Altruism and Burnout: Long Hours in the Teaching Profession

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Abstract:

This article explores why many public school teachers work substantially more hours than required by contract, given that the elasticity of their earnings with respect to their hours is close to zero. The author introduces a theoretical framework for public-sector employees in which high levels of effort can indicate either altruism (for intrinsically motivated employees) or low productivity (for low-ability employees). 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. Findings show that teachers with very low levels of experience exhibit little or no relationship between weekly hours and the probability of remaining in teaching. This correlation becomes more positive as teaching experience increases. Similarly, the level of work hours is positively related to self-reported burnout at low levels of experience, but the relationship is reversed for teachers who have been in the profession longer.

Keywords: intrinsic motivation | working hours | teachers | public-sector labor markets

Article:

Whereas the short- and long-term career benefits 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 et al. 2011); Rebitzer and Taylor (2011) provided further review of the related literature.

In this study, I examine 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 in which 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 little monetary payoff for high effort and long working hours. 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. Stress and burnout are recognized as common problems among teachers (Greenberg, Brown, and Abenavoli 2016) and may have negative effects on student achievement (Arens and Morin 2016).

This article attempts to reconcile the low level of incentive pay in teaching with the commonly observed high levels of effort. I introduce a theoretical framework 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 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. To test the model empirically I define effort as working hours.

My 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 U.S. Census and the American Community Survey (ACS), I compare the elasticity of annual earnings with respect to weekly hours for teachers to the elasticity for workers in professional occupations in the for-profit sector. I then use 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 to document the observed relationship between weekly hours and the probability of remaining in teaching at varying levels of experience. I also use subjective survey questions designed to measure teacher motivation to test whether weekly hours become more positively correlated with motivation over time.

The findings contribute to our understanding of the determinants of hours of work for teachers and public-sector employees in general. 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), but the existing literature does not make it clear what incentivizes them to do so. There is conflicting evidence as to whether teachers' labor supply responds to incentives built into the school system. Stoddard and Kuhn (2008) showed that although teachers' average weekly work hours have risen steadily, no evidence suggests that education reforms result in longer working hours, or, if so, the effect is very small. Hoxby (2002) demonstrated that teachers work more hours in schools located in areas with more school choices available to parents. Lavy (2009) showed evidence that high school teachers in Israel increase the time they spend on instruction when their students' exam performance is tied to monetary incentives. Gershenson (2016) used 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. A number of recent studies have examined the relationship between incentive pay and other dimensions of teacher effort (see, e.g., Podgursky and Springer 2007a, 2007b; Atkinson et al. 2009; and Goodman and Turner 2013), but none of them analyze labor supply responses. In addition to documenting that teacher pay is very weakly related to hours worked, the current study is the first to link teacher labor supply explicitly to intrinsic motivation.

This article also adds to the literature on teacher turnover. Previous research, such as Murnane and Olsen (1989, 1990) and Dolton and van der Klaauw (1995, 1999), has demonstrated that potential earnings in other sectors play a role, although more recent studies that rely on administrative data do not find strong support for the claim that non-teaching earnings have strong impact on teacher exits (Podgursky, Monroe, and Watson 2004; Scafidi, Sjoquist, and Stinebrickner 2006). Working conditions and satisfaction with teaching have also been found to be important determinants of teacher turnover (Ingersoll 2001; Hanushek, Kain, and Rivkin 2004). This study explores how teacher motivation and working hours are related to the probability of staying in the profession.

Theoretical Framework

To model the role of intrinsic motivation, I begin with the assumption that the labor market is composed of a public and a private sector. I do not model workers' choices and outcomes in the private sector and assume away heterogeneity in this sector, which simplifies the model without affecting its main predictions. 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, 2006), Prendergast (2007), and Delfgaauw and Dur (2008), have examined theoretically and empirically the labor market implications of worker heterogeneity in intrinsic motivation. Macartney, McMillan, and Petronijevic (2018) showed that teacher value-added in particular can be separated into intrinsic ability and effort, with the difference being that the latter responds to incentives whereas the former does not. Productivity in the model is observed by employers, so no screening or signaling is present, but a minimum required level of output in the public sector does exist.

All workers in the model start off in the public sector and remain there until they are laid off or until they choose to leave voluntarily.[1] Public-sector output for worker i conditional on her level of effort e is verifiable and given by

$$q_{i(e)} = a_i e,$$

where ai measures inherent ability. Wages in the public sector are fixed at $\widetilde{w}$, 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

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

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

Similar to Delfgaauw and Dur (2008), I assume three types of workers: regular (r), motivated (m), and low-productivity (l). It holds that $0 < a_l < a_r = a_m$ and $0 = \gamma_l = \gamma_r < \gamma_m$. Workers know their type γ; output, effort, and thus ai are observed by everyone. Without loss of generality, it is assumed that the initial share of workers of each type is 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. Assuming that $e_m^* > \bar{q}/a_m$, where e_m^* solves $C'(e_m^*) = \gamma_m V'(e_m^*)$, motivated workers produce more than the minimum required output, even though there is no monetary reward for output above $\bar{q}$. The corresponding value of a public-sector job for worker i is

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

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 distinct reasons: Effort increases utility for type m, whereas low-productivity workers need to exert higher effort than workers of type r in order to attain the minimum required level of output $\bar{q}$. In the rest of this section, I assume that $e_m^* = e_l^* = e_H$, which makes motivated and low-productivity workers observationally equivalent on effort.

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.2 Allowing workers to receive an outside offer prior to the start of the first period is one way to incorporate selection into the public sector. Workers leave the public sector if $V_i^* < \overline{V}(t)$. The distribution of outside options likely changes over time; for example, outside options generally 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 $F(\cdot)$.

The probability p_s of an individual of type s remaining in the public sector from period t to t+ 1 is thus time-invariant and equal to

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

with $p_l < p_r < p_m$.

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

$$R_s(t) = \frac{[p_s]^t}{\sum_{i=\{m,r,l\}} [p_i]^t}.$$

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:

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

Note that initially m(0) = 0.5, but the share of motivated workers increases over time: m'(t) > 0. (Proofs are presented in the Online Appendix.) The average motivation of workers with t years of experience who exert high effort is $\bar{\gamma}_{e_H}(t) = m(t)\gamma_m$, and the average motivation of low-effort workers is $\bar{\gamma}_{e_l^*}(t) = 0$. The model predicts that high levels of effort become more positively related to intrinsic motivation as experience increases: $d\left(\bar{\gamma}_{e_H}(t) - \bar{\gamma}_{e_l^*}(t)\right)/dt > 0$ since m'(t) > 0.

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

$$\tau(t) = m(t)\, p_m + (1 - m(t))\, p_l.$$

It holds that high levels of effort become more strongly predictive of remaining in the public sector as experience increases: τ'(t) > 0 because m'(t) > 0 and $p_l < p_m$.

The theoretical setup also implies that increasing the wage offered in the public sector can decrease average worker motivation conditional on experience. This result is consistent with previous studies that 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) pointed out the lack of evidence that across-the-board salary increases led to better student achievement. At the same time, the current model predicts that offering higher wages increases the probability of staying in the public sector, which can have important policy implications if employers seek to reduce turnover.

