Uncompensated Long Hours in the Public Sector: Sign of Altruism or Cause of Burnout?

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Abstract

This paper presents a theoretical model in which some public sector employees are intrinsically motivated to supply effort above the level stipulated by their contract, while others have low productivity and require high effort to maintain the minimally required level of output. In this setting, high levels of effort can be indicative of either altruism or low productivity. Because intrinsically motivated employees derive higher utility from working in the public sector, they are less likely to exit it. Over time, selection makes high levels of effort more strongly predictive of altruism than of low ability. Focusing on the market for public school teachers where I define effort as working hours, I show that at very low levels of experience, there is little or no relationship between weekly hours and the probability of remaining in teaching. The correlation becomes more positive as teaching experience increases. In addition, I use subjective survey questions designed to measure teacher motivation to show that long weekly hours become more strongly predictive of motivation, in addition to retention, over time.

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1 Introduction

Whereas the long-term implications of supplying long hours in the private sector have been analyzed in a number of studies, not much is known about the labor supply decisions and subsequent career outcomes of nonprofit workers. Pro-social motivation seems to drive some employees in the public sector to donate hours or effort. This general trend has been analyzed theoretically (Delfgaauw and Dur 2008) and documented empirically (Gregg, Grout, Ratcliffe, Smith and Windmeijer 2011); Rebitzer and Taylor (2011) provide further review of the related literature.

I examine in this study labor supply in the nonprofit sector in the context of the labor market for public school teachers. In addition to this being an occupation with high potential for pro-social motivation, it is also one where understanding how to recruit and retain motivated and effective workers is particularly important (e.g. Stinebrickner 2002). The teacher labor market is large, and salary schedules are mostly fixed meaning that there is little monetary payoff to high effort and long working hours.[1] Yet, during the school year teachers report working hours similar to those for college educated workers in other occupations that are more likely to offer monetary rewards for higher levels of labor supply (Drago, Caplan, Costanza, Brubaker, Cloud, Harris, Kashlan and Riggs 1999, Stoddard and Kuhn 2008). Stress and burnout are recognized as common problems among teachers (Greenberg, Brown and Abenavoli 2016) and may have negative impact on student achievement (Arens and Morin 2016).

This paper attempts to reconcile the low level of incentive pay in teaching with the observed high levels of effort among some workers in this occupation. I present a theoretical model in which some public sector employees are intrinsically motivated to supply effort above the level stipulated by their contract, while others have low productivity and require

[1] Podgursky (2011) offers an overview of teacher compensation practices in the U.S.

high effort to maintain the minimally required level of output. In this setting, high levels of effort can be indicative of one of two things: altruism or low productivity. Because intrinsically motivated employees derive higher utility from working in the public sector, they are less likely to leave. Over time, high levels of effort become more strongly predictive of altruism than of low ability. Defining effort as working hours, I show empirical evidence consistent with this model.

The theoretical framework is contingent on the assumption that immediate monetary rewards or longer-term career concerns are not a compelling reason for teachers to supply long working hours. Using data from the Census and American Community Survey (ACS), I show that the elasticity of annual earnings with respect to weekly hours is close to zero for teachers and is orders of magnitude lower than the elasticity for professional occupations in the for-profit sector. Using data from three waves of the Schools and Staffing Survey (SASS) conducted by the National Center for Education Statistics, which surveys teachers from a nationally representative sample of schools, I show that at very low levels of experience the observed relationship between weekly hours and the probability of remaining in teaching is on average close to zero, but the correlation becomes more positive as teaching experience increases. I also use subjective survey questions designed to measure teacher motivation to show that long weekly hours become more strongly predictive of motivation, in addition to retention, over time.

While a number of recent studies have examined the relationship between incentive pay and teacher effort,[2] not much is known about the determinants of hours of work for teachers. Time diary data suggest that it is common for teachers to work additional hours in the evenings and on weekends (Drago et al. 1999, Krantz-Kent 2008). Stoddard and Kuhn

[2]See for example Jacob (2005), Podgursky and Springer (2007a), Podgursky and Springer (2007b), Atkinson, Burgess, Croxson, Gregg, Propper, Slater and Wilson (2009), Lavy (2009), Podgursky and Springer (2011), and Goodman and Turner (2013).

(2008) show that while teachers' average weekly work hours have risen steadily, there is no evidence that education reforms result in longer working hours, or the effect is very small. Hoxby (2002) demonstrates that teachers work more hours in schools located in areas with more school choices available to parents. Gershenson (2016) uses administrative data from North Carolina to show that teachers are absent fewer days when their school fails to make adequate yearly progress under the No Child Left Behind Act.

This paper also adds to the literature on teacher turnover. Previous research has demonstrated that potential earnings in other sectors play a role,[3] although more resent studies that rely on administrative data do not find strong support for the claim that nonteaching earnings have strong impact on teacher exits (Podgursky, Monroe and Watson 2004, Scafidi, Sjoquist and Stinebrickner 2005). Working conditions and satisfaction with teaching have also been found to be important determinants of teacher turnover (Ingersoll 2001, Hanushek, Kain and Rivkin 2004). The contribution of this study is to analyze the relationship between teacher motivation, working hours, and the probability of staying in the profession.

The following section presents the theoretical framework that motivates the empirical analysis. Sections 3 and 5.1 show further evidence, using data from the Census/ACS and SASS respectively, that annual earnings among teachers do not increase much, if at all, with hours. Section 4 provides more details about the SASS data, which I use in Section 5.2 to test the main predictions of the theory. Section 6 concludes.

2 Theoretical Framework

The labor market is comprised of a public and private sectors in this theoretical setup. I do not model workers' choices and outcomes in the private sector and for the sake of simplicity assume away heterogeneity in the private sector given that it is not essential for

[3]See for example Murnane and Olsen (1989, 1990) and Dolton and van der Klaauw (1995, 1999).

the predictions of the model. Workers are heterogeneous along two dimensions: productivity and intrinsic motivation in the public sector. A number of recent studies, such as Gaynor, Rebitzer and Taylor (2004), Heyes (2005), Besley and Ghatak (2005), Besley and Ghatak (2006), Prendergast (2007), and Delfgaauw and Dur (2008) have examined theoretically and empirically labor market implications of worker heterogeneity in intrinsic motivation. Productivity in the model is observed by employers, so there is no screening or signaling, but there is a minimum required level of output in the public sector that each worker has to produce.

All workers in the model start off as public sector employees. Output for worker i conditional on her level of effort e is verifiable and given by

$$q_i(e) = a_i e,$$

where q_i measures inherent ability or productivity. Wages in the public sector are fixed at $\tilde{w}$, and workers who produce output below the minimum required level $\bar{q}$ are laid off and receive unemployment utility below their reservation value. Some workers have public service motivation and derive utility from exerting effort in public sector jobs. Instantaneous utility in this sector is given by

$$U_i(e) = \tilde{w} + \gamma_i V(e) - C(e),$$

where $\gamma_i \geq 0$ and $V'(\cdot) > 0, V''(\cdot) \leq 0$.[4] The cost of exerting effort is the same for all workers, and the usual assumptions that $C'(\cdot) > 0$ and $C''(\cdot) > 0$ apply.

