70	0.46
Male	0.30	0.46
Age (years)	44.80	11.04
Salary (NOK)/1000	25.96	3.61
Education		
- Unlicensed (<= 12 years)	0.04	0.19
- Bachelor degree (12+3/4 years)	0.92	0.29
- Master or PhD degree (12+5/6 -9/10 years)	0.04	0.20
Marital status		
- Unmarried	0.24	0.43
- Married	0.64	0.48
- Widow/widower	0.01	0.12
- Divorced/separated	0.10	0.30
- Missing information	0.01	0.04
Children		
- Number of children children	1.86	1.19
- Child(ren) <= 12 year(s)	0.32	0.47

Note. Number of observations: 258,903; number of teachers: 84,001. All the variables are reported Oct. 1st every school year by the principal or other school leaders.

4 Empirical approach

Regarding sick leave, many aspects are of interest. The current paper focuses on one of them; the amount of sickness absence and how it is affected by observed characteristics. This section outlines how to empirically estimate this.

Assume that the amount of sick leave of teacher i in school s and year t (a_{ist}) is generated by the following equation:

$$a_{ist} = \alpha + x'_{ist}\gamma + \eta_i + \theta_s + \delta_t + u_{ist} \quad (1)$$

where x'_{ist} is a vector consisting of all observable attributes of the teachers and schools presented in table 2. Clearly, a large part of the sickness variation is explained by the teacher's general health condition which is unobservable. Under the assumption that the teacher's health state is constant over the period under investigation, it is captured by the teacher fixed effect, η_i. A school fixed effect θ_s is included to control for all other unobserved attributes with the schools that potentially is correlated with the sick leave, δ_t are time indicator variables and u_{ist} is a random error term.[6]

In principle, all types of fixed effects can be handled by including indicator variables in the model. This is however a high dimensionality problem given the size of our sample. One way to handle this is to exploit that with fixed individual effects included, school specific effects are solely identified by teachers moving between different schools during the sample period. This implies that possible biases caused by teacher movements between schools can be avoided if a teacher who moves from one school to another is treated as two different individuals. Technically this involves that each teacher-school combination is given a unique identifier. In the empirical implementation I will rely only on intertemporal variation within teacher-school matches to identify the effects of the observed characteristics of interest on absence. This is equivalent to including a full set of individual and school effects and the interaction between these effects (Falch and Strøm, 2005; see also Goux and Maurin, 1999). In addition to controlling for variation across teachers, this strategy also rules out that the results are driven by teachers who change schools. The exact model I estimate is give by equation (2).

$$a_{ist} = \alpha + x'_{ist}\gamma + \eta_i \cdot \theta_s + \delta_t + u_{ist} \quad (2)$$

[6]The model in equation (1) is on reduced form since we do not know the accurate reason why the teachers are absent. Any underlying structural model is therefore not formalized.

5 Results

This section presents results from estimating different variations of equation (2). Because of the high correlation between the two variables that measure the school's resource use, separate regressions are run for each of them, and only those which include teacher hours per student are reported in full tables. The teacher man-year coefficients are reported in Table 5.[7] In all tables, I only report the estimation results for the working conditions, while the effects of the individual control variables are reported in appendix Table A1 and A2.

To shed some light on how the amount of sickness absence is related to observed characteristics, I start out by presenting estimates based on a simple OLS regression. The results are reported in column (1) of Table 3. Although it is difficult to give estimation results obtained from a cross sectional analysis causal interpretations, it is of interest to compare these findings with the results obtained from the fixed effect analysis (FE) where intertemporal variation within teachers who have not changed schools are used to identify the effects. The results obtained from the latter approach are reported in column (2) of the same table.[8]

The OLS analysis produces a zero correlation between the school's resource use and teacher absence, suggesting that the school's resource use have no impact on absence. It is difficult to explain why this occurs, but it is important to point out that schools in Norway differ substantially in terms of size, location, student body and also teaching staff. Larger schools in big urban cities are typically faced with relatively few resources per pupil, whereas small schools situated in remote areas have relatively more resources per pupil.[9]

When condition on fixed effects I find evidence that increased use of resources has a significant negative effect on sickness absence. More precisely, when ruling out variation across teachers and schools I find that sickness absence declines by 2 percent of a standard deviation if teacher hours per student increases by one standard deviation. In terms of percentage points this effect amounts to 0.3, and is not negligible given that average sickness absence is 6 percent. The effect of teacher man-year per pupil is similar and reported in column 1 of Table 5.