Even if wages in the public sector do not depend on effort ($\partial\widetilde{w}/\partial e = 0$), it is plausible that some employers offer nonmonetary rewards for high effort. The Online Appendix and working paper version of this study (Gicheva 2020a) show a simple way to incorporate nonmonetary rewards into the model. I provide evidence in the empirical part of the article that longer hours may lead to transfer to higher-resource schools or perceived improvements in other characteristics of the work environment. A substantial literature demonstrates that many effective teachers move to higher-resource schools; see, for example, Hanushek et al. (2004), who showed that student body characteristics are more important than salary for teacher mobility.

The current model can also be reconciled with recent evidence that teachers who exit the profession at low levels of experience tend to have higher ability than do teachers who exit later on, as measured by SAT scores and non-teaching wages (Wiswall 2007) or teacher fixed effects (Wiswall 2013). A simple modification to the model allows for the distribution of outside options F(·) to depend on ability so that high-ability workers tend to receive better offers; this is shown in the Online Appendix and in Gicheva (2020a).

The assumption of only three 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 γi and ai are independent random draws from continuous distributions.3 Panel A shows that the correlation between motivation and effort increases with experience. The plot in panel B illustrates that the hazard of leaving the public sector decreases faster over time for workers who exert high levels of effort.

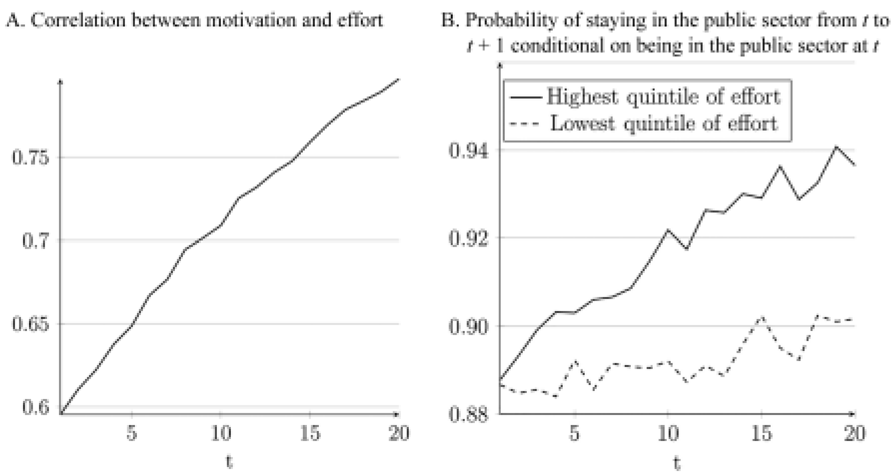


Figure 1. Simulation of Model with Continuous Types

Notes: Simulation results for the theoretical model, where g3U [0.1]; a3U [1,2]; N = 100,000 workers; t = 20 periods; $\bar{q}$ = 0.55; $\tilde{w}$ = 0.6; $\bar{V}$ ~ N (0,0.5). The utility function takes the form $U_i(e) = \tilde{w} + \gamma_i e - e^2$.

In summary, the two main empirically testable predictions of the model are:

> Prediction 1 (P1): The correlation between motivation and effort becomes more positive with public-sector experience.
>
> Prediction 2 (P2): The probability that a worker who exerts high effort remains in the public sector, compared to the probability that a low-effort worker stays, increases with experience.

These implications are contingent on the assumption that earnings do not increase with effort and are thus most likely to apply to certain public-sector jobs, such as teaching. Another important feature of the model is that the two types of workers exert high effort for distinct reasons: Motivated workers choose to exert high effort because they are intrinsically motivated, and low-productivity workers need to exert high effort in order to meet a production quota. This characteristic of the model leads to a dynamically evolving relationship between motivation and effort attributable to an underlying selection process. This conceptual framework complements prior studies, such as Gregg et al. (2011), which showed a positive relationship between public-sector employment and the probability of supplying uncompensated effort (working hours), and Wiswall (2013), who examined sorting out of teaching over time based on ability. Note that although heterogeneity in the level of intrinsic motivation is key in this setup, the main results in this section can also be obtained from a model with worker heterogeneity in terms of γ only, but in which ability is an increasing function of experience.

In the rest of the article I provide empirical evidence in support 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 flat with respect to hours. I then examine how the relationships between working hours and motivation and between the probability of remaining in teaching and hours vary with experience.

Elasticity of Teachers' Earnings with Respect to Hours

I begin by presenting further evidence in support of the assumption that earnings for teachers are largely uncorrelated with hours. Podgursky (2011) offered a detailed overview of teacher compensation systems in the United States, noting that salary systems are based on experience and education, with unions playing a big part. He argued 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 U.S. Census and from the 2001–2017 installments of the American Community Survey (ACS) provided in Ruggles et al. (2018) to compare teachers to full-time workers in other professional occupations. Table 1 shows average working hours for nine groups of occupations. I limit the sample to workers with a bachelor's degree, who are 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.4 Because the survey asks respondents to report their usual hours for the weeks they worked, it is likely that for teachers the measure of weekly hours reflects labor supply during the school year. As Table 1 shows, teachers worked on average 41.5 hours in 1980, which is 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 2000. Hours remained fairly constant or decreased between 2000 and 2017, when teachers' hours are approximately equal to or higher than average hours in all professional occupations except for managers and legal professionals. These trends are consistent in other years not shown in Table 1.

Table 1. Average Hours Worked per Week in Professional Occupations

Year	Teachers [2310-2330]	Managers [0020-0430]	Business & financial [0500-0950]	Computer & mathematical [1000 – 1240]	Architects & engineers [1300 – 1960]	Scientists [1600 – 1960]	Community and social services [2000-2060]	Legal [2100-2150]	Health care [3000 – 3540]
1980	41.54 (6.026)	44.99 (7.423)	42.20 (5.445)	41.34 (4.823)	42.14 (5.178)	42.35 (6.029)	43.90 (8.669)	44.80 (7.117)	44.79 (10.22)
2000	43.60 (7.295)	47.63 (8.421)	45.03 (7.544)	43.90 (6.705)	44.79 (6.806)	44.39 (7.435)	44.15 (8.224)	47.67 (8.789)	45.38 (10.40)
2012-2017	44.22 (7.354)	46.31 (7.952)	44.19 (6.959)	42.94 (5.961)	44.20 (6.718)	43.56 (6.837)	42.93 (6.793)	46.72 (8.693)	44.11 (9.506)

Sources: Ruggles et al. (2018): 1980, 1990, and 2000 U.S. Census and 2001–2017 American Community Survey.
Notes: Weighted means and standard deviations. The sample includes full-time (35+ hours per week) workers with a bachelor's degree 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 Standard Occupational Classification (SOC) codes corresponding to each occupational group.

Table 2 highlights the differences in the returns to long working hours for teachers and other professionals. I estimate the elasticity of annual earnings with respect to weekly hours for each occupational group and for six separate 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,5 a quadratic in age, and indicators for gender, race, Hispanic ethnicity, graduate degree, private-sector employment, survey year, and detailed occupation.

