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Have U.S. Education Reforms  
Increased Teachers' Work Hours?**

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## **ABSTRACT**

### **Incentives and Effort in the Public Sector: Have U.S. Education Reforms Increased Teachers' Work Hours?**

Beyond some contracted minimum, salaried workers' hours are largely chosen at the worker's discretion and should respond to the strength of contract incentives. Accordingly, we consider the response of teacher hours to accountability and school choice laws introduced in U.S. public schools over the past two decades. Total weekly hours of full-time teachers have risen steadily since 1983 by about an hour, and after-school instructional hours have increased 34 percent since 1987. Average hours and the rate of increase also vary widely across states. However, after accounting for a common time trend in hours, we find no association between the introduction of accountability legislation and the change in teacher hours. We conjecture that the weak link between effort and compensation in most school reforms helps explain the lack of such an association.

JEL Classification: I21, I28, J22, J44, J45

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## 1. Introduction

Among salaried workers, the decision to supply weekly work hours beyond some nominally contracted amount is generally left to the employee's discretion. Thus, weekly hours play a role analogous to that of effort in principal-agent models: Increased hours raise the worker's expected output, thereby raising employee compensation by an amount that reflects the strength of incentives in the employment contract. For salaried workers, an increase in the degree of "incentivization" in the contract should therefore raise the equilibrium level of hours worked.

In recent years, partly in response to concerns that public schools and their teachers faced inadequate incentives to improve student performance, states have passed a variety of accountability and school choice laws designed to strengthen those incentives. These laws include mandatory testing of all students in at least some grades with scores publicly reported by school; sanctions for schools with low student performance; rewards for schools with high student performance; and charter school laws. States introduced these education reforms asynchronously, thus providing a promising "natural experiment" for evaluating their effects. The goal of this paper is to ascertain whether these laws increased the hours worked by full-time public school teachers. Understanding the effects of reforms on teacher hours adds an additional perspective to the burgeoning literature examining their effects on student performance.<sup>1</sup>

Using data from the Current Population Survey (CPS) from 1983 to 1998, and the Schools and Staffing Surveys (SASS, waves 1987 through 1999), we show the following. First, the usual weekly hours worked by full-time teachers, as well as the extra after-school hours they reported in the SASS, increased steadily over this period of expanding educational reform. Second, long-

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<sup>1</sup> See for example Ladd (1999), Grissmer et al. (2000), and Murnane and Levy (2001) on the impact of accountability reforms; Hanushek et al. (2001) on the impact of charter schools.

term increases in neither of these variables are well explained by changes in the composition of the teacher work force across a variety of dimensions, such as age, gender, race and union status. Third, while pooled regressions across years and states suggest positive effects of accountability and choice reforms, the common time trends in hours and reforms drives these results. After including either year fixed effects or state specific time trends, we find no connection between the observed increase in teachers' work hours and education reforms: hours increases were no greater in states that adopted reforms than in states that did not.

These findings are consistent with the work of other authors (e.g. Figlio and Lucas 2000; Kane and Staiger 2002) who point out that the connection between school-level performance and individual teacher salaries is not direct in many U.S. reforms<sup>2</sup>. Problems include small rewards, large elements of randomness, nonmonotonicity of rewards in performance (badly-performing schools are often offered extra resources), incentives that are poorly understood by the participants, and numerous possibilities for gaming the system.

## **2. Trends in Teacher Hours**

Our analysis focuses on two distinct measures of teacher work hours, taken from different data sets. One measure, taken from the Current Population Survey Outgoing Rotations, is the total number of hours worked in a usual week at a respondent's primary job. This includes both hours spent in the workplace and at home, and (importantly) excludes any hours worked on other jobs.<sup>3</sup> Attractive features of the CPS are that it has annual data on total hours that is consistently

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<sup>2</sup> This is in contrast to Lavy's findings (2002) in an (Israeli) context where the connection between school-level performance and individual teacher salaries was relatively direct and clearly understood by the participants.

<sup>3</sup> Conveniently, the interviewing instructions explicitly refer to teachers as an example, and state that the hours they spend grading and preparing lessons at home should be counted along with hours at school.

reported across the years in our sample<sup>4</sup>, it allows for comparisons with non-teachers, and since 1983 it has recorded whether or not an individual is covered by a union contract. A limitation is small sample sizes in some states and years; for some of our analysis the CPS data is therefore pooled over 4-year intervals.

A distinct indicator of teacher work hours is taken from the Schools and Staffing Survey (SASS). The SASS is a survey of public and private school teachers, with detailed information about personal and school characteristics.<sup>5</sup> The survey was administered in 1987, 1990, 1993, and 1999. Our analysis of SASS data focuses the number of hours spent by teachers after school *without* students preparing lessons, grading, and in other instructional activities. These extra instructional hours seem more likely to be sensitive to incentives based on students' academic performance than hours spent after school coaching or running the yearbook, or