



Teacher pay and school productivity: Exploiting wage regulation



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ABSTRACT

The impact of teacher pay on school productivity is a central concern for governments worldwide, yet evidence is mixed. In this paper we exploit a feature of teacher labour markets to determine the impact of teacher wages. Teacher wages are commonly set in a manner that results in flat wages across heterogeneous labour markets. This creates an exogenous gap between the outside labour market and inside (regulated) wage for teachers. We use the centralised wage regulation of teachers in England to examine the effect of pay on school performance. We use data on over 3000 schools containing around 200,000 teachers who educate around half a million children per year. We find that teachers respond to pay. A ten percent shock to the wage gap between local labour market and teacher wages results in an average loss of around 2% in average school performance in the key exams taken at the end of compulsory schooling in England.

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The importance of education means teacher productivity, and the effect of pay on teacher performance, is a central concern for governments worldwide. However, evidence on the subject is mixed (Hanushek, 2003; Hanushek, 1997). One reason for this is the difficulty in identifying the true impact of teacher pay on performance due to the endogeneity of teacher wages. Further, while experiments investigating the impact of performance pay for teachers have been plentiful (e.g. Woessmann, 2011), experimental evidence on the impact of teacher pay levels is extremely limited. Instead, one must resort to exploiting natural experiments in order to identify the impact.

One feature common to many teacher labour markets is the use of wage setting at a higher spatial level than the school. While such mechanisms avoid the cost of negotiation at school or district level, they also have an effect on the wage structure for teachers, flattening teacher wages across heterogeneous labour markets so the variation that exists does not fully reflect the wage differentials in the external labour markets in which teachers are employed (e.g. Duncombe and Yinger, 1998). The consequence is that teacher wages will be relatively worse in areas where local labour market wages are high: effectively the wage setting sets a ceiling on teacher pay. If pay matters for teaching, teacher output will be lower where the wage ceiling bites harder. We use this insight to test the effect of teacher pay on school performance. Our research design exploits the centralised pay setting of over 200,000 teachers who teach around half a million children each year in the

English public (state) school system and a national system of pupil testing and assessment of school quality.

In England pay for teachers is set by a central review body that sets pay scales in which there is very limited regional variation.¹ However, as regional pay differences are considerable in the private sector even after controlling for human capital characteristics and other factors (Bulman, 2002) this creates a gap between local labour market wages and the regulated wages paid to teachers. We use this to examine the effect of exogenous local wage shocks on the quality of schooling in all public (state) secondary (equivalent to US middle and high) schools. Our primary measures of performance are based on the performance of pupils in the high stakes exams taken at the end of compulsory schooling. We complement this by examining quality as measured by in-depth assessments made by the national school regulatory body. We use a data source on pupil performance that allows us to control for the initial ability of the school intake, time varying attributes of the school body and time constant pupil, family and neighbourhood characteristics that may affect levels of attainment independently of teacher effort. We examine some of the potential pathways by which wages may result in greater pupil attainment including the cross-sectional

¹ Collective wage setting is a feature of many education systems. For example, in the USA, as of 1988, all but seven states had passed a law either allowing for the right of teachers to bargain collectively or explicitly requiring districts to bargain with teachers' unions (Lovenheim, 2009). Wages are also centrally negotiated between the state or national government and the teaching unions in many European countries (Galgóczi and Glassner, 2008).

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relationship between teacher tenure and outside wages and seek to rule out that our findings are explained by pupil and parental, rather than teacher, responses to wage shocks.

We find a ten per cent shock to the gap between the local average outside wage and the teacher wage results in an average loss of about 2% in the high-stake exams taken at the end of secondary school and a 5% loss in a key metric by which schools are assessed by the regulator, the public and the government. The loss is greater in schools that are located in areas where the ceiling bites harder and for schools that have no control over the employment conditions of teachers. We find that a measure of teaching quality from inspections by the national school regulator is lower where wage shocks are higher and that higher outside wages are associated with lower lengths of tenure. The results are robust to a wide range of specification tests, and to alternative explanations relating to other channels through which the outside wage might affect pupils' performance.

Our paper contributes to the large body of evidence on school performance and the teacher labour market. There is the large and growing literature on the impact of teacher pay on school performance. Research on the effect of teacher salaries on school level pupil outcomes initially suggested that this was mixed. For example, [Hanushek, 2003](#), reports that only 20% of 119 estimates found a positive effect of teacher wages on school performance. But later research has found more response to wages. For example, for the USA, [Loeb and Page, 2000](#), find teacher wages to be a significant determinant of pupil outcomes, estimating that a 10% increase in teacher wages would reduce dropout rates in the US by between 3 and 6%, while [Hendricks, 2014](#), finds that paying teachers more improves student achievement through higher retention rates. [Dolton and Marcenaro-Gutierrez, 2011](#), finds both relative and absolute levels of teacher salaries exert an important influence on pupil performance using data on 39 countries. Another focus has been the impact of teacher pay on the labour supply of teachers, including entry, duration of teaching, mobility of teachers and teacher absenteeism. Examples include [Murnane and Olsen, 1990](#); [Dolton, 1990, 2006](#); [Dolton and van der Klaauw, 1995](#); [Figlio, 1997](#); [Barr and Zeitlin, 2010](#) and [Leigh, 2012](#). All of these find an effect, though [Hanushek and Rivkin, 2006](#), stress that teacher responses to alternative wages may be muted compared to other workers. A separate strand in the education literature examines the effect of differences in the educational cost across areas on performance from the USA. This research makes the point that centrally determined financing formulae, intended to help equalise finances between areas have differential ability to raise funds (e.g. [Duncombe and Yinger, 1998](#); [Hoxby, 2001](#)), may also have unintended consequences, for example on student performance (e.g. [Duncombe and Yinger, 2011](#); [Eom et al., 2007](#)) and teacher attrition ([Ondrich et al., 2008](#)).