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

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

Sources: Ruggles et al. (2018): 1980, 1990, and 2000 U.S. Census and 2001–2017 American Community Survey.

Notes: 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; quadratics 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 sample includes full-time (35+ hours per week) workers with a bachelor's degree between the ages of 22 and 61 who worked 27 weeks or more in the previous year.

Considerable variation is evident 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.6 Occupations in the health care sector and in community and social service also have low elasticity of earnings with respect to hours; Gicheva (2020b) showed that earnings in occupations with high pro-social value tend to change relatively little with hours as workers in these occupations are more likely to donate labor.

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 are positive but between 0.01 and 0.03 for the 2000 to 2017 period. This finding is consistent with the model in the previous section. 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. I examine these relationships further in later sections.

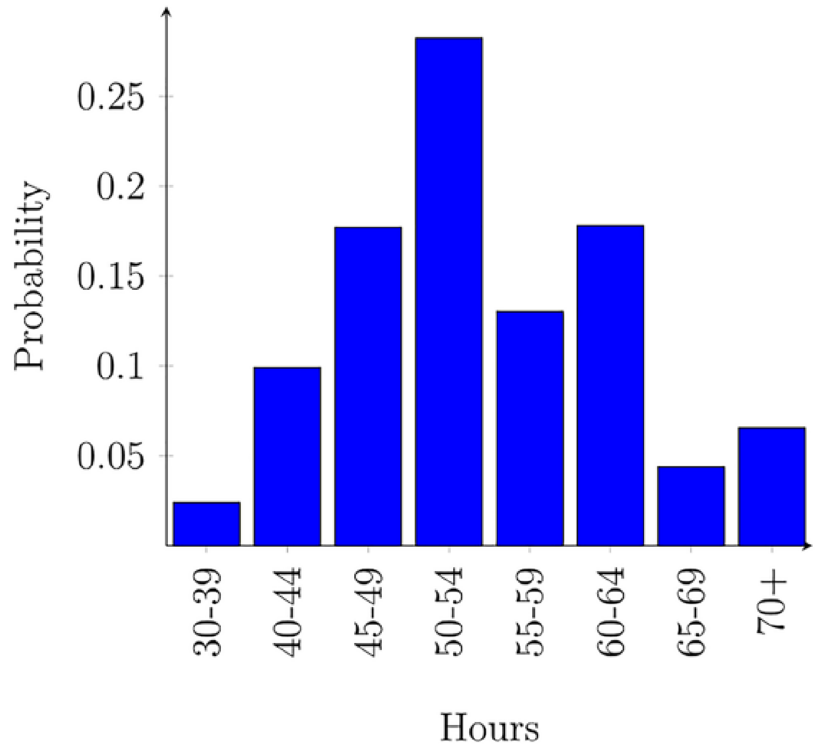
Schools and Staffing Survey Data

To test the predictions of the model presented in the theoretical framework, I use the 2003–04, 2007–08, and 2011–12 waves of the Schools and Staffing Survey (SASS), conducted by the National Center for Education Statistics (NCES). (The survey underwent a major redesign after the 2011–12 wave and was renamed the National Teacher and Principal Survey.) 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, provides a wide range of information including subjective measures of teacher motivation, and records turnover.

The survey uses a stratified sampling design in which a new nationally representative sample of schools is selected each year; my analysis is restricted to public schools. The NCES assigns a unique time-invariant identification number to each school, so observations for schools surveyed multiple times can be linked; approximately 15% 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 detailed survey 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.7 The final sample, which is limited to teachers who report full-time employment, includes 105,290 public school teachers at 20,270 unique schools.8 Combining all waves of the SASS, only 1,690 of the teachers appear as a unique observation within a school; the median number of sampled teachers per school is 4, but 11% of schools have 10 or more teachers in the final estimation sample, accounting for 30% of teachers in the data.

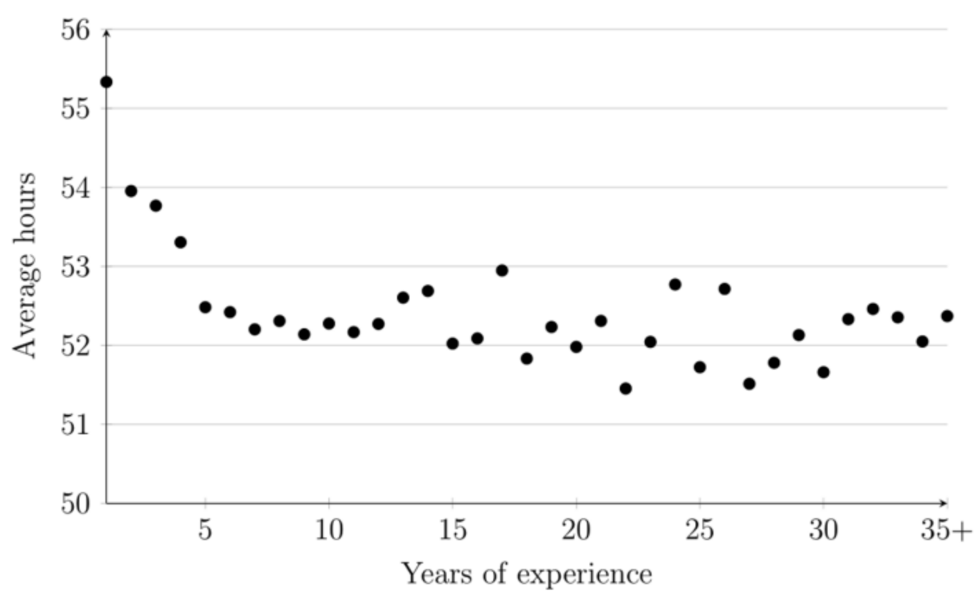
Figure 2 shows the distribution of reported weekly hours among respondents in the sample.9 Reported hours in the SASS are higher than hours in the Census/ACS. I restrict the SASS sample to include only individuals who self-report as regular full-time teachers, excluding part-time, substitute and itinerant (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) reported large discrepancies in time diary data between total labor supply and the amount of face time reported by teachers in their sample.

Figure 2. Distribution of Reported Hours in the SASS



Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), 2003–04, 2007–08, and 2011–12.

Figure 3. Average Working Hours by Years of Teaching Experience



Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), 2003–04, 2007–08, and 2011–12.
Notes: The calculations use SASS teacher weights.

Figure 2 shows that it is very common for teachers to report working 50 or more hours per week, even though most teachers also report that their contract requires them to work between 35 and 40 hours. Figure 3, which summarizes average hours by years of teaching experience, shows that after the first four years in the profession—when teachers tend to work the longest—average hours do not vary with experience. Teachers with five or more years of experience report working on average approximately 52 hours per week.

Table 3 shows unweighted descriptive statistics at the teacher level for the main variables used in the analysis; means and standard deviations of other variables are shown in the Online Appendix. The SASS reports detailed earnings information, including base salary, other earnings from teaching including bonuses and state supplements, non-teaching 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 approximately $1,700 in 2011 dollars, or 3.5% of the average base salary. This result provides some evidence of the limited role of incentive pay in teaching. The table also shows that based on the principals' follow-up interviews, 93% of respondents remain in teaching one year after their survey.