The relationships between sickness absence and both variables that measure

[7] In a "horse-race" competition between teacher man-year per student and teacher hours per student, the latter is significant at the five percent level (point estimate = 0.112), whereas the first one is clearly insignificant.

[8] Since many teachers have zero absence, the arguably most correct model would be a Tobit specification. However, teachers who are non-absent over the whole sample period will drop out from the fixed effect approach.

[9] Winkler (1980) also find zero effect of the pupil-teacher ratio on absence

Table 3: The effect of working conditions on teacher sickness absence.

	OLS	FE
	(1)	(2)
WORKING CONDITIONS		
Teacher hours per pupil	−0.0021	−0.0139
	(0.0024)	(0.0056)**
Minority students	0.0148	−0.0184
	(0.0039)***	(0.0126)
Special need students	0.0280	0.0247
	(0.0108)***	(0.0178)
Pupil	0.0027	0.0097
	(0.0010)***	(0.0058)*
$\text{Pupil}^2/1000$	−0.0032	−0.0155
	(0.0014)**	(0.0067)**
School type (ref = Primary)		
- Lower secondary	−0.4241	
	(0.0906)***	
- Combined	−0.0510	
	(0.0943)	
Workload	−0.0198	0.2102
	(0.0022)***	(0.0058)***
Permanent position	0.9187	0.9458
	(0.0921)***	(0.1781)***
N teachers	84,001	44,988
N observations	258,903	176,499

Note: The dependent variable is teacher *i's* sickness absence in year *t* measured in percent. Standard errors are heteroscedasticity robust and corrected for individual level clustering. Year dummies; dummy variables for missing information on the teacher's contract type, length of education and marital status are included. *. ** and *** denote significance level at 10, 5 and 1 percent respectively

student composition are positive and highly significant in the OLS analysis. The point estimates suggest that a one standard deviation increase in minority and special need students will increase the amount of sickness absence by 1 and 0.8 percent of a standard deviation respectively. Although the effects are rather small, they indicate that teachers working in schools that face a large share of minority and special needs students have more sickness absence.[10] The literature looking at teacher quit behavior typically find that teacher mobility is strongly related to characteristics of the students (e.g. Hanushek et al. 2004). The true effect of student composition on sickness absence is then overestimated if teachers with good health sort themselves to schools with few minority and special needs students. With respect to minority students this seems to be confirmed in column (2). It is however somewhat puzzling that the effect is negative and almost significant at the ten percent level. The point estimate of the special need students is on the other hand fairly unchanged in the fixed effect specification, but note that the standard error has increased (t-value equals 1.4 in column 2).

Furthermore, absence is highest in schools with 313 pupils which is slightly larger than average school size. Teachers working in pure lower secondary schools are less absent than teachers working in schools with students at the primary level only.

The predicted positive effect on absence of both workload and being on a permanent employment contract may be underestimated in an OLS analysis if teachers with good health more often ask for a higher workload and are more easily given a permanent position. Regarding workload this seem to be the case. The correlation between workload and sickness absence is negative and significant in the OLS analysis, but obtains the expected significant positive sign in the fixed effect analysis. The latter implies that a ten percentage point increase in workload will increase sickness absence by 2 percentage points. This corresponds to 14 percent of a standard deviation. The point estimate of having a permanent position is similar in the OLS and fixed effect analysis. Teachers on a permanent job contract are almost 1 percentage point (about 7 percent of a standard deviation) more absent per year than teachers who have a temporary position which is consistent with earlier evidence.

Although the fixed effect approach handles a large part of the potential selection bias, a small route for bias in the fixed effect estimates may remain. Biases arise if workload and contract type are correlated with unobserved changes in the teacher's health condition over time. However, since the most likely scenario is a positive correlation (higher workload and permanent employment contracts are given to

[10] Also Clotfelter, Ladd and Vigdor (2009) find that absence rates are slightly higher in schoolw with a high share of students that are eligible to free lunch.

teachers with improved health), the potential unobserved time varying health effect will indeed bias the fixed effect estimates downwards, *ceteris paribus.*

The effects of the remaining individual control variables that correspond to Table 3 are reported in appendix Table A1. As expected divorced teachers and teachers with small children are more absent. Note also that married teachers seem to be more absent than unmarried teachers. It is difficult to interpret why the latter result occurs, but it may be due to that being married is correlated with other conditions that we do not control for in this model. Moreover, increased salary seems to correlate negatively with absence (both in the OLS and FE specification), but as already emphasized this coefficient may also capture omitted variables (see footnote 6).[11]

5.1 Gender differences

Since female employees turn out to have higher sickness absence than male employees, a common practice in the absence literature is to separately look at at the genders (e.g. Johansson and Palme, 2005; Leuven, 2006; Askildsen et al., 2005). I follow this tradition and estimate equation 2 separately for female and male teachers.

