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Does Raising the School Leaving Age Reduce Teacher Effort? A Note from a Policy Experiment

Colin Green and Maria Navarro Paniagua

The Department of Economics
Lancaster University Management School
Lancaster LA1 4YX
UK

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Abstract

This paper examines the impact of an increase in the school leaving age on high school teachers' absence behaviour. We estimate difference in difference models of absenteeism using count data approaches. Employing data from the Spanish Labour Force Survey, our findings suggest that high school teachers reduced their effort due to the reform that raised the age of compulsory education commencing in the academic year 1998-1999 in Spain. In particular, they take 15% more sickness absence in the posttreatment period. This result should be of interest to both policy makers and researchers who rely upon compulsory school law changes as a source of exogenous variation in educational attainment.

KEY WORDS: Absenteeism, Compulsory Schooling Laws, Count data, Teachers
JEL Classification: J22, J38.

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I. Introduction

Raising the compulsory school leaving age (henceforth RoSLA) is a key policy instrument used to increase minimum educational attainment levels. At the same time, RoSLA has been widely used in the literature on returns to education as a source of exogenous variation in years of schooling/educational levels (see for instance Harmon and Walker (1995) for the UK, Pischke and von Wachter (2008) for Germany and Pons and Gonzalo (2002) who use the 1970 RoSLA in Spain).

However, teachers who take classes in the 'affected' years of schooling are unlikely to be indifferent to this policy change.[1] Increasing the compulsory schooling age increases the number of students in those years, but also changes the distribution of ability and motivation of students that teachers have to instruct. For instance, teachers at the latter part of compulsory secondary school will now have lower ability students and/or those with less interest in formal schooling in their class, along with those students who would have voluntarily chosen post-compulsory schooling in the absence of the legislative change. Teaching (and managing) these students is likely to be more difficult. In the absence of compensating differentials it is difficult to imagine that this will not affect teacher motivation and effort.[2]

This paper is the first to our knowledge that investigates this motivational effect of compulsory schooling laws on teachers. Specifically, we examine the impact of the increase in the school leaving age that occurred in Spain in the academic year 1998-1999 on one element of high school teacher behaviour,

[1] i.e. teaching previously non-compulsory years of schooling that became mandatory.

[2] And to our knowledge generally and in the particular case we examine, compulsory schooling changes were not introduced with an increase in salary or conditions to high school teachers.

absenteeism. Employing Spanish labour force survey data that covers the relevant policy reform period we estimate difference in difference models of absenteeism using count data approaches. We demonstrate that raising the compulsory schooling age lead to an increase in teacher absenteeism. This is a matter of concern as previous research has demonstrated a negative causal effect of teacher absence on student achievement (Duflo, Hanna, and Ryan, 2007; Miller, Murnane, and Willett, 2007, 2008; Clotfelter, Ladd, and Vigdor, 2009). This may be the result of absent teachers being replaced by less qualified substitutes and/or the disruption inherent in the use of replacement teachers. Critically, the negative impact of teacher absenteeism appears to be larger for students from lower socioeconomic backgrounds (Clotfelter, Ladd, and Vigdor, 2009).

This leads to a concern that increasing the compulsory school leaving age may decrease the quality of educational provision in the affected years. In this paper we demonstrate a causal effect of the most recent RoSLA in Spain on teacher absenteeism. This result should be of concern to both policy makers and researchers who use RoSLA to instrument educational attainment.

II. Data

The policy reform examined consisted of an extension of free, compulsory and comprehensive education from 14 to 16 years old.[3] Specifically, from the last quarter of 1998, students that otherwise would have dropped out (were the previous academic year in the last year of compulsory schooling) were obliged to stay two more years at school. This leads to compulsory

[3] Specifically the "*Ley de Ordenación General del Sistema Educativo , 1990 (LOGSE)*" (General Regulation of the Education System of 1990).

education comprising a total of 10 years, divided into two educational levels: Primary education (6 to 12 years old) and lower Secondary Education that it is ordinarily completed from the ages of 12 to 16 years old.[4] In Spain, compulsory and post compulsory secondary education teachers must have a university degree, only teach subjects of their field of specialisation and most of them are civil servants who attained their post through state or regionally competitive exams.