Table 3. SASS Descriptive Statistics

Variable	Mean	Standard deviation
School-year based salary (2011 dollars)	$49,378	$13,052
School-year earnings from teaching (2011 dollars)	$51,105	$13,460
Hours required by contract	38.16	3.45
Hours above contract	14.71	8.58
Continued working as a teacher	0.93	
Strongly disagree: Feel tired	0.53	
Coach sport	0.21	
Club sponsor	0.43	
Department chair	0.25	
Lead curriculum specialist	0.11	
District-wide committee	0.50	

Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), 2003–04, 2007–08, and 2011–12.
Note: N = 105,290.

I construct a subjective measure of teachers' intrinsic motivation by combining several survey questions about respondents' attitudes. The teacher motivation index comprises 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." Other possible responses, coded as 0, 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." The index 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 transform the variables so that higher numbers correspond to greater satisfaction with teaching and use principal component analysis to combine the four measures into a single variable, which I standardize to have mean 0 and standard deviation of 1 for all full-time teachers interviewed in the SASS, including those with missing values on some key variables. The factor loadings, which are approximately equal, are shown in the Online Appendix.

Another subjective measure, indicative of burnout, is 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. As Table 3 shows, 53% of teachers disagree strongly that they feel too tired for school. Table 3 also shows that it is common for teachers to undertake additional responsibilities such as coaching a sport (21%), sponsoring student organizations (43%), serving as department lead or chair (25%) or lead curriculum specialist (11%), or serving on a district-wide committee (50%).

Empirical Specifications and Results

Factors Related to Variations in Hours

It is important to understand what observable teacher and workplace characteristics account for the variation in labor supply observed in the SASS. Table 4 shows coefficient estimates from descriptive regressions of weekly hours on several covariates of interest; additional coefficients are shown in the Online Appendix. The dependent variable in the first specification shown in the table is the hours required to receive base pay, whereas the dependent variable in column (2) is total reported hours spent on teaching-related activities. The specifications include school fixed effects, but models with school-level covariates instead of fixed effects yield similar results.

The estimates from the first column of Table 4 show little variation in contract hours. The coefficients in this specification are either not statistically significant or small in magnitude. The results in the second column, by contrast, point to systematic differences in total hours associated with teacher and workplace characteristics. Involvement in extracurricular activities is associated with an average increase of 0.76 to 2.9 hours per week, depending on the activity. Hours tend to increase with the highest grade taught (coefficients shown in the Online Appendix), but elementary homeroom teachers work longer than elementary subject specialists. Teachers in writing-intensive subjects (English and social sciences) tend to work more, as do science teachers. Some of these trends may be associated with teaching Advanced Placement classes, but the SASS does not collect such information. Teaching a larger number of distinct grade-subject combinations (preps) is also associated with higher weekly hours.

Do Earnings Increase with Hours for Teachers in the SASS?

I proceed by verifying that the previous finding 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 previously described. The estimation results shown in Table 5 are from models that are richer than the ones based on Census/ACS data. In addition to variables shown in the table, the specifications include indicators for gender, race, and Hispanic ethnicity; quadratics in age, experience as a teacher, and tenure at the current school; indicators for each of the first three years of experience and tenure; indicators for graduate degree and for the number of courses in teaching methods taken by a respondent; indicators for union membership, subjects and highest grade taught, and for whether the respondent teaches any students with an Individualized Education Program (IEP) and another indicator for 10 or more IEP students; the number of distinct subject-grade teaching assignments; and indicators for survey year. The regressions also include controls for school-level covariates: school level 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 results are similar if the school-level controls are replaced with school fixed effects.) The reported errors are clustered at the district level.

Table 4. Factors Related to Variations in Hours Worked

Dependent variable	Hours required by contract (1)	Total hours (2)
Coach sport	0.195*** (0.030)	2.926*** (0.082)
Club sponsor	0.106*** (0.024)	1.379*** (0.064)
Department chair	0.016 (0.028)	0.755*** (0.075)
Lead curriculum specialist	0.036 (0.037)	1.025*** (0.099)
District-wide committee	0.050** (0.023)	0.821*** (0.063)
Subject (excluded: Other)		
Early Childhood or General Elementary	0.139 (0.094)	2.617*** (0.253)
Special Education	–0.183** (0.085)	–0.482** (0.230)
Arts and Music	–0.012 (0.088)	–0.108 (0.237)
English and Language Arts	0.043 (0.081)	1.814*** (0.219)
ESL or Bilingual Education	–0.114 (0.140)	0.197 (0.378)
Foreign Languages	–0.069 (0.096)	0.382 (0.258)
Health or Physical Education	0.003 (0.089)	–0.121 (0.240)
Mathematics	–0.150* (0.082)	0.499** (0.221)
Natural Sciences	–0.014	1.731***

	(0.083)	(0.224)
Social Sciences	0.017 (0.083)	1.608*** (0.225)
Vocational, Career, or Technical Education	–0.099 (0.084)	–0.282 (0.228)
Teaches multiple classes	0.017 (0.064)	0.436** (0.173)
Number of different preps	0.006 (0.011)	0.074** (0.031)

Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), 2003–04, 2007–08, and 2011–12.
Notes: The models include school fixed effects; indicators for gender, race, and Hispanic ethnicity; quadratics in age, experience as a teacher, and tenure at the current school; indicators for each of the first three years of experience and tenure; indicators for graduate degree and for the number of courses in teaching methods taken by a respondent; indicators for union membership, highest grade taught, and for whether the respondent teaches any students with an Individualized Education Program (IEP) and another indicator for 10 or more IEP students; the number of different subject-grade teaching assignments; and indicators for survey year. The errors are clustered at the district level. N = 105,290.
*p < 0.10; **p < 0.05; ***p < 0.01.

Table 5. Relationship between Annual Earnings and Hours for Teachers in the SASS

Dependent variable	Ln(total salary)		Ln(base salary)
	(1)	(2)	(3)
Ln(total hours) x 2003	0.0183***		
	(0.0053)		
Ln(total hours) x 2007	0.0205***		
	(0.0060)		
Ln(total hours) x 2011	0.0111*		
	(0.0062)		
Hours required by contract (x10)		-0.0036	-0.0049**
		(0.0022)	(0.0022)
Hours above contract (x10)		0.0037***	-0.0026***
		(0.0006)	(0.0006)
Extracurricular activities			
Coach sport	0.0398***	0.0398***	–0.0098***
	(0.0016)	(0.0017)	(0.0015)
Club sponsor	0.0014	0.0014	–0.0049***
	(0.0012)	(0.0012)	(0.0011)
Department chair	0.0040***	0.0040***	–0.0016
	(0.0014)	(0.0014)	(0.0013)
Lead curriculum specialist	0.0120***	0.0119***	0.0090***
	(0.0018)	(0.0018)	(0.0017)
District-wide committee	0.0068***	0.0068***	0.0054***
	(0.0012)	(0.0012)	(0.0011)

Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), 2003–04, 2007–08, and 2011–12.
Notes: Total salary includes school-year earnings from bonuses and extracurricular activities. The models include the same controls as Table 4 with the exception of school fixed effects, as well as 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. N=105,290.
*p < 0.10;**p < 0.05;***p < 0.01.