Results obtained from fixed effect estimations are presented in the first two columns of Table 4. An increase in teacher hours per pupil has strongest effect on male teachers who reduce their sickness absence by 4.5 percent of a standard deviation if teacher hours per pupil increases by one standard deviation. This may indicate that only male teachers react on the school's resource use. However, female teachers are more sensitive to an increase in teacher man-year per pupil as is shown in column 2 of Table 5. If teacher man-year per pupil increases by one standard deviation, female teachers lower their absence by 1.2 percent of a standard deviation. A general conclusion about resource use and gender differences is then difficult to derive. The point estimate of minority students is similar to the one in the pooled sample, whereas only female teachers appear to increase their absence if the fraction of special need students increases. Regarding changes in workload and the contract type, the impact on both genders resembles the findings in Table 3 to a large extent.

Columns (1) and (2) in appendix Table A2 report the effects of the remaining individual control variables that correspond to column (1) and (2) of Table 4. Only female teachers seem to respond to marital status and small children. The fact that only married women have higher sickness absence is in accordance with Barmby et al. (2002). Salary has still a negative effect on absence and the size of the coefficients

[11] With respect to the fixed effect specification(s) in Appendix A, it is important to point out that the results are driven by variation within very few teachers.

Table 4: The effect of working conditions on teacher sickness absence, fixed effect estimates for different sub groups

	Female (1)	Male (2)	Young (3)	Old (4)
WORKING CONDITIONS				
Teacher hours per pupil	−0.0087	−0.0277	−0.0104	−0.0171
	(0.0066)	(0.0103)***	(0.0061)*	(0.0109)
Minority students	−0.0240	−0.0062	−0.0101	−0.0381
	(0.0157)	(0.0196)	(0.0140)	(0.0254)
Special need students	0.0339	0.0028	0.0137	0.0431
	(0.0218)	(0.0308)	(0.0199)	(0.0346)
Pupil	0.0103	0.0079	0.0060	0.0166
	(0.0070)	(0.0103)	(0.0066)	(0.0108)
$Pupil^2/1000$	−0.0149	−0.0168	−0.0107	−0.0252
	(0.0082)*	(0.0118)	(0.0078)	(0.0125)**
Workload	0.2153	0.1845	0.1499	0.3210
	(0.0065)***	(0.0129)***	(0.0064)***	(0.0112)***
Permanent position	1.0197	0.7257	0.9677	1.1820
	(0.2161)***	(0.2950)**	(0.1819)***	(0.6459)*
N teachers	33,075	11,913	29,855	15,133
N observations	127,983	48,516	112,672	63,827

Note: See table 3.

are similar to the ones in appendix Table A1.

5.2 Age differences

Another dimension for which differences in sickness absence are large is age. Although sickness absence is increasing in age, the exact reason why this is observed is still unknown. One explanation is that health is negatively affected by external factors such as working pressure, allowing health problems to arise over time. On the other hand, it cannot be ruled out that health itself simply is a declining function of time, implying that poorer health is inevitable when we become older. Separating these two effects are difficult. However if only the latter explanation is relevant, I expect no systematic differences to exist between young and old teachers with respect to the effect of observed characteristics. As an attempt to check this I stratify on the teachers age and estimate equation 2 separately for old (born latest 1950) and young teachers (born after 1950).

The fixed effects estimates are presented in columns (3) and (4) of Table 4. The point estimates of teacher hours per student is larger for old teachers than for young teachers. However, if interpreting the effects in terms of percent of a standard devia-

Table 5: The effect of teacher man-year per pupil (TMYPP) on teacher sickness absence, fixed effect estimates for all teachers and different sub groups of teachers

		Sub groups			
	All	Female	Male	Young	Old
	(1)	(2)	(3)	(4)	(5)
TMYPP	−0.0536	−0.0731	0.0161	−0.0322	−0.0954
	(0.0271)**	(0.0303)**	(0.0620)	(0.0283)	(0.0626)

Note: The dependent variable is teacher *i's* sickness absence in year t measured in percent. Standard errors are heteroscedasticity robust and corrected for individual level clustering. Each row represent one regression. Included control variables are the same as in corresponding specifications in table 3 to 4.