More generally, labour economists have long been interested in the impact of labour market changes on firm performance. Theories of “efficiency wages”, for example, suggest that improvements in the labour market outside the firm's boundaries could lead to decreased productivity within a firm because there may be more shirking ([Shapiro and Stiglitz, 1984](#)), a loss of high quality workers ([Weiss, 1980](#)) or perceptions of inequity (e.g. [Akerlof, 1982](#); [Mas, 2006](#)). It is difficult to test these ideas in an unregulated labour market. Where pay is set by regulation, however, there is a wedge between inside and outside wages that enables identification of the impact of external labour markets on firm outcomes. So we can effectively use regulation to generate exogenous variation in factor prices. In this design, two papers are antecedents to ours. The first is [Cappelli and Chauvin, 1991](#), who show that higher outside wages increase shirking in a US auto manufacturer. Like our paper, the authors exploit the fact that the union contract stipulates the same pay rates across diverse metropolitan areas. But their sample is small and is a cross section of 78 plants, whereas we have a much larger panel of around 3000 schools. The second, and closest, paper is [Propper and van Reenen, 2010](#), who examine the impact of centralised wage regulation for nurses on death rates following emergency admissions for heart attacks to English hospitals between 1996

and 2005. They find that the aggregate death rate rises due to the regulation and that removal of centralised wage setting would have positive welfare consequences. Our paper complements theirs by focusing on another key part of state provision: the education of around 3 million of England's children per annum.

The remainder of the paper is as follows. [Section 1](#) outlines the institutional background of education in the UK, [Section 2](#) provides information on the data used and [Section 3](#) discusses the methodology. The results and a range of robustness checks are given in [Section 4](#). [Section 5](#) studies potential mechanisms through which the outside wage could operate. [Section 6](#) presents a simple calculation of the potential gains from removing wage regulation and [Section 7](#) offers concluding comments.

1. Institutional background

Education in England is compulsory between the ages of five and sixteen. While children can be educated privately, the public (state) system dominates. State sector pupils attend primary school from age five to eleven and secondary school from age eleven to sixteen. Pupils can then stay on for a further 2 years to get qualifications that allow them to undertake university level education. In 2007 approximately three million young people (around 84% of eleven to sixteen year olds) were attending public secondary schools. In each secondary school there are five (or seven if the school provides education up to 18) separate age cohorts within the school at any one time.

Pupils take nationally set exams at four points during their ages of compulsory school attendance. At primary school these are Key Stage 1 (KS1) at age 7 and Key Stage 2 (KS2) at age 11 (the year of exit), in Mathematics, English and Science. In secondary schools these are Key Stage 3 (KS3) exams at age 14 in Maths, English and Science and Key Stage 4 (KS4) examinations in multiple subjects (typically between eight and twelve) at the end of compulsory schooling at age 16. We focus on KS4 (GCSE) examinations as our measure of school performance as these are high stake examinations. For pupils they determine progress into education after age of 16, as a minimum of five pass grades required to continue on to further education, are used by parents to choose secondary schools for their children, by the media to rank school performance to create school ‘league tables’ and by local and central government to identify ‘failing schools’.

Schools in England are heavily regulated by central and local government. Summary statistics on school performance have been published annually since the early 1990's. The key measure used to compare schools has been the number of pupils attaining at least 5 good grades in the KS4 exams (known as 5 A*-C GCSEs), though the number of metrics published increased during the mid- and late 2000's. In addition, in-depth assessments of the quality of the school are undertaken by the schools regulator, OFSTED. Each school is inspected roughly every five years. Inspections often last several days. On the basis of these site visits, OFSTED publishes a report rating the school's performance on numerous dimensions, including an overall rating of the school and an assessment of teaching and learning at the school. More details on these metrics are provided below in [Section 3.1](#).

1.1. Teacher pay in England

Teacher wages are set by Local Education Authorities (LEAs) based on guidelines issued by the national Government Department for Education.² Despite the existence of four pay bands (‘Inner London’, ‘Outer London’, ‘The Fringe’ and ‘The rest of England’), teacher wages have exhibited very little regional variation relative to private sector wages since the early 1970's. For example, the average teacher wage

² LEAs are geographically coterminous with the primary and larger units of local government, the Local Authority (LA). We use the term LEA when discussing education/school issues and data and LA when discussing data available at this level.

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