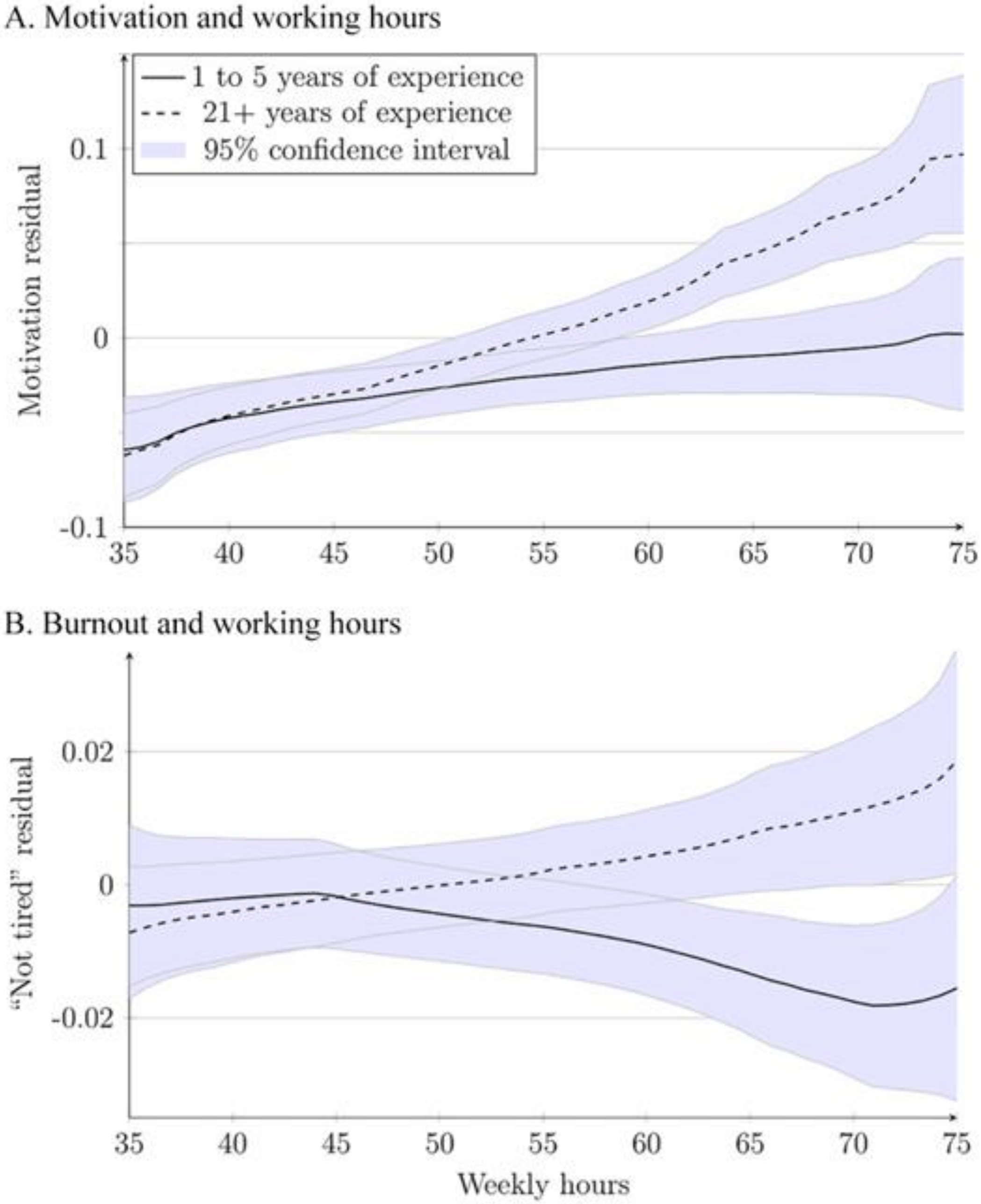
Column (1) of Table 5 shows elasticity of annual earnings with respect to usual weekly hours for teachers similar to that observed in Table 2: The estimated elasticity is 0.02 in 2003 and 2007 and 0.01 in 2011. Further, I estimate the relationship between total annual earnings or a teacher's base salary on the one hand and contract hours and hours above those required for base pay on the other; columns (2) and (3) show the results. Hours enter these models linearly because some teachers report working no hours above those required to receive base pay. The estimates in column (2) suggest no statistically significant 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 0.4%. This result is consistent with the finding of positive but small elasticity of earnings with respect to hours. The estimated coefficients on base and additional hours are negative but also small in magnitude in column (3), where the dependent variable is the natural log of base salary. Some lower-resource schools may pay less and also be understaffed so teachers need to work longer hours. Another possible explanation is that teachers with lower salaries may work more additional hours in order to increase their earnings.

Among other covariates, the models in Table 5 control for involvement in common extracurricular activities, which Table 4 shows to be associated with longer hours. The results in columns (1) and (2) show that teachers receive some compensation for coaching a sport (approximately 4% of their salary), serving as lead curriculum specialist (approximately 1% salary increase), being on a district-wide committee (0.7% salary increase), or serving as department lead or chair (0.4% higher salary). Excluding these variables from the models results in slightly higher elasticity of earnings with respect to hours. The negative coefficients in column (3) suggest that some teachers may take on extra duties, for example coaching sports or sponsoring student organizations, to compensate for lower base salaries.

Labor Supply, Teacher Motivation, and Occupational Changes

Having established the low monetary payoff to long working hours for teachers, I next investigate empirically the predictions of the theoretical model, beginning with P1 regarding the relationship between hours and teacher motivation. I first do so descriptively in Figure 4, panel A, which plots the measure of teacher motivation against reported total weekly hours, while panel B plots the corresponding relationship between hours and the indicator for disagreement with the statement that one feels too tired for work. I show the relationships for teachers who fall in two experience categories: more than 0 but fewer than 6 years of teaching experience (the solid lines in Figure 4) and 21 or more years of teaching experience (the dashed lines in Figure 4). These intervals are chosen to exclude teachers who are brand new to the profession; 5 and 21 years of experience correspond to the 25th and 75th percentiles of the distribution. The curves and 95% confidence intervals shown in Figure 4 are from local polynomial regressions. The regressions also include indicators for grades and subjects taught, a quadratic in teaching experience, indicators for survey year, and school-level controls for school level 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.

Figure 4. Relationship between Working Hours, Motivation, and Burnout



Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), 2003–04, 2007–08, and 2011–12. Notes: Local polynomial regression results. The residuals are obtained from regressions of the teacher motivation index described in the section on SASS data or an indicator for strongly disagreeing with the statement, ‘‘I think about staying home from school because I’m just too tired to go,’’ on indicators for subjects and highest grade taught, a quadratic in teaching experience, indicators for survey year, and 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.

Figure 4, panel A, shows that the relationship between motivation and labor supply is almost flat for teachers with low levels of experience but positive for experienced teachers. As seen in panel B, burnout rates tend to increase with hours for novice teachers working more than 45 hours per week, whereas among experienced teachers, those working fewer hours are more likely to report being too tired for work. The trends are consistent with the theoretical framework, which predicts that high effort becomes more strongly correlated with intrinsic motivation in the public sector as experience increases.