Similarly to Delfgaauw and Dur (2008), I assume that there are three types of workers in the population: regular (r), motivated (m), and low-productivity (l). It holds that $0 <$

[4]This utility function is in line with the idea of impure, or "warm-glow" altruism because individuals derive utility directly from their actions, not from the level of output they provide to society (Andreoni 1989, Francois and Vlassopoulos 2008). Because output in this model is directly related to effort, changing the utility function to reflect pure, or output-oriented altruism does not alter the predictions of the model.

$a_l < a_r = a_m$ and $0 = \gamma_l = \gamma_r < \gamma_m$. Workers know their type γ; output and thus a_i are observed by everyone. Without loss of generality, it is assumed that the share of workers of each type starts off being the same.

Regular and low-productivity workers produce $\bar{q}$ in public-sector jobs, exerting effort levels $e_r^* = \bar{q}/a_r$ and $e_l^* = \bar{q}/a_l$ respectively. Motivated workers in public sector jobs choose effort e_m^* such that $C'(e_m^*) = \gamma_m V'(e_m^*)$. Assuming that $e_m^* > \bar{q}/a_m$, motivated workers produce more than the minimum required output, even though there is no monetary reward for output above $\bar{q}$.[5] The corresponding value of a public-sector job for worker i is

$$V_i^* = \tilde{w} + \gamma_i V(e_i^*) - C(e_i^*).$$

It will be the case that $V_m^* > V_r^* > V_l^*$.

In this model, types m and l may both exert high levels of effort but for different reasons: effort increases utility for type m, while low-productivity workers need to exert higher effort than workers of type r in order to attain the minimum required level of output $\bar{q}$. The rest of this section assumes that $e_m^* = e_l^* = e_H$, which makes it impossible to distinguish between motivated and low-productivity workers based only on observed effort.

Workers remain in the public sector until they are laid off or until they choose to leave voluntarily. In each period t public sector employees receive an outside option worth $\overline{V}(t)$ drawn from a known common distribution $F_t(\cdot)$. Outside options include employment in the private sector, where motivation does not play a role, or time at home.[6] It is likely that the distribution of outside options changes over time; for example, outside options generally

[5] Rebitzer and Taylor (2011) show theoretical support for the idea that it may be beneficial for employers not to place explicit incentives on output even when it is easily observable in cases when a second valuable dimension of effort is difficult to observe and reward. In the context of the labor market for teachers, test scores are an observable dimension of output, while the second dimension of output may be students' noncognitive abilities.

[6] Stinebrickner (2002) for example shows that among female teachers age 32 or younger, exits to nonemployment are more common that occupation changes.

become more attractive as workers accumulate enough experience to be eligible for pension benefits. The key assumption here is that the distribution of outside offers at a given level of experience t is the same for all types of workers. To simplify the exposition, I assume that $F_t(\cdot)$ is stationary and denoted by $F(\cdot)$, which does not change the main predictions of the model.

The probability p_s of an individual of type s remaining in the public sector from period t to $t+1$ equals

$$p_s = F(\tilde{w} + \gamma_s V(e_s^*) - C(e_s^*)), \tag{1}$$

with $p_m > p_r > p_l$. The probability that a type-s worker is observed in the public sector after t periods, $P_s(t)$, is given by

$$P_s(t) = [F(\tilde{w} + \gamma_s V(e_s^*) - C(e_s^*))]^t. \tag{2}$$

Among public sector workers with t years of experience, the share of workers of type s is

$$R_s(t) = \frac{P_s(t)}{P_m(t) + P_r(t) + P_l(t)}.$$

Let $m(t)$ denote the probability that a worker with t years of experience is of type m conditional on the worker exerting effort e_H:

$$m(t) = \frac{R_m(t)}{R_m(t) + R_l(t)}.$$

Proposition 1 *High levels of effort are more strongly predictive of the probability that a public sector employee is motivated at higher levels of experience:* $m'(t) > 0$.

Initially, $m(0) = 0.5$, but the share of motivated workers increases over time because

$R'_m(t) > 0$ and $R'_l(t) < 0$.[7]

The probability that a worker with t years of experience who exerts effort e_H remains in the public sector for another year is

$$q(t) = m(t)p_m + (1 - m(t))p_l.$$

Proposition 2 *High levels of effort become more strongly predictive of remaining in the public sector as experience increases:* $q'(t) > 0$.

It is straightforward to show this results since $m'(t) > 0$ and $p_m > p_l$.

Another result from the model is that increasing the wage offered in the public sector does not necessarily increase average worker motivation and output:

$$\frac{\partial R_m(t)}{\partial \tilde{w}} \gtrless 0.$$

Previous studies have linked lower wages in the public sector to self-selection of more motivated workers (Heyes 2005, Brekke and Nyborg 2010, Rebitzer and Taylor 2011). In a review of the literature, Hanushek and Rivkin (2006) point out the lack of evidence that across-the-board salary increases lead to better student achievement. It is also a feature of the model that the average effort level of workers in the public sector with t years of experience, $\overline{e}(t) = \sum_{s=m,r,l} R_s(t)e^*_s$, could be increasing, decreasing or constant over time because there are more workers of type m and fewer workers of type l at higher levels of t, but types m and l both exert high effort.

The assumption of only 3 types of workers in the population simplifies the analysis and the interpretation of the results but is not necessary for the main theoretical predictions. Figure 1 shows simulation results from a similar model with continuous worker types, where

[7] See Appendix A for the proof of Proposition 1.

γ_i and a_i are independent random draws from continuous distributions.[8] Panel (a) shows that the correlation between motivation and effort increases with experience. The plot in Panel (b) illustrates the result that the hazard of leaving the public sector decreases faster over time for workers who exert high levels of effort.

In the rest of the paper I examine the implications of the model in the context of the labor market for public school teachers. I use working hours as a measure of effort and begin by verifying that unlike most other professional occupations, particularly ones concentrated in the private sector, the earnings of teachers are almost completely flat with respect to hours. I then turn to Propositions 1 and 2 and examine how the fraction of motivated teachers and the probability of remaining in teaching are related to observed hours at different levels of experience.

3 Elasticity of Teachers' Earnings with Respect to Hours Worked

I begin by presenting further evidence in support of the assumption that earnings for teachers are largely uncorrelated with hours. Podgursky (2011) offers a detailed overview of teacher compensation systems in the U.S., noting that salary systems are based on experience and education, with unions playing a big part. He argues that while merit and performance pay have become more common in recent years, they still do not make considerable difference in overall pay.