The data we use is drawn from the quarterly Spanish Labour Force Survey (SLFS). We select a sample of full-time employees in the period spanning 1^{st} quarter of 1996 to 4^{th} quarter of 2004. Self-employed workers are excluded. The full sample consists of about 988,329 workers, 2.57% of them are high school teachers.[5] To test the robustness of our results we use a number of sub-samples. This includes dropping the vacation period (third quarter of the year surveys) as teachers have more summer holidays. Furthermore, to ensure that the timing of other holidays are not generating our results, we estimate our models on two successively more restrictive samples. The first is workers in the education industry only and in the second we only include primary and secondary school teachers. These latter two groups have essentially identical holiday schedules and provisions. Importantly our key results are robust to the choice of these samples. The second sample contains 63,062 workers in the education sector, and the third sample is comprised of 49,106 primary and secondary school teachers.

(Insert Table 1)

[4] Although students can stay in school until they are 18 (or 21 in the case of pupils with special education needs).

[5] We are able to identify high school teachers in our data as we have available three digit dissagregation of occupations (ISCO).

We use information on the hours of absence per week reported as due to sickness to generate our dependent variable.[6] We calculate this variable as the difference between usual hours and actual hours for those that report the reason of any difference between them as due to sickness.[7] We appreciate that using sickness absence only may be quite restrictive. In unreported estimates our main results are robust to using more broad definitions where we include differences in usual and actual hours due to other forms of absence including personal/family responsibilities, bad weather, summer schedule/flexible hours and 'other reasons'.

(Insert Figure 1)

A range of control variables are available in the SLFS. We use gender, age, age squared, marital status, education, public sector, industry dummies, occupation dummies and size of the firm/establishment. We also control for year, quarter and Regional (CCAA) fixed effects so as to take into account regional differences.[8]

[6] The Spanish Labour Force Survey has been demonstrated to have an internationally consistent definition of absence (Barmby, Ercolani, and Treble, 2002).

[7] We consider usual hours as synonymous with contractual hours. This is similar in spirit to the approach used in previous research such as Hamermesh, Myers, and Pocock (2008) and Lozano (2009).

[8] Such as wage differences and unemployment rates due to different industrial structures within regions and patterns of morbidity.

III. Methodology

In our baseline model, workers' minutes of absence per week can be specified as follows:

$$\text{Absm}_{it} = \phi + \delta\text{RoSLA}_{it} + \gamma\beta\text{HST}_i + \beta\text{RoSLA}_{it} \times \text{HST}_i + \alpha\text{X}_i + \varepsilon_i, \quad (1)$$
$$i = 1, \ldots, 988, 329 \quad \text{and} \quad t = 1996\text{Q1}, \ldots, 2004\text{Q4}$$

where Absm_{it} corresponds to the minutes of absence of worker i in the period t. RoSLA_{it} is an indicator that takes value of unity if the worker is observed during the reform period. HST_i is a dummy variable that equals one if the worker is a high school teacher and 0 otherwise. And the interaction term $\text{RoSLA}_{it} \times \text{HST}_i$ equals one for treated individuals (HSTeachers) in the posttreatment period (after the RoSLA was implemented). The OLS estimate of β is equivalent to the Differences-in-Differences (DID) estimator and thus provides the absence caused by the reform for the treated group (i.e. the absence caused by the RoSLA for secondary school teachers) (Cameron and Trivedi, 2005, pp. 890-891).

Our dependent variable, minutes of absence, is a count variable. Moreover, there is an excess of zero outcomes. This could occur during the reference week both if (i) the worker/teacher never gets sick and doesn't skip work during the reference week but could have been absent in case of illness (sampling zeros). (ii) The worker/teacher always goes to work due to commitment and motivation despite of illness (structural zeros). As a result we estimate zero-inflated models that allow for these excessive number of zeroes in addition to overdispersion.[9] Importantly, zero-inflated models permit the

[9]See for instance (Delgado and Kniesner, 1997) who estimate worker absences due to

zero absence of teachers to be explained in a different manner than that of those workers that are absent for more than zero hours. It combines a count density with a binary process in such a way that a binary model is estimated to predict, with probability ψ_i, whether a worker will always have a zero count (i.e. type ii above). Then, a count model (Poisson or negative binomial) chosen with probability $1-\psi_i$ is generated to predict the counts for those who will not always have a zero count (type i).