To explore the relationships further, I estimate models in which the dependent variables are the measures of commitment to teaching used in Figure 4: the teacher motivation index and the measure of burnout. To test P2 of the model, I also estimate models in which the dependent variable is an indicator variable that equals 1 for individuals who continued working as teachers in the year following their interview, either at their current or a different school, and 0 for those who left the profession. In the case of the two binary dependent variables, I estimate linear probability models. These models have the advantage of easily interpretable coefficients, particularly in the presence of school fixed effects; using other specifications such as conditional logit produces similar results. I estimate the following model for teacher i at school j:

$$y_{ij} = \alpha_j + \gamma_1 h_{ij} + \gamma_2 h_{ij} T_i + \boldsymbol{X}_{ij}\beta + \varepsilon_{ij}, \tag{2}$$

where hij denotes reported total weekly hours, and Ti is individual i’s experience as a teacher, measured in years. The variable T measures actual experience; respondents are instructed to exclude periods spent on parental leave or sabbatical when reporting the number of years of teaching experience they have accumulated. Estimating a model that includes hours required for base pay and additional hours separately, with the latter interacted with experience, produces similar results.

The model in Equation (2) assumes away systematic cohort-specific differences in teacher motivation or turnover rates. Because the analysis is based on three waves of data, and because T measures potential experience and is not perfectly collinear with cohort even in a cross section of the data, it is possible to identify cohort effects separately from the coefficients on experience. No evidence, however, suggests that motivation varies in a systematic way by cohort. The Online Appendix shows that controlling for experience, the values of the motivation index do not vary by the year teachers entered the profession past 1970, which constitutes more than 99% of the sample. Furthermore, the results do not change if cohort fixed effects are added to the model; these alternative estimates are available on request.

The additional controls in Xij include the teacher-level covariates from the models in the preceding subsection. The errors are clustered at the district level. In some specifications I also include controls for extracurricular activities, which Tables 4 and 5 show to be related to both hours worked and salary. If involvement in extracurricular activities is partly driven by intrinsic motivation, however, their inclusion in the model could pick up part of the effect of motivation on hours, thereby weakening the underlying relationships of interest. Thus, I show results with these variables but exclude them from the main specifications. I also control in all regressions for the natural log of teacher i's total teaching-related annual earnings, which should capture the extrinsic rewards to taking on additional duties.

Table 6 shows estimation results for the model in Equation (2) in which the dependent variable is the teacher motivation index (columns (1) through (5)) or the binary indicator equal to 1 if a teacher strongly disagrees that she feels too tired for school (column (6)). Columns (1) and (6) show the main estimates based on the model in Equation (2); the school fixed effects are replaced with detailed school-level characteristics in column (2). Column (3) shows results with controls for extracurricular activities. Teachers with fewer than three years of experience are excluded from the sample in column (4). 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 sample in column (5) excludes female teachers under the age of 34. It is common for young female teachers to leave the profession temporarily to take care of young children. Stinebrickner (2002) showed 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, in which the oldest respondents were approximately 32 years old. Dolton and van der Klaauw (1999) also found family reasons to be an important factor. Family-related reasons can be thought of as an outside option within the theoretical framework, but many females may eventually return to teaching, which would not be captured in the data because retention is measured only one year after the initial interview.

As the theoretical model predicted, the estimate for $\gamma 2$ is positive and highly statistically significant in all specifications: Teacher motivation is more strongly correlated with working hours at higher levels of experience. This result is slightly more pronounced in the model with school fixed effects and becomes even stronger when novice teachers or the females most likely to have young children are excluded from the sample. For teachers new to the profession, long working hours are generally not predictive of motivation. These findings are consistent with the selection-based framework in which high-effort low-motivation employees are likely to leave the public sector relatively soon, whereas employees who are intrinsically motivated and derive utility from the effort they exert are likely to remain in the public sector and are more strongly represented among those with high levels of experience. The results also show that teacher motivation is positively related to the likelihood of taking on additional responsibilities, such as coaching a sport, sponsoring a student organization, or taking on leadership positions, as shown in column (3). The results in column (6) suggest that longer working hours tend to be associated with burnout for novice teachers, for whom 10 additional hours per week correspond to 1.3 percentage points higher probability of reporting being too tired for school. Among teachers with more than 14 years of experience, those who work longer hours are less likely to report burnout.

Table 7 shows how the relationship between working hours and the probability of remaining in teaching changes with experience; the dependent variable in these models is an indicator equal to 1 if an individual was still working as a teacher in the year following their initial interview. The specifications in columns (1) through (3) are similar to those in the first three columns of Table 6; columns (5) and (6) impose the same sample restrictions as columns (4) and (5) of Table 6; finally, the specification in column (4) includes the measures of motivation and burnout as additional regressors.

Table 6. Relationship between Motivation and Working Hours

Dependent variable:	Teacher motivation index					Strongly disagree: Feel tired
	(1)	(2)	(3)	(4)	(5)	(6)
Total hours (x10)	0.0021 (0.0063)	0.0006 (0.0056)	–0.0106* (0.0063)	–0.0050 (0.0086)	0.0003 (0.0080)	–0.0129*** (0.0032)
Total hours (x10) x Years of teaching experience	0.0017*** (0.0004)	0.0015*** (0.0003)	0.0015*** (0.0004)	0.0021*** (0.0004)	0.0018*** (0.0004)	0.0009*** (0.0002)
Coach sport			0.1160*** (0.0093)			
Club sponsor			0.1112*** (0.0072)			
Department chair			0.0263*** (0.0084)			
Lead curriculum specialist			0.0560*** (0.0109)			
District-wide committee			0.0594*** (0.0072)			
School fixed effects	Yes	No	Yes	Yes	Yes	Yes
Sample	All	All	All	Exper>3	All males; females age 34+	All
N	105,290	105,290	105,290	88,140	82,920	105,290

Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), 2003–04, 2007–08, and 2011–12.
Notes: Coefficients from linear models that include the controls from Table 4. The model in column (2) also includes the school-level controls from Table 5. The errors are clustered at the district level. All sample sizes are rounded to the nearest 10.
*p < 0.10;**p < 0.05;***p < 0.01.