I use data from the 1980, 1990, and 2000 Census and from the 2001–2017 installments of the American Community Survey (ACS) provided in Ruggles, Flood, Goeken, Grover, Meyer, Pacas and Sobek (2018) to compare teachers to full-time workers in other professional

[8] Specifically, $\gamma \sim U[0,1]$ and $a \sim U[1,2]$. Other parameter values are as follows: $N = 100,000$ workers; $t = 20$ periods; $\overline{q} = 0.55; \tilde{w} = 0.6; \overline{V} \sim N(0, 0.5)$. The utility function takes the form $U_i(e) = \tilde{w} + \gamma_i e - e^2$.

occupations. Table 1 shows average working hours and their evolution over time for nine groups of occupations I consider, which are based on the 2010 SOC system. I limit the sample to workers between the ages of 22 and 61 who report usual weekly hours of 35 or more and who worked 27 or more weeks during the year preceding their interview.[9] Because the survey question asks respondents to report their usual hours in the weeks when they worked, it is likely that for teachers the variable reflects labor supply during the school year.

As Table 1 shows, teachers worked on average 41.5 hours in 1980, comparable to full-time workers in computer-related and mathematical occupations and less than an hour below those in business and financial occupations, as well as scientists or architects and engineers. Average hours increased for all occupations between 1980 and 1990 and for all but one occupation groups between 1990 and 2000. Hours remained fairly constant or decreased between 2000 and 2011 for all occupations with the exception of teachers. By the most recent period, between 2012 and 2017, when incentive pay has become more common for teachers, their average hours are approximately equal to or higher than average hours in all professional occupations except for managers and legal professionals.

Hours in these data are likely measured with error, and there is some evidence that teachers may overreport hours more than workers in other occupations (West 2014). In addition, teachers tend to work fewer weeks per year than other professionals. Nonetheless, Table 1 suggests that especially in more recent years, it is common for teachers to put in weekly hours in excess of the standard workweek, and in this respect their labor supply is similar to that of workers in most other professional occupations. The fact that teachers

[9]The usual definition of full-time full-year workers used in the literature, which places more conservative restrictions on the number of weeks worked, would exclude many teachers from the sample if they do not work during the summer months. Starting in 2008, the ACS provides only interval data on weeks worked. I include the 27–39 week category since the typical school year is 36 weeks in most states. There are relatively few workers in non-teaching professional occupations who report working between 27 and 39 weeks: the fraction ranges between 2 and 4% depending on the survey year. Excluding these workers does affect the estimates for non-teaching occupations.

tend to work fewer weeks per year compared to other professionals is relevant for comparing hourly or weekly wages, which this paper does not do. The focus of this study is on the reasons for supplying more hours than required by contract in weeks when individuals are working.

Table 2 highlights the differences in the returns to long working hours for teachers and other professionals. Using the Census and ACS data, I estimate the elasticity of annual earnings with respect to weekly hours for each occupational group and for six different time periods using a method similar to the one in Goldin (2014). In particular, Table 2 reports the coefficient estimates for the interactions between the log of usual weekly hours and indicators for occupational group from regressions of the natural log of annual earnings. I also include controls for the natural log of weeks worked in the previous year[10], a quadratic in age, and indicators for gender, race, Hispanic ethnicity, graduate degree, private sector employment, survey year, and detailed occupation.

There is considerable variation seen in Table 2 in the estimated elasticity of earnings with respect to hours across occupational groups. The elasticities tend to increase over time but are always lowest for teachers.[11] Occupations in the health care sector and in community and social service also have low elasticity of earnings with respect to hours; Gicheva (2018) shows evidence that earnings in occupations with high pro-social value tend to change relatively little with hours because workers in these occupations are more likely to donate labor. Goldin (2014) points out that the high elasticity of earnings with respect to hours in business and financial occupations can likely be explained by the fact that workers in these jobs tend to

[10]For the years when only intervalled weeks are reported, I use the modal number of weeks as observed in surveys prior to 2008, when the actual number of weeks worked is observed. Thus, I use 36 weeks for the interval 27–39 (42% of observations); 40 weeks for the interval 40–47 (45% of observations); 48 weeks for the interval 48–49 (76% of observations); and 52 weeks for the 50–52 interval (94% of observations).

[11]Cortés and Pan (2019) report similar elasticity trends by broad occupational groups, but they include preschool teachers, vocational and educational counselors, librarians, archivists, and curators in the same category as primary, secondary and special education teachers and estimate higher elasticity for this group.

be poor substitutes for one another, which makes the production function convex in hours.

The main takeaway from Table 2 is that for teachers, annual earnings do not increase much, if at all, with weekly hours. The estimated elasticities are negative for 1980 and 1990 and positive but between 0.01 and 0.03 for the period between 2000 and 2017. This is consistent with the assumption in Section 2 that wages in the public sectors are fixed and do not depend on effort once output exceeds the minimum required level. At the same time, Table 1 shows that even in the absence of strong monetary incentives to supply long hours, teachers tend to supply as much labor as other professionals. Furthermore, reported job satisfaction among teachers is high relative to other occupations (Smith 2007), which points to the importance of intrinsic motivation. These issues are examined further in the rest of the paper in the context of the theory presented in Section 2.

4 Schools and Staffing Survey Data

To test the predictions of the model in Section 2, I use the 2003–04, 2007–08 and 2011–2012 waves of the Schools and Staffing Survey (SASS), conducted by the National Center for Education Statistics (NCES).[12] Advantages of the SASS over other data sets such as administrative records from a single state or district include that it is nationally representative, covers a fairly long time period during which many districts implemented various performance or merit pay policies, includes a wide range of questions such as subjective measures of teacher motivation, and records turnover.

The survey uses a stratified sampling design in which a new nationally representative sample of public and private schools is selected each year; I use the public schools in the data for my analysis. The NCES assigns a unique time-invariant identification number to

[12]The survey underwent a major redesign after the 2011–12 wave and was renamed to the National Teacher and Principal Survey.

each school, which makes it possible to link observations for schools surveyed multiple times; about 15 percent of public schools in the data appear in multiple waves. Teachers within each sampled school are also stratified and sampled at random. Each sampled teacher is asked to complete a questionnaire. A follow-up survey administered at the beginning of the following academic year collects information from the school's principal on whether each of the teachers in the sample remained at the same school, continued teaching at another school, or left the teaching profession. I use this follow-up survey to construct an indicator for whether respondents changed occupations during the year following their survey.[13,14] The teacher questionnaire provides information on teachers' gender, race, ethnicity, education, years of teaching experience, subject and grade assignment, tenure, union membership, and earnings.

The final sample, which is limited to teachers who report full-time employment, includes 105,290 public school teachers at 20,270 unique schools.[15] Combining all waves of the SASS, only 1,690 of the teachers appear as a unique observation within a school; the modal number of sampled teachers from a given school is 3 and the median is 4, but 11 percent of schools have 10 or more teachers in the final estimation sample, accounting for 30 percent of teachers in the data.