Then Absm_i has a zero-inflated distribution given by Long (1997, pp. 242-250). For robustness we use both Zero Inflated Poisson and Zero Inflated Negative Binomial approaches:

$$\Pr(\text{Absm}_i = k|x_i, z_i) = \begin{cases} f_1(0) + (1-f_1(0))f_2(0) & \text{if k=0} \\ (1-f_1(0))f_2(k) & \text{if } k \geqslant 1 \end{cases} \tag{2}$$

Zero Inflated Poisson (ZIP):

$$\begin{aligned} \Pr(\text{Absm}_i = 0|x_i, z_i) &= \psi_i + (1-\psi_i)e^{-\mu_i} \\ \Pr(\text{Absm}_i = k|x_i) &= (1-\psi_i)\frac{e^{-\mu_i}\mu_i^k}{k!} \end{aligned} \tag{3}$$

Zero Inflated Negative Binomial (ZINB):

$$\Pr(\text{Absm}_i = 0|x_i, z_i) = \psi_i + (1-\psi_i)(\frac{\alpha^{-1}}{\alpha^{-1}+\mu_i})^{\alpha^{-1}}$$

$$\Pr(\text{Absm}_i = k|x_i) = (1-\psi_i)\frac{\Gamma(\alpha^{-1}+k)}{\Gamma(\alpha^{-1})k!}(\frac{\alpha^{-1}}{\alpha^{-1}+\mu_i})^{\alpha^{-1}}(\frac{\mu_i}{\mu_i+\alpha^{-1}})^k \tag{4}$$

illness using count model methods.

IV. Results

Table 2 presents estimates of the effect of RoSLA on high school teacher absence behaviour. Two sets of estimates are reported for the ZIP and ZINB models, respectively. The Vuong test (reported in each of the tables) suggests that our zero-inflated models are a significant improvement over standard Poisson or Negative Binomial models. For both models the policy effect dummy (RoSLA $\times$ HSTeacher) demonstrates a statistically significant increase in high school teacher absenteeism as a result of the RoSLA. Coefficient estimates from count data models can be difficult to interpret so we also present the incident rate ratio (IRR) or exponentiated coefficient $e^{\hat{\beta}}$. Thus, an IRR greater than one indicates that the expected count in the exposed group is greater than the expected count in the unexposed group. These demonstrate that the effect of the policy was to increase the count of absence of teachers by 15% (IRR=1.15).

(Insert Table 2)

Comparing high school teacher absence behaviour and that of all other workers may be too broad and may induce measurement error. For instance, there may be unobserved changes to the incentives for worker absence occurring for other occupations / industries during the same period. Alternatively, there may be some unobserved shock to teachers absence that coincides with the policy change. These may serve to bias our estimates of the policy effect in some unknown way. To mitigate this problem we examine two successively more restrictive sub-samples of workers. First, we restrict our estimates to only those workers in the education sector, this should eliminate the possibility of bias originating from unobserved changes in absence incentives in other industries. In the second sample we compare primary and high school teachers only. This has the added advantage that these workers face a very similar holiday structure and leave timing. The cost of these robustness checks are decreased sample size and potentially less precise estimates.

(Insert Table 3)

Table 3 reports the estimates for these two sub-samples, where for brevity we only report the key policy variable estimates. Again these estimates reveal that the change in compulsory schooling laws lead to an increase in teacher absence. Moreover, restricting our sample leads to an increase in the magnitude of this effect to 20%, suggesting that our earlier estimates were biased downwards.

(Insert Table 4)

As a final robustness check, we re-estimate our models excluding the summer quarter of the SLFS. This is done for two reasons, first the bulk of school holidays occur in the summer quarter hence the opportunity (or need) for teachers to take sickness absence in this quarter are diminished. Second, it has been suggested that increases in temperature are generally associated with increases in absence (Connolly, 2008). Estimates of these further restricted models are reported in Table 4. The pattern of these estimates largely follow those reported in Tables 2 and 3, although the policy estimates for the full sample just misses statistical significance at standard levels. Together the results in tables 3 and 4 suggest that our estimated impact of RoSLA on teacher absence is not being driven by unobserved variations in holiday availabilty/timing or unobserved shocks to the absenteeism of teachers.

V. Conclusions

Raising the compulsory school leaving age is seen as a key instrument for increasing basic education levels within society. At the same time, it has been relied upon by many researchers as a source of exogenous variation in educational attainment in econometric studies of the returns to education. In this paper we asked the question, how do teachers react to the changes in teaching environment implicitly created by retaining students at school who would have otherwise left? Specifically, we focus on one potential response, changes in teacher absence behaviour.