Table 7. Long Hours as Predictors of Remaining in Teaching

Dependent variable:	Teacher at t + 1					
	(1)	(2)	(3)	(4)	(5)	(6)
Total hours (x 10)	0.0012 (0.0019)	0.0003 (0.0017)	–0.0005 (0.0019)	0.0012 (0.0018)	0.0002 (0.0022)	–0.0011 (0.0023)
Total hours (x10) 3Years of teaching experience	0.0004*** (0.0001)	0.0003*** (0.0001)	0.0003*** (0.0001)	0.0003*** (0.0001)	0.0004*** (0.0001)	0.0005*** (0.0001)
Coach sport			0.0173*** (0.0024)			
Club sponsor			0.0114***			

			(0.0019)			
Department chair			0.0070*** (0.0022)			
Lead curriculum specialist			–0.0013 (0.0029)			
District-wide committee			0.0132*** (0.0019)			
Teacher motivation index				0.0250*** (0.0011)		
Strongly disagree: feel tired				0.0052*** (0.0019)		
School fixed effects	Yes	No	Yes	Yes	Yes	Yes
Sample	All	All	All	All	Exper>3	All males; females age 34+
N	105,290	105,290	105,290	105,290	88,140	82,920

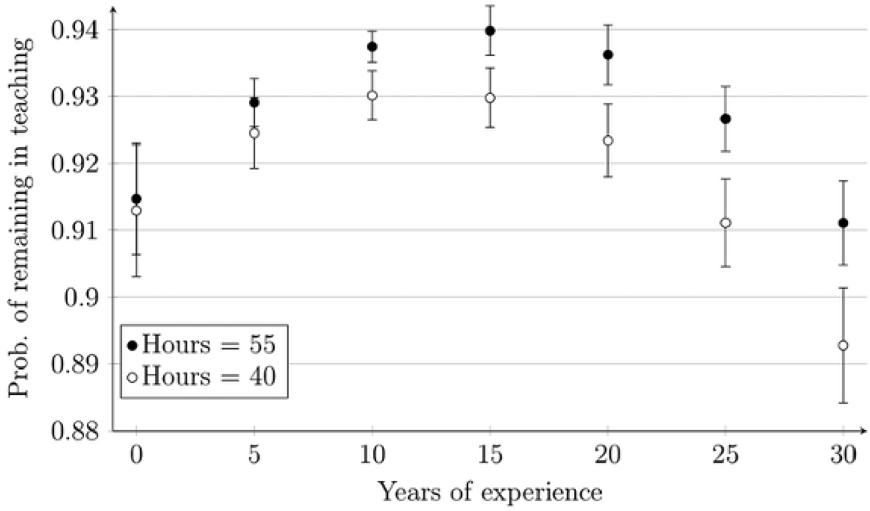
Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), 2003–04, 2007–08, and 2011–12.
Notes: Coefficients from linear models that include the controls from Table 4. The model in column (2) also includes the school-level controls from Table 5. The errors are clustered at the district level. All sample sizes are rounded to the nearest 10.
*p < 0.10;**p < 0.05;***p < 0.01.

The results suggest that longer hours are predictive that a teacher will remain in the profession—for experienced teachers. At low levels of experience, however, hours are not strongly correlated with retention. While highly significant, the coefficient estimates for $\gamma 2$ are not large; the results from the main model in column (1) indicate that if we compare 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. This result represents a 7% increase in turnover given the baseline retention rate of 93%. Figure 5 illustrates the estimated effects from column (1) at various levels of experience.

The predicted probability of remaining in teaching is shown for two values of weekly hours, 40 and 55. The predicted probability of remaining in the profession has an inverse U-shape with respect to experience for both groups. The probability of leaving the profession starts off approximately the same for standard- and long-hour teachers but diverges over time, with the difference still not statistically significant at 5 years of experience but highly significant at 10 years and after that. The estimated difference in the predicted probability of leaving the profession between teachers who work 40 hours per week and those who work 55 hours per week is close to 2 percentage points at 30 years of experience.

Column (2) of Table 7 shows that the results become somewhat weaker but remain qualitatively the same when the school fixed effects are replaced with controls for school characteristics. The estimated coefficient on the interaction between hours and experience is also slightly lower but still highly statistically significant when the controls for extracurricular activities are included in the model in column (3), with participation in all included activities except serving as lead curriculum specialist being positively correlated with retention.

Figure 5. Predicted Probability of Remaining in Teaching



Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), 2003–04, 2007–08, and 2011–12. Notes: Linear prediction and 95% confidence intervals based on the specification in column (1) of Table 7.

The measure of motivation and indicator for not suffering from burnout are also strongly positively correlated with retention, and their inclusion in the model similarly attenuates the estimate of $\gamma2$, although it remains highly significant. The coefficient estimate for the interaction between hours and experience remains similar to that in the main specification if novice teachers are excluded from the sample and becomes larger if the sample is restricted to exclude females younger than 34. The latter 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.

Nonmonetary Returns to Long Hours

In addition to intrinsic motivation playing a role, it is possible that public-sector jobs have nonmonetary incentives built in that incentivize workers to exert more than the minimum level of effort. I provide suggestive evidence that this may be the case for some public school teachers, although the data do not allow me to draw strong conclusions.

For example, principals and other school administrators, who do not have much freedom to reward teachers monetarily, may use the prospect of transfer to a more desirable school as reward for high effort. To test this hypothesis, I rely on the relatively small subsample of teachers who were interviewed a year after their SASS survey as part of the TFS. For respondents who remained in teaching, I use information about the zip codes of the schools where they worked at the time of the SASS and TFS interviews; the location would be the same for respondents who did not change schools. I then link the zip codes to data from the 2000 Census on mean family income in the zip code in which each school is located. Family income is a proxy for school resources, the assumption being that schools in higher-income areas tend to be more desirable. Prior studies of teacher mobility, such as Hanushek et al. (2004), have demonstrated that at least a subset of teachers seek to move to schools or districts serving students of higher socioeconomic status.

Columns (1) and (2) of Table 8 show coefficient estimates from a regression of mean family income in the zip code of the school in which a teacher worked in year t+ 1 on mean family income for the year-t school and controls for total hours, the teacher motivation index, the other controls used in the previous sections including the natural log of total school-related earnings, and school-level covariates. I split the sample into teachers who started off at schools in areas with higher than the median (column (1)) and lower than the median (column (2)) family income.

Table 8. Nonmonetary Rewards for Long Hours

			Current position better than last year's:			
Dependent variable:	Mean family income in school zip code at t +1		Opportunities for prof. development	Promotion opportunities	Working conditions	Manageability of workload
	(1)	(2)	(3)	(4)	(5)	(6)
Total hours	-14.4	57.2***	0.0011*	0.0011**	0.0002	0.0011**
	(22.1)	(19.1)	(0.0006)	(0.005)	(0.0006)	(0.0006)
Teacher motivation	56.6	-577.5***	0.0096*	-0.0007	-0.0238***	-0.0152***
	(199.6)	(185.3)	(0.0052)	(0.0046)	(0.0053)	(0.0052)
Mean family income at t	0.790***	0.722***				
	(0.013)	(0.032)				
Sample	zip code income > $45,000	zip code income < $45,000	All TFS respondents working as teachers at t +1			
N	3,830	3,810	7,910			

Sources: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), 2003–04, 2007–08, and 2011–12, and Teacher Follow-Up Survey (TFS), 2004–05, 2008–09, and 2012–13. U.S. Census Bureau, 2000 Census.
Notes: The models include the controls from the model in column (2) of Table 6. All sample sizes are rounded to the nearest 10.
*p < 0.10; **p < 0.05; ***p < 0.01.

The estimates are consistent with the idea that for teachers at low-resource schools, long hours might lead to better school assignment; the coefficient on weekly hours is positive and significant in column (2), indicating that longer hours are associated with an increase in average income in the zip code in which a teacher works. No statistically significant relationship exists between hours and mean family income at t+ 1 for teachers whose initial schools are located in higher-income areas. The results also show that motivated teachers are less likely to move from low- to higher-resource schools, which is consistent with nonmonetary rewards being less important for intrinsically motivated teachers.