Figure 2 shows the distribution of reported weekly hours among respondents in the sample; Panel (a) shows total weekly hours,[16] while Panel (b) reports the difference between

[13]Preferably, turnover information would be collected from teachers rather than from administrators. A subset of the teachers who are SASS respondents are interviewed at the beginning of the following academic year for the Teacher Follow-Up Survey (TFS) and are asked to report their employment status. Comparing weighted teacher and principal responses from the 2005 TFS shows that principals are correct in identifying teachers who left the profession 69% of the time, but 25% of the teachers whom principals classify as leavers self-report to have moved to another school. I use principals' responses rather than information from the TFS because the TFS has considerably fewer respondents and sample selection is non-random, disproportionately sampling those who left their school.

[14]A small fraction of teachers are deceased (fewer than 0.1 percent) or have unknown status (less than 0.25 percent); they are excluded from the analysis.

[15]All sample sizes in the paper are rounded to the nearest 10 as per NCES restricted-use data requirements.

[16]The exact wording of the survey question is "Including hours spent during the school day, before and after school, and on the weekends, how many hours do you spend on ALL teaching and other school-related

the total hours from Panel (a) and the number of hours each teacher reports to be required to work in order to receive base pay. Reported hours in the SASS are considerably higher than hours in the Census/ACS data, which several factors can explain. The SASS sample includes only individuals who self-report as regular full-time teachers, excluding part-time, substitute and itinerant (delivering instruction at more than one school) teachers, teacher aides and student teachers. Further, the Census and ACS questionnaires instruct respondents whose hours varied considerably in the 12 months preceding the interview to provide an average, which means that some teachers may adjust their response to account for the fact that they do not work during the summer months, especially if they are interviewed during the summer. In addition, the SASS survey question explicitly asks respondents to include hours worked on weekends and at home, while Census/ACS respondents may be less likely to include hours worked outside of school. For example, Drago et al. (1999) report large discrepancies in time diary data between total labor supply and the amount of face time reported by teachers in their sample.

Figure 2 shows that it is very common for teachers to report working 50 or more hours per week or 10 or more hours above what is required for base pay. Teachers may tend to overreport their hours in surveys like the SASS; West (2014) finds about a 3-hour difference between the length of the average school-year workweek for teachers as derived from time diary data compared to reported usual weekly hours in the CPS. But even with this level of overreporting, Figure 2 still indicates that a considerable fraction of full-time teachers work long hours.

Table 3 shows weighted descriptive statistics at the teacher level for the variables used in the analysis. The SASS reports detailed earnings information, including base salary, other earnings from teaching including bonuses and state supplements, non-teaching school-

activities during a typical FULL WEEK at THIS school?"

related earnings during the school year and the summer, and earnings from other jobs. For my analysis I focus on teaching-related earnings accumulated during the school year; as Table 3 shows, the difference between base and total pay is about $1,400, or less than 3 percent of the average base salary. This provides some evidence of the limited role of incentive pay in teaching. The table also shows that based on the principals' followup interviews, on average 93 percent of respondents remain in teaching one year after their survey.

I construct a subjective measure of teachers' intrinsic motivation based on survey questions about respondents' attitudes. The "teacher motivation" index is comprised of responses to the following survey questions. First, respondents are asked to identify on a 5-point Likert scale the degree to which they agree with the statement: "If you could go back to your college days and start over again, would you become a teacher or not?" Second, respondents are asked how long they plan to remain in teaching, and I construct a binary variable equal to 1 for those who selected "As long as I am able."[17] The index of teacher motivation also includes responses on a 4-point Likert scale to the statements "I don't seem to have as much enthusiasm now as I did when I began teaching" and "If I could get a higher paying job I'd leave teaching as soon as possible." I use principal component analysis to combine the four measures into a single index of teacher motivation,[18] which I standardize to have mean 0 and standard deviation of 1 in the unweighted sample. As a subjective measure of burnout, I use the degree to which respondents agree with the statement "I think about staying home from school because I'm just too tired to go." I construct an indicator variable equal to 1 if a teacher strongly disagrees with this statement and to 0 if the teacher strongly agrees, somewhat agrees or somewhat disagrees with this statement. As Table 3 shows, 53 percent of teachers disagree strongly that they feel too tired for school.

[17]Other possible responses include "Until I am eligible for retirement benefits from this job," "Until a specific life event occurs (e.g., parenthood, marriage)," "Until a more desirable job opportunity comes along," and "Definitely plan to leave as soon as I can."

[18]The factor loadings are shown in Appendix Table A1.

To measure teacher effectiveness, I use the number of undergraduate and graduate courses focusing solely on teaching methods or teaching strategies that respondents have taken; this information is reported in the SASS in interval form. Table 3 shows that there is considerable variation in responses, with 10 percent of teachers in the sample having taken no teaching methods courses, and around a quarter falling in each of the following intervals: 3 or 4; 5 to 9; 10 or more. I also include indicators for highest degree earned, but previous studies indicate that this is not a reliable predictor of teacher quality (Hanushek 2002, Clotfelter, Ladd and Vigdor 2007). Half of the teachers in the SASS sample hold a graduate degree.

Using the SASS sample described in Table 3, in the following section I test the predictions from the theory in Section 2 about the relationship between hours and occupational changes or motivation for teachers at different levels of experience. Before doing so, in analysis that supplements Section 3, I examine in more detail how the earnings of teachers in the SASS correlate with hours worked.

5 Empirical Specifications and Results

5.1 Do Earnings Increase with Hours for Teachers in the SASS?

I begin by verifying that the finding from Section 3 that teachers' earnings are only weakly related to reported weekly hours holds in the SASS sample. I estimate the year-specific elasticity of total annual teaching-related earnings with respect to reported weekly hours using an approach similar to the one in Section 3, as well as the relationship between total annual earnings or a teacher's base salary on the one hand and contract hours and hours above those required for base pay on the other. The main difference compared to the empirical specifications based on the Census and ACS data is that the SASS data allow me to include school-specific fixed effects, but the results do not change much if I replace

the fixed effects with controls for school characteristics such as the student-to-teacher ratio, fraction of minority students and teachers at the school, and share of students who qualify for free or reduced-price lunch. The estimation results for the specifications with school fixed effects are shown in Table 4; results without school fixed effects are available on request.