tion, both effects are close to 2 if teacher hours per pupil increases with one standard deviation.[12] Furthermore, both younger and older teachers increase their absence by about 7 percent of a standard deviation if they are given a fixed employment contract.The fraction of special need students has still the expected positive sign for both age-groups, but as emphasized earlier, this effect is very small. The effect of minority students is unchanged compared to the findings in previous tables. Thus, with respect to resource use, student composition and contract type the effects are similar to the corresponding ones in Table 3.[13] Increased workload turns now out to have larger impact on old teachers. The effect amount to 19 percent of a standard deviation if workload increases by 10 percentage points and is highly significant. This is a 35 percent increase compared to the effect in the pooled sample in column (2) of Table 3. The effect for young teachers is 11.6 percent of a standard deviation and is also significant.

Summarized, older teachers appear to be more sensitive to changes in workload than young teachers. This finding therefore supports that subsidized work time reduction for older workers may be a good policy to lower sickness absence among older workers (Leuven, 2006).

Regarding the effects of the remaining control variables at the individual level that correspond to the two last columns of Table 4, no big changes compared to the overall findings are revealed. The only exception is that the dummy variable for small children only affects young teachers' absence (which is not surprising since having small children is less frequent among older teachers). This is reported in the two last columns of appendix Table A2.

[12] Once again, the effects of teacher man-year per pupil is fairly similar.

[13] With respect to old teachers, it is important to point out that most of them have a fixed position.

Table 6: The effect of working conditions on teacher sickness absence, fixed effect estimates for the stable worker sample

		Sub groups			
	All	Female	Male	Young	Old
	(1)	(2)	(3)	(4)	(5)
WORKING CONDITIONS					
Teacher hours per pupil	−0.0175	−0.0132	−0.0283	−0.0135	−0.0211
	(0.0062)***	(0.0074)*	(0.0114)**	(0.0073)*	(0.0109)*
Minority students	−0.0132	−0.0182	−0.0007	−0.0186	−0.0045
	(0.0130)	(0.0162)	(0.0206)	(0.0145)	(0.0246)
Special need students	0.0176	0.0281	−0.0016	0.0206	0.0088
	(0.0193)	(0.0240)	(0.0322)	(0.0229)	(0.0339)
Pupil	0.0120	0.0149	0.0069	0.0116	0.0113
	(0.0063)*	(0.0077)*	(0.0107)	(0.0074)	(0.0109)
$Pupil^2/1000$	−0.0191	−0.0204	−0.0175	−0.0211	−0.0150
Workload	0.2099	0.2197	0.1784	0.1421	0.3045
	(0.0084)***	(0.0094)***	(0.0183)***	(0.0101)***	(0.0139)***
Permanent position	0.4442	0.5428	0.2621	0.5153	0.7545
	(0.2367)*	(0.2986)*	(0.3744)	(0.2424)**	(0.7543)
N teachers	22,234	15,411	6,823	13,364	8,870
N observations	106,644	74,084	32,560	63,010	43,634

Note: see table 3. The effects of the remaining individual control variables are not reported in any tables.

6 Robustness checks

A relevant question that arises when studying sickness absence is to what extent the effects are driven by the composition of the labor force (Askildsen et al., 2005; Araj and Thoursie, 2005). In periods with excess demand for labor, marginal workers will be employed to a larger degree, and these workers are expected to have higher sickness rates on average due to poorer health. Similarly, the same type of workers may also be the first ones to leave when the labor market gets slacker again.

With respect to teachers, the teaching staff is a function of the school size and also the student composition. The demand for teachers automatically increases if school size increases. Schools are in need for extra teachers if the student composition worsen. It can neither be ruled out that teachers leave the school sector for a job in other sectors, especially in periods when the labor market is tight. In order to check whether our results are driven by variation in the composition of the teaching staff from year to year, I restrict the sample to teachers who are present in the whole sample period (stable worker sample).[14] The results are presented in Table 6. The effects of all variables are basically unchanged compared to the whole sample, but note that the effect of teacher hours becomes clearer. The only exception is being on a permanent employment contract which has now a smaller effect, although it is still positive and mainly significant at the 10 percent level. This suggest that teachers opting in and out of the education sector account for a large part of the positive effect of this variable derived in earlier tables.

7 Discussion and conclusion

In order to reduce the amount of sickness absence it is necessary to accumulate knowledge about possible sources that explain variation in sickness absence.