Columns (3) through (6) of Table 8 explore other potential nonmonetary rewards for effort, using the TFS to compare respondents' perceptions of their work environment for those who were still working as teachers at time t+ 1. The TFS asks respondents how their current position compares to last year's position along various dimensions. I construct indicators for whether one perceives their job in year t+ 1 to be better than the job in year t in terms of opportunities for professional development, promotion opportunities, general working conditions, and manageability of the workload. Each of these indicators is used as a dependent variable in linear probability models with the same covariates as in the specifications in columns (1) and (2). Longer hours are associated with perceived improvements in working conditions for three of the four outcomes, general working conditions being the exclusion.

The observed link between motivation and hours should be less pronounced at low-resource schools if teachers there who are not intrinsically motivated are incentivized by the prospect of better future assignments. To explore this possibility further, I re-estimate the models from column (1) of Tables 6 and 7 separately for teachers at low- and high-resource schools, as measured by the percentage of students at the school who are approved for the National School Lunch Program (NSLP).10 The results are shown in Table 9, panel A, with columns (1) and (3) displaying results for schools with less than 25% of students approved for free or reduced lunch and columns (2) and (4) restricting the sample to schools with more than 50% NSLP students.

Table 9. Results by School Type

Dependent variable:	Teacher at t +1		Teacher motivation	
	(1)	(2)	(3)	(4)
A. Results by free or reduced lunch status				
Total hours (x 10)	–0.0037	0.0033	–0.0139	0.0087
	(0.0030)	(0.0032)	(0.0110)	(0.0105)
Total hours (x 10) x Experience	0.0006***	0.0002	0.0021***	0.0010*
	(0.0002)	(0.0002)	(0.0006)	(0.0006)
% free or reduced lunch	<25%	>50%	<25%	>50%
N	34,160	35,700	34,160	35,700
B. Results by school level				
Total hours (x 10)	0.0038	-0.0006	0.0049	0.0010
	(0.0030)	(0.0026)	(0.0107)	(0.0088)
Total hours (x 10) x Experience	(0.0030)	0.0005***	0.0004	0.0023***
	(0.0030)	(0.0002)	(0.0006)	(0.0005)
School level	Elem. & Middle	High	Elem. & Middle	High
N	43,610	49,450	43,610	49,450

Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), 2003–04, 2007–08, and 2011–12.
Notes: The models include the controls from the main model in Table 6. The errors are clustered at the district level. Schools for which the share of students receiving free or reduced lunch is missing are excluded from panel A. Schools with levels listed as “combined” are excluded from panel B. All sample sizes are rounded to the nearest 10.
*p < 0.10;**p < 0.05;***p < 0.01.

The coefficient estimates imply that the results are more pronounced at schools in which relatively few students are approved for free or reduced lunch. The coefficient estimates for the interaction between hours and experience in columns (2) and (4) are less than half as large in magnitude as the corresponding estimates in columns (1) and (3), suggesting that my theoretical framework is less representative of the teacher labor market at low-resource schools. Table 8 shows suggestive evidence that administrators may use nonmonetary incentives at lower-resource schools; this mechanism should be explored further with better-suited data.

Table 9, panel B, explores whether the relationship between hours and motivation or retention is heterogeneous by school level. Arguably, most high school subjects offer more opportunities for donating uncompensated labor. For example, high school teachers have more discretion over how many essays or projects to assign or how much time to spend on instruction outside the regularly scheduled class time. It is plausibly also the case that less productive high school teachers need more additional time to meet the minimum required level of output than do elementary school teachers. Then the theoretical model would be more representative of the labor market for high school teachers than for individuals who teach lower grades. Columns (1) and (3) of panel B show estimation results for the sample of elementary and middle school teachers and columns (2) and (4) restrict the sample to the high school teachers in the sample.11 The results show much more pronounced positive relationships between hours and retention or motivation at high levels of experience for high school teachers compared to teachers at elementary and middle schools.

Conclusion

The observed variations in labor supply for full-time workers in occupations with small monetary rewards for long working hours are somewhat puzzling. In this article 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 United States. This market is characterized by a 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 article, I introduce a theoretical framework 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 varying 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 intrinsic motivation or 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 show further evidence 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 articles 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. Many public-sector employees, such as teachers, are not as strongly incentivized by career advancement concerns and monetary compensation as are workers in legal and financial occupations in the private sector, for example, and it is important to take intrinsic motivation into account when trying to answer the question of why some, but not all, public-sector employees have a tendency to donate labor. As Tables 1 and 2 show, the phenomenon of relatively long weekly hours and elasticity of earnings with respect to hours close to zero is not limited to the labor market for teachers. Health-related occupations, for example, also fit this pattern. Further evidence suggests that many public-sector employees working in the fields of health, education, and social care tend to supply additional uncompensated hours (Gregg et al. 2011), which is in line with the theoretical framework presented here. The approach in this article can be extended further to examine to what extent the patterns apply to other occupations and other dimensions of effort, not measurable in the data used in this study.

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1. An alternative assumption is that workers receive a noisy signal of their utility of public-sector employment prior to entering the labor market and gradually learn about their true utility parameters. The data do not allow me to examine selection into public-sector jobs empirically, but in my specifications and results, I show that some of the empirical relationships are stronger when teachers with fewer than three years of experience are excluded from the sample. This finding is consistent with some degree of learning about one’s utility from public-sector employment.

2. Stinebrickner (2002), for example, showed that among female teachers age 32 or younger, exits to non-employment are more common than are occupation changes.

3. 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; $\bar{q}$ = 0.55; $\tilde{w}$ = 0.6; $\bar{V}$ ~N (0,0.5). The utility function takes the form $U_i (e) = \tilde{w} + \gamma_i e - e2$. The results are not contingent on the shape of the uniform distribution and can be obtained with other distribution functions.

4. 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 to 39 week category since the typical school year is 36 weeks in most states. Relatively few workers in non-teaching professional occupations report working between 27 and 39 weeks: The fraction ranges between 2 and 4%. Excluding these workers does not affect the estimates for non-teaching occupations.

5. For the years that weeks worked are reported only as intervals, 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).

6. Cortés and Pan (2019) reported similar elasticity trends by broad occupational groups, but they included preschool teachers, vocational and educational counselors, librarians, archivists, and curators in the same category as primary, secondary, and special education teachers and estimated higher elasticity for this group.

7. Preferably, turnover information would be collected directly from teachers. A subset of teachers in the SASS 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. A small fraction of teachers are deceased (fewer than 0.1%) or have unknown status (less than 0.25%); they are excluded from the analysis.

8. All SASS and TFS sample sizes in the article are rounded to the nearest 10 as per NCES restricted-use data requirements.

9. 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 activities during a typical FULL WEEK at THIS school?”

10. This is a more accurate measure of family resources at the school level than is family income in the school’s zip code, but it is not available in the TFS, which is why the specifications in Table 8 use family income in the school’s zip code as a measure of school resources.

11. A small number of schools in the main sample do not fit into these categories, as they offer combined grade levels. They are excluded from the samples in Table 9.

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