We examined changes in high school teacher absence behaviour due to an increase in the school leaving age in Spain in the academic year 1998-1999. Using representative labour force data we demonstrated that teachers affected by this reform increased their absenteeism by 15%. Our interpretation of this result is that more onerous teacher environments lead to decreases in effort by high school teachers. This result is of importance for two related reasons. Given previous research that demonstrates a link between teacher absence and lower student performance, our result suggests that increasing the compulsory school leaving age has the potential to reduce educational quality. In turn, this suggests that researchers using RoSLA as an instrumental variable should consider its possible effects on educational 'quality'.

Finally, a policy recommendation that is derived from our work is that education authorities should consider the need for increased compensation or improved working conditions for teachers adversely affected by increasing the compulsory school leaving age.

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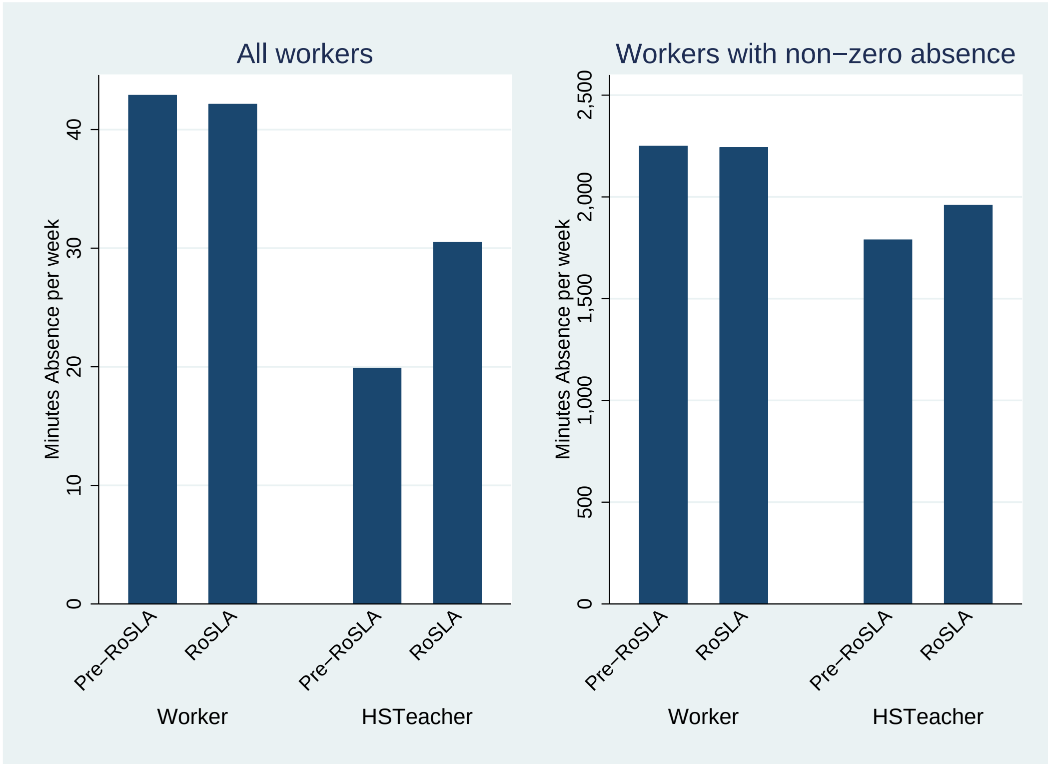

Figure 1: Minutes of absence for full-time workers before and after the reform

Table 1: Descriptive statistics

	All Workers	Education Workers	High/Primary School Teachers
Total Observations	988,329	63,062	49,106
Absence due to illness	18,349	922	785
	Excluding Summer Quarter		
Total Observations	742,458	47,876	37,321
Absence due to illness	14,012	800	690

Source: SLFS

Table 2: Changes in Compulsory Schooling Laws and Teacher Absenteeism, All workers, Spanish Labour Force Survey 1996-2004