Column 1 of Table 4 shows similar, although slightly higher, elasticity of annual earnings with respect to usual weekly hours for teachers to that observed in Table 2. The estimated elasticity is 0.03 in the 2003 and 2011 surveys and 0.04 in 2007, which is again indicative of low responsiveness of earnings to an increase in hours worked compared to most other professional occupations. Hours enter the models in columns 2 and 3 of Table 4 linearly because some teachers report working no hours above those required to receive base pay. The estimates in column 2 suggest that when school-level fixed effects are included in the model, there is no relationship between the hours required for base pay and total annual compensation, but teachers who work more additional hours tend to earn slightly more: 10 additional hours per week correspond to a salary increase of 0.6 percent. This relationship is party explained by the fact that some of the additional hours may be spent on extracurricular activities such as coaching a sport, which teachers get compensated for. The estimated coefficient is negative in column 3, where the dependent variable is the natural log of base salary, implying that teachers with lower salaries may work more additional hours in order to increase their earnings. The estimates in Table 4 further show that conditional on experience and holding a graduate degree, teachers who have taken 5 or more classes focusing on teaching methods earn higher salary (both base and total) than teachers at the same school who have taken fewer classes with pedagogical focus.

5.2 Labor Supply, Teacher Motivation, and Occupational Changes

Having established the low monetary payoff of long working hours for teachers, I next use the SASS data to investigate empirically the relationship between hours and teacher motivation. I model the probability that respondent i from school j continues working as a teacher one year after the initial survey with a linear probability function with school fixed effects, in which the dependent variable $stay_i$ equals 0 for individuals who left the teaching profession and to 1 for those who remained in teaching, either at their current or a different school:[19]

$$stay_i = \alpha_j + \gamma_1 h_{ij} + \gamma_2 h_{ij} T_i + \mathbf{X}_{ij}\beta + \varepsilon_{ij} \tag{3}$$

Here h_{ij} denotes reported weekly hours, and T_i is individual i's experience as teacher, measured in years. The additional controls in $\mathbf{X}_{ij}$ include indicators for gender, race and Hispanic ethnicity; quadratics in age, experience as teacher, and tenure at the current school; indicators for graduate degree and for the number of courses in teaching methods taken by a respondent; the natural log of teacher i's base salary; indicators for union membership, subjects and grades taught and for whether the respondent teaches any students with an Individualized Education Program (IEP) and another indicator for 10 or more IEP students; and indicators for survey year.

The estimation results for the model in (3) are shown in column 1 of Table 5. As predicted by the theory in Section 2, the estimate for γ_2 is positive and highly statistically significant. Longer hours are predictive that a teacher will remain in the profession for experienced teachers, but at low levels of experience hours are not strongly correlated with retention. The magnitude of the coefficient estimates is small, indicating that if we compare

[19] Using other specifications such as conditional logit produces similar results, which are available on request. The linear probability specification has the advantage of easily interpretable coefficients, particularly in the presence of school fixed effects in the model.

two teachers with 10 years of experience, the one who works 10 fewer hours is about 0.5 percentage points more likely to leave teaching over the next year: an 8 percent increase in turnover given the average rate of 7%.

Figure 3 illustrates how the relationship between hours and the probability of remaining in teaching changes as experience increases. I estimate the predicted probability of remaining in teaching based on the model in (3). I then plot a local polynomial of the predicted probability of remaining in teaching as a function of experience for two levels of weekly hours, 40 and 55. The predicted probability of leaving the profession has an inverse U-shape for the 40-hour group, decreasing during the first 10 years and increasing thereafter. For teachers who report 55 hours, the turnover rate also decreases initially but remains almost flat between 10 and 18 years of experience before it starts increasing. The two lines start off overlapping: the predicted probability of remaining in teaching is the same for new teachers who work 40 hours per week and those who work 55 hours per week. The curves start diverging, and the distance between them increases to over 2 percentage points at high levels of experience.

Column 2 of Table 5 shows that the results do not change substantially when the school fixed effects are replaced by controls for school type (elementary, middle or high) and size, the student-to-teacher ratio, the fraction of minority students and teachers at the school, the share of students who qualify for free or reduced-price lunch, an indicator for charter school, and state dummies. As another robustness check, teachers with fewer than 3 years of experience are excluded from the sample in column 3. An argument can be made that it takes time for teachers to adjust their labor supply to the demands of the profession, and it also takes time for an individual to decide whether teaching is the right occupation. The estimates for γ_1 and γ_2 in columns 1 and 3 are also similar.

It is common for young female teachers to leave the profession temporarily to take care of young children; Stinebrickner (2002) shows the presence of a newborn child to be the

strongest predictor of leaving the profession for female teachers in his sample from the National Longitudinal Study of the High School Class of 1972, where the oldest respondents are around 32 years old. Dolton and van der Klaauw (1999) also find family reasons to be an important factor. Family-related reasons can be thought of as an outside option in the context of the theory in Section 2, but many females may return to teaching after a few years, which would not be captured in the data because retention is measured only one year after the initial interview. Column 4 of Table 5 shows the estimation results for the main model in (3) when the sample is restricted to exclude females younger than 34, since respondents in this group are most likely to exit for family reasons. This sample restriction strengthens the finding that hours are not predictive of exits at low levels of experience but become more positively correlated with the probability of remaining a teacher as experience increases. This suggests that intrinsic motivation may be less of a factor in retention for young female teachers, but it is possible that exits are temporary for many members of this group.

The results in column 5 of Table 5, also from a linear model with school fixed effects, show that the subjective measure of teacher motivation that I construct is similarly more strongly correlated with working hours at higher levels of experience. For teachers new to the profession, long working hours are not predictive of motivation. For experienced teachers, long hours are positively correlated with motivation. Lastly, column 6 of Table 5 shows results from a linear probability model similar to (3) in which the dependent variable is an indicator for whether a respondent disagrees strongly with the statement that she feels too tired to go to school. The results suggest that longer working hours are likely to be associated with burnout for novice teachers, but among teachers with more than 14 years of experience, those who work longer hours are less likely to report burnout. The magnitudes of the estimated relationships in columns 5 and 6 are again small but highly significant,

and the findings provide further support of the idea that long hours in the public sector are indicative either of intrinsic motivation or of low productivity.

6 Conclusion

It is somewhat of a puzzle why we observe variations in labor supply for full-time workers in occupations where the monetary rewards for long working hours are small. In this paper I propose two explanations, pro-social motivation and low productivity combined with contractually enforceable minimum output. I also suggest a way to distinguish between the two empirically in the context of the labor market for public school teachers in the U.S. This market is characterized by flat pay structure that mainly depends on experience and education, and a large fraction of workers whose reported weekly hours exceed 50.

To formalize the main idea of the paper, I show a straightforward theoretical model in which public sector employees differ in their productivity and motivation, and high effort can be indicative of either altruism or low ability. Consequently, teachers may work long hours either because they derive utility from their work, or because they need additional time to complete the required tasks. To distinguish between motivated and low-productivity teachers empirically, I use three waves of the Schools and Staffing Survey to analyze the relationship between observed weekly hours and the probability of exiting the teaching profession at different levels of experience. I also examine a similar relationship between hours and subjective measures of motivation and burnout.

The theory predicts and the data show that long hours are not necessarily predictive of occupational changes for teachers who are new to the profession. At higher levels of occupational experience, selection leads to motivated workers being more strongly represented than low-productivity workers, and the likelihood that long hours are driven by altruism

increases. As a result, the relationship between weekly hours and the probability of exiting teaching becomes more negative with experience. Using the subjective measures of teacher motivation and burnout, I also show that, as predicted by the theory, labor supply is more closely linked to motivation at higher levels of experience.