Using longitudinal register data on teachers sickness absence linked to school and individual characteristics, this paper studies the effect of workplace characteristics on the amount of medical reported sickness absence among teachers in public primary and lower secondary school in Norway. The findings suggest that teachers lower their amount of sickness absence when the school's resource use increases. I also find evidence that increased workload and having a permanent employment contract are associated with higher absence. Moreover, old teachers appear to be more sensitive to changes in workload than young teachers. All results are derived from specifications where variation within teachers who have not changed schools is

[14] Average sickness absence for the stable worker sample is 4.76. This is 1.23 percentage points lower compared to the whole sample. The standard deviation is 12.03.

used to identify the effects.

To what extent we should be concerned about teacher absence depends on its influence on students outcome. This is a question which so far has been (almost) neglected in the literature and more research on his field is therefore highly demanded.

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A Appendix

Table A1: Table 3 cont'd

	OLS (1)	FE (2)
INDIVIDUAL CONTROL VARIABLES		
Male teacher	−2.3459	
	(0.0734)***	
Age	6.4526	
	(0.7519)***	
Age^2	−0.2098	0.4674
	(0.0277)***	(0.0838)***
Age^3	0.0029	−0.0091
	(0.0004)***	(0.0013)***
$Age^4/1000$	−0.0136	0.0622
	(0.0026)***	(0.0075)***
Number of children	−0.3394	−2.7057
	(0.0450)***	(0.2326)***
Child(ren) $<=$ 12 year(s)	0.7036	0.3210
	(0.0954)***	(0.2048)
Salary (NOK)/1000	−0.1433	−0.1697
	(0.0155)***	(0.0556)***
Education (ref = Unqualified)		
- Bachelor	0.1840	−0.2720
	(0.1922)	(0.8150)
- Master or PhD	−0.0417	−2.8499
	(0.2563)	(1.3715)**
Marital status (ref = Unmarried)		
- Married	0.4067	2.4455
	(0.1061)***	(0.3669)***
- Widow/widower	0.3032	−10.2182
	(0.3577)	(1.2490)***
- Divorced/separated	2.6415	1.2082
	(0.1604)***	(0.5322)**

Note: See table 3

Table A2: Table 4 cont'd

	Female (2)	Male (3)	Young (4)	Old (5)
INDIVIDUAL CONTROL VARIABLES				
Age^2	0.3669	0.8791	−0.0083	−19.0954
	(0.1003)***	(0.1540)***	(0.1829)	(6.0842)***
Age^3	−0.0079	−0.0144	−0.0014	0.2103
	(0.0016)***	(0.0024)***	(0.0032)	(0.0709)***
$Age^4/1000$	0.0568	0.0874	0.0163	−0.8558
	(0.0091)***	(0.0137)***	(0.0208)	(0.3092)***
Number of children	−4.1323	0.0600	−2.9359	−3.7072
	(0.3385)***	(0.2564)	(0.2357)***	(1.5431)**
Child(ren) $<=$ 12 year(s)	0.6982	−0.3896	0.5080	0.3269
	(0.2608)***	(0.3160)	(0.2186)**	(0.6277)
Salary (NOK)/1000	−0.1609	−0.1969	−0.1847	−0.1894
	(0.0692)**	(0.0929)**	(0.0592)***	(0.1173)
Education (ref = Unqualified)				
- Bachelor	−0.6071	0.4665	0.0719	0.2517
	(0.9485)	(1.4571)	(0.8327)	(1.6077)
- Master or PhD	−4.3810	0.3639	−2.4591	−2.1009
	(1.6847)***	(2.2811)	(1.4247)*	(3.3410)
Marital status (ref = Unmarried)				
- Married	3.4397	0.4233	2.3442	5.5363
	(0.4848)***	(0.4864)	(0.3692)***	(2.5855)**
- Widow/widower	−9.8520	−8.7715	−11.5517	−6.7296
	(1.4229)***	(2.5753)***	(2.6127)***	(2.9027)**
- Divorced/separated	1.5454	0.9771	1.1929	4.0576
	(0.6612)**	(0.8887)	(0.5527)**	(2.7598)

Note: see table 3.

B

Returadresse:
Statistisk sentralbyrå
NO-2225 Kongsvinger

Statistics Norway

Oslo:
PO Box 8131 Dept
NO-0033 Oslo
Telephone: + 47 21 09 00 00
Telefax: + 47 21 09 00 40

Kongsvinger:
NO-2225 Kongsvinger
Telephone: + 47 62 88 50 00
Telefax: + 47 62 88 50 30

E-mail: ssb@ssb.no
Internet: www.ssb.no

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