	ZIP[a]	ZINB[b]
RoSLA × HSTeacher	0.140** (0.069)	0.141** (0.070)
	[1.150**]	[1.152**]
HSTeacher	-0.203*** (0.068)	-0.203*** (0.069)
	[0.817***]	[0.816***]
RoSLA	-0.048 (0.059)	-0.057 (0.062)
	[0.953]	[0.945]
Age	0.001 (0.001)	0.001 (0.001)
	[1.001]	[1.001]
Age^2	0.000 (0.001)	0.000 (0.001)
	[1.000]	[1.000]
Female	0.003 (0.003)	0.003 (0.004)
	[1.003]	[1.003]
Married	0.004 (0.003)	0.004 (0.003)
	[1.004]	[1.004]
Secondary Education	-0.009** (0.004)	-0.009** (0.004)
	[0.991**]	[0.991**]
Higher Education	-0.004 (0.005)	-0.004 (0.005)
	[0.996]	[0.996]
Public Sector	-0.027*** (0.004)	-0.027*** (0.004)
	[0.974***]	[0.974***]
Establishment size: workers 0-5	-0.019*** (0.007)	-0.018*** (0.007)
	[0.981***]	[0.982***]
workers 6-10	0.001 (0.006)	0.002 (0.006)
	[1.001]	[1.002]
workers 11-19	0.007 (0.005)	0.008 (0.005)
	[1.007]	[1.008]
workers ⩾ 50	0.004 (0.004)	0.004 (0.004)
	[1.004]	[1.004]
Observations	988329	988329
Vuong test	1225.01	-2.60
p-value	0.0000	0.9953

Note: *, ** and *** indicate statistical significance at the 10%, the 5 % and the 1% levels, respectively. Controls for industry, workers' occupation, region, year and quarter are included but not reported. [a] Zero Inflated Poisson. [b] Zero Inflated Negative Binomial. Robust standard errors are in parentheses. IRR are in brackets.

Table 3: Changes in Compulsory Schooling Laws and Teacher Absenteeism, Alternative Sub-Samples

	ZIP[a]		ZINB[b]	
	Education Workers	High / Primary School Teachers	Education Workers	High / Primary School Teachers
RoSLA × HSTeacher	0.181** (0.072)	0.182* (0.108)	0.189** (0.075)	0.190* (0.107)
	[1.198**]	[1.199*]	[1.208**]	[1.209*]
HSTeacher	-0.181** (0.071)	-0.164 (0.108)	-0.187** (0.074)	-0.169 (0.106)
	[0.835**]	[0.849]	[0.829**]	[0.845]
RoSLA	-0.169** (0.071)	-0.176 (0.136)	-0.174** (0.076)	-0.182 (0.136)
	[0.845**]	[0.838]	[0.840**]	[0.834]
Observations	63062	49106	63062	49106
Vuong test	327.47	285.21	3.04	2.89
p-value	0.0000	0.0000	0.0012	0.0019

Note: *, ** and *** indicate statistical significance at the 10%, the 5 % and the 1% levels, respectively. All other controls as in Table 2. [a] Zero Inflated Poisson. [b] Zero Inflated Negative Binomial. Robust standard errors are in parentheses. IRR are in brackets.

Table 4: Changes in Compulsory Schooling Laws and Teacher Absenteeism, Excluding Summer Quarter

	ZIP[a]			ZINB[b]		
	All Workers	Education Workers	High / Primary School Teachers	All Workers	Education Workers	High / Primary School Teachers
RoSLA × HSTeacher	0.105 (0.071)	0.166** (0.077)	0.183* (0.109)	0.106 (0.072)	0.171** (0.081)	0.189* (0.113)
	[1.111]	[1.180**]	[1.201*]	[1.111]	[1.187**]	[1.208*]
HSTeacher	-0.168** (0.070)	-0.159** (0.076)	-0.164 (0.109)	-0.169** (0.071)	-0.163** (0.079)	-0.167 (0.112)
	[0.845**]	[0.853**]	[0.849]	[0.845**]	[0.850**]	[0.846]
RoSLA	-0.031 (0.067)	-0.169* (0.087)	-0.188 (0.142)	-0.041 (0.070)	-0.174* (0.092)	-0.192 (0.145)
	[0.969]	[0.844**]	[0.829]	[0.960]	[0.840*]	[0.825]
Observations	742458	47876	37321	742458	47876	37321
Vuong test	1062.48	311.04	285.16	-1.95	3.10	3.05
p-value	0.0000	0.0000	0.0000	0.9743	0.0010	0.0012

Note: *, ** and *** indicate statistical significance at the 10%, the 5 % and the 1% levels, respectively. All other controls as in Table 2. [a] Zero Inflated Poisson. [b] Zero Inflated Negative Binomial. Robust standard errors are in parentheses. IRR are in brackets.