The importance of labor supply for the careers of college-educated workers has been the focus of several recent papers such as Gicheva (2013), Goldin (2014), and Cortés and Pan (2019). The current study adds to the discussion by analyzing uncompensated long hours in the public sector. Public school teachers are not as strongly incentivized by career advancement concerns and monetary compensation as are workers in legal and financial occupations for example, and it is important to take intrinsic motivation into account when trying to answer the question of why some, but not all, teachers work long hours. The approach in this paper can be extended further to examine more closely the relationship between teacher working hours and student outcomes at different levels of teacher experience, which would help us understand further the ways in which motivation, effort, and productivity are interrelated.

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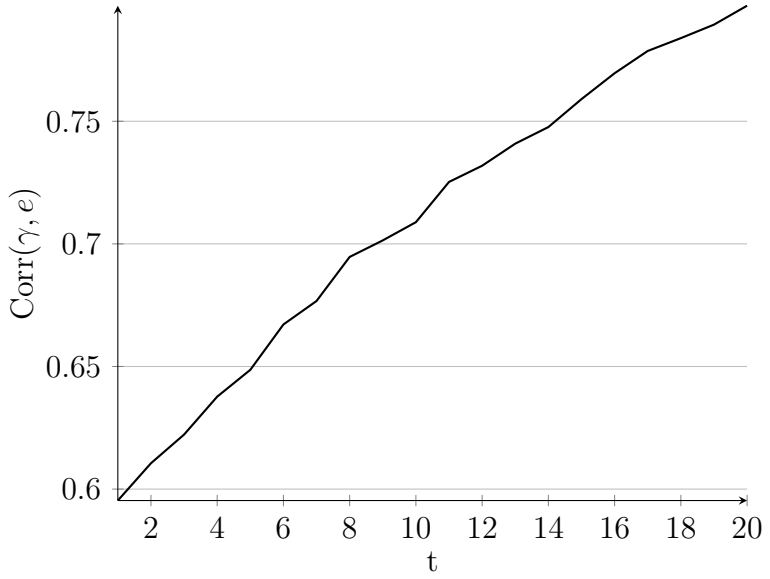
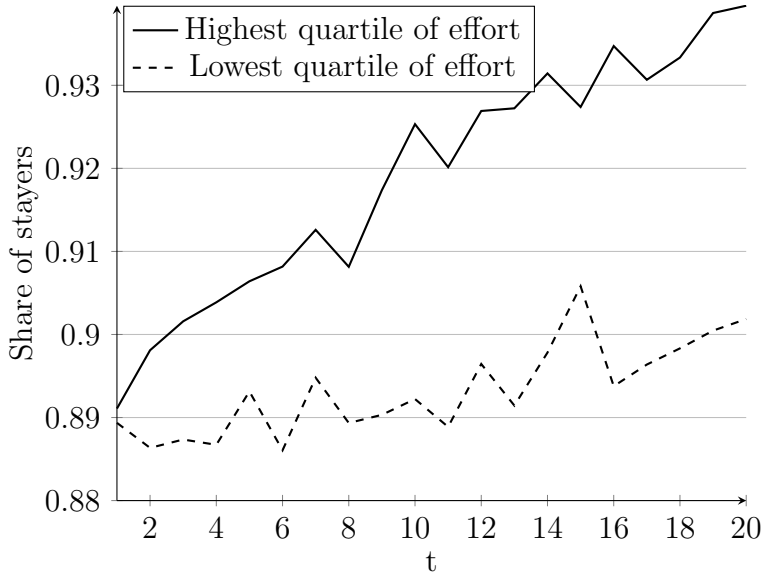
Figure 1: Simulation of Model with Continuous Types

(a) Correlation between Motivation and Effort over Time

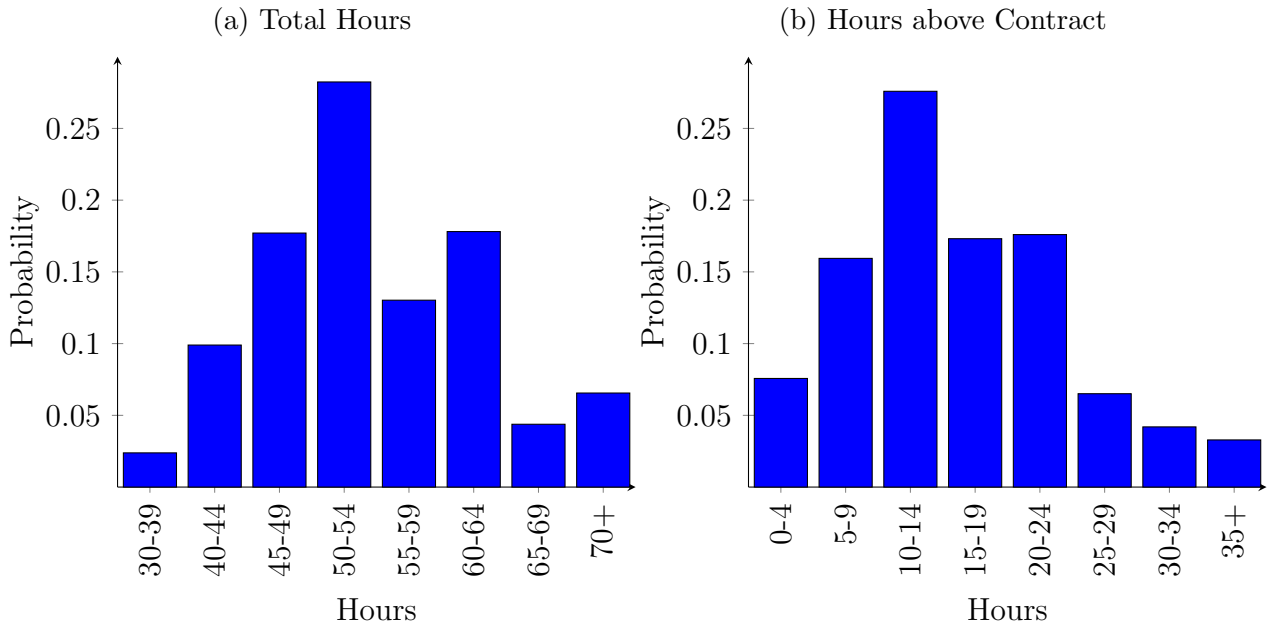


(b) Probability of Staying in the Public Sector from t to $t+1$ Conditional on Being in the Public Sector at t



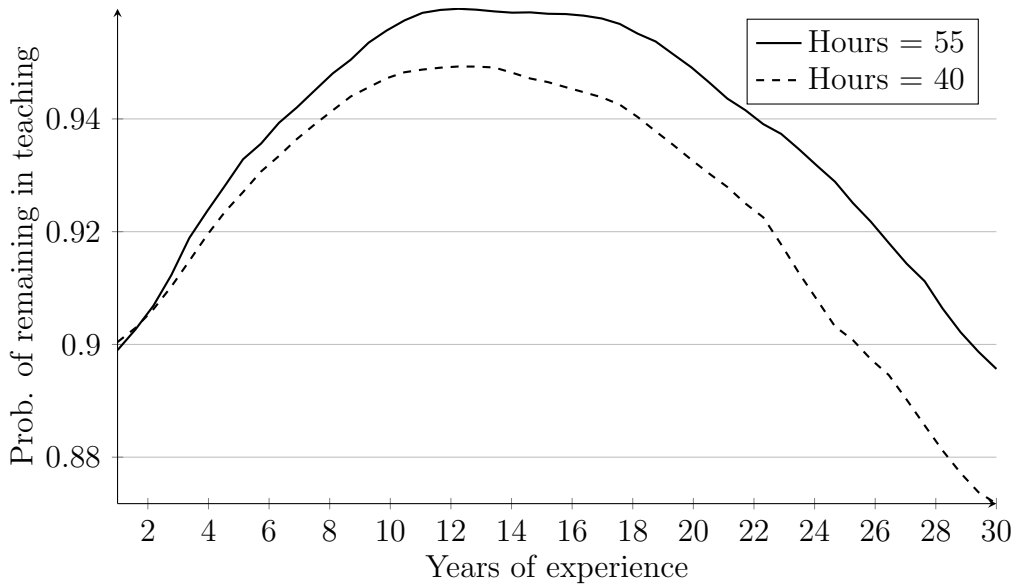
Simulation results for the model in Section 2 where $\gamma \sim U[0.1]$; $a \sim U[1,2]$; $N = 100,000$ workers; $t = 20$ periods; $\overline{q} = 0.55; \tilde{w} = 0.6; \overline{V} \sim N(0, 0.5)$. The utility function takes the form $U_i(e) = \tilde{w} + \gamma_i e - e^2$.

Figure 2: Distribution of Reported Hours in the SASS



Data from the 2003-04, 2007-08 and 2011-12 installments of the Schools and Staffing Survey. N = 105,290.

Figure 3: Predicted Probability of Remaining in Teaching



Local polynomial regression of the predicted probability of remaining a teacher one year after the SASS interview for teachers who reported working 40 or 55 hours per week. The predicted values are based on a linear regression model with school fixed effects estimated on the full SASS sample and using the same covariates as in Table 5.

Table 1: Average Hours in Professional Occupations

	1980	1990	2000	2001-2005	2006-2011	2012-2017
Teachers	41.54	42.50	43.60	43.62	43.74	44.22
[2310-2330]	(6.026)	(6.526)	(7.295)	(7.229)	(7.127)	(7.354)
Managers	44.99	46.41	47.63	47.04	46.82	46.31
[0020-0430]	(7.423)	(8.029)	(8.421)	(8.269)	(8.213)	(7.952)
Business and financial	42.20	43.74	45.03	44.54	44.45	44.19
[0500-0950]	(5.445)	(6.678)	(7.544)	(7.229)	(7.172)	(6.959)
Computer and mathematical	41.34	42.58	43.90	43.47	43.23	42.94
[1000-1240]	(4.823)	(5.645)	(6.705)	(6.387)	(6.208)	(5.961)
Architects and engineers	42.14	43.71	44.79	44.51	44.45	44.20
[1300-1530]	(5.178)	(6.231)	(6.806)	(6.758)	(6.789)	(6.718)
Scientists	42.35	43.76	44.39	44.10	43.83	43.56
[1600-1960]	(6.029)	(6.935)	(7.435)	(7.142)	(7.033)	(6.837)
Community and social service	43.90	44.50	44.15	43.78	43.40	42.93
[2000-2060]	(8.669)	(8.618)	(8.224)	(7.773)	(7.353)	(6.793)
Legal	44.80	46.88	47.67	47.45	47.19	46.72
[2100-2150]	(7.117)	(8.115)	(8.789)	(8.894)	(8.894)	(8.693)
Health care	44.79	45.23	45.38	44.98	44.57	44.11
[3000-3540]	(10.22)	(10.16)	(10.40)	(10.28)	(9.879)	(9.506)
N	371,429	539,070	704,087	450,706	1,125,696	1,276,037

Weighted means and standard deviations from the 1980, 1990 and 2000 Census and 2001–2017 American Community Survey. The sample includes full-time (35+ hours per week) workers between the ages of 22 and 61 who worked 27 weeks or more in the previous year. Standard deviations are in parentheses. The numbers in brackets show the 2010 SOC codes corresponding to each occupational group.

Table 2: Elasticity of Annual Earnings with Respect to Usual Weekly Hours

	1980	1990	2000	2001-2005	2006-2011	2012-2017
Teachers	-0.126	-0.038	0.028	0.014	0.010	0.026
	(0.010)	(0.009)	(0.008)	(0.010)	(0.007)	(0.007)
Managers	0.436	0.681	0.739	0.761	0.783	0.850
	(0.008)	(0.007)	(0.007)	(0.008)	(0.005)	(0.005)
Business and financial	0.610	0.735	0.913	0.961	1.024	1.104
	(0.015)	(0.012)	(0.010)	(0.012)	(0.007)	(0.007)
Computer and mathematical	0.232	0.322	0.537	0.571	0.579	0.639
	(0.031)	(0.020)	(0.013)	(0.016)	(0.011)	(0.010)
Architects and engineers	0.353	0.366	0.421	0.419	0.434	0.435
	(0.018)	(0.015)	(0.015)	(0.017)	(0.012)	(0.012)
Scientists	0.308	0.365	0.396	0.480	0.472	0.453
	(0.021)	(0.017)	(0.018)	(0.022)	(0.015)	(0.016)
Community and social service	-0.057	0.044	0.109	0.214	0.198	0.209
	(0.019)	(0.016)	(0.015)	(0.019)	(0.012)	(0.013)
Legal	0.449	0.798	0.817	0.891	0.943	1.000
	(0.024)	(0.018)	(0.017)	(0.019)	(0.013)	(0.013)
Health care	-0.030	0.132	0.147	0.084	0.061	0.060
	(0.012)	(0.011)	(0.010)	(0.011)	(0.007)	(0.007)
N	371,429	539,070	704,087	450,706	1,125,696	1,276,037

Coefficient estimates from regressions of annual earnings on the interaction between occupation group indicators and the natural log of usual weekly hours. Other controls include the natural log of weeks worked, quadratic in age, gender, race and ethnicity, indicator for graduate degree, indicator for working in the private sector, and year and occupation indicators. Standard errors in parentheses. The data are from the 1980, 1990 and 2000 Census and 2001–2017 American Community Survey. The sample includes full-time (35+ hours per week) workers between the ages of 22 and 61 who worked 27 weeks or more in the previous year.

Table 3: SASS Descriptive Statistics

Variable	Mean	St. dev.
School-year base salary (2011 dollars)	$51,972	$13,449
School-year earnings from teaching (2011 dollars)	$53,395	$13,785
Hours required by contract	37.88	3.57
Hours above contract	14.74	8.54
Continued working as teacher	0.93	
Teacher motivation	0.02	0.99
Strongly disagree: feel tired	0.53	
Female	0.75	
Black	0.08	
Asian/Pacific Islander/Native American	0.03	
Hispanic	0.07	
Teaches any IEP students	0.85	
Teaches 10 or more IEP students	0.35	
Union member	0.75	
Age	41.92	11.29
Years of tenure at current school	7.55	7.83
Years of teaching experience	13.38	9.72
Number of courses in teaching methods:		
0	0.10	
1 or 2	0.13	
3 or 4	0.25	
5 to 9	0.28	
10 or more	0.24	
Highest degree earned:		
Associates/no college	0.02	
BA	0.48	
Master's	0.43	
Education Specialist	0.06	
Ph.D or Ed.D.	0.01	

Data from the 2003–04, 2007–08 and 2011–12 installments of the Schools and Staffing Survey. The means are calculated using SASS survey weights. N = 105,290.

Table 4: Relationship between Annual Earnings and Hours for Teachers in the SASS

Dep. Variable:	Ln(total salary)		Ln(base salary)
	(1)	(2)	(3)
Ln(Total hours) × 2003	0.0289***		
	(0.0051)		
Ln(Total hours) × 2007	0.0424***		
	(0.0060)		
Ln(Total hours) × 2011	0.0287***		
	(0.0058)		
Hours required by contract		0.00019	-0.00024
		(0.00018)	(0.00017)
Hours above contract		0.0006***	-0.0003***
		(0.0001)	(0.0001)
Number of courses in teaching methods:			
1 or 2 courses	-0.0010	-0.0010	-0.0019
	(0.0021)	(0.0021)	(0.0019)
3 or 4 courses	-0.0002	-0.0002	-0.0016
	(0.0020)	(0.0020)	(0.0018)
5 to 9 courses	0.0048**	0.0048**	0.0036*
	(0.0020)	(0.0020)	(0.0019)
10 or more courses	0.0120***	0.0119***	0.0120***
	(0.0022)	(0.0022)	(0.0021)

* p<0.10, ** p<0.05, *** p<0.01. Data from the 2003–04, 2007–08 and 2011–12 installments of the Schools and Staffing Survey. Total salary includes school year earnings from bonuses and extracurricular activities (coaching, student activity sponsorship, mentoring teachers, teaching evening classes). The models include school fixed effects as well as the controls from Table 3 and indicators for survey year, grade and subject taught. The errors are clustered at the district level. N = 105,290.

Table 5: Long Hours as Predictors of Dedication to Teaching

Dep. variable:	Teacher at $t+1$				Motivation	Strongly disagree: feel tired
	(1)	(2)	(3)	(4)	(5)	(6)
Total hours	0.00014	0.00005	0.00004	-0.00011	0.00097	-0.00109***
	(0.00019)	(0.00017)	(0.00022)	(0.00023)	(0.00062)	(0.00032)
Total hours × Yrs teaching experience	0.00004***	0.00003***	0.00004***	0.00005***	0.00014***	0.00008***
	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00004)	(0.00002)
Number of courses in teaching methods:						
1 or 2 courses	0.00383	0.00694*	-0.00280	0.00444	0.05688***	-0.00153
	(0.00415)	(0.00387)	(0.00450)	(0.00478)	(0.01481)	(0.00751)
3 or 4 courses	0.01109***	0.01009***	0.00576	0.01266***	0.08459***	0.00370
	(0.00374)	(0.00344)	(0.00402)	(0.00428)	(0.01317)	(0.00685)
5 to 9 courses	0.00975***	0.01045***	0.00305	0.01025**	0.10894***	0.00521
	(0.00364)	(0.00341)	(0.00398)	(0.00424)	(0.01313)	(0.00705)
10 or more courses	0.00975**	0.01269***	0.00462	0.01203***	0.14517***	0.01733**
	(0.00389)	(0.00364)	(0.00415)	(0.00439)	(0.01340)	(0.00714)
Ln(School-year base salary)	0.01100	0.01394***	0.00805	0.00803	0.04691*	0.02143*
	(0.00680)	(0.00533)	(0.00725)	(0.00759)	(0.02449)	(0.01299)
School fixed effects	Yes	No	Yes	Yes	Yes	Yes
Sample	All	All	Exper>3	All males; females age 34+	All	All
N	105,290	105,290	88,140	82,920	105,290	105,290

* p<0.10, ** p<0.05, *** p<0.01. Coefficients from linear regression models using data from the 2003–04, 2007–08 and 2011–12 installments of the Schools and Staffing Survey. The models include the controls from Table 3 and indicators for survey year, grade and subject taught. The model in column 2 also includes school-level controls for school type (elementary, middle or high) and size, the student-to-teacher ratio, the fraction of minority students and teachers at the school, the share of students who qualify for free or reduced-price lunch, an indicator for charter school, and state dummies. The errors are clustered at the district level.

Appendix A

Proof of Proposition 1 We have that

$$m'(t) = \frac{R'_m(t)R_l(t) - R_m(t)R'_l(t)}{(R_m(t) + R_l(t))^2}.$$

Note that

$$R'_s(t) = \frac{P'_s(t)(P_m(t) + P_r(t) + P_l(t)) - P_s(t)(P_m(t) + P_r(t) + P_l(t))}{(P_m(t) + P_r(t) + P_l(t))^2},$$

where

$$P'_s(t) = \ln[F(\tilde{w} + \gamma_s V(e_s^*) - C(e_s^*))]P_s(t).$$

Then

$$R'_m(t) = \frac{P_r(t)(\ln(p_m) - \ln(p_r)) + P_l(t)(\ln(p_m) - \ln(p_l))}{(P_m(t) + P_r(t) + P_l(t))^2} > 0$$

and

$$R'_l(t) = \frac{P_r(t)(\ln(p_l) - \ln(p_r)) + P_m(t)(\ln(p_l) - \ln(p_m))}{(P_m(t) + P_r(t) + P_l(t))^2} < 0.$$

Thus, $m'(t) > 0$.

Appendix B

Table A1: Factor Loadings for the Teacher Motivation Index

Would become teacher if starting over	0.459
Plans to remain in teaching as long as possible	0.482
As much enthusiasm as when began teaching	0.526
Stay in teaching even if higher paying job available	0.529
Eigenvalue	1.998

Factor loadings from principal component analysis based on data from the 2003–04, 2007–08 and 2011–12 installments of the Schools and Staffing Survey. N = 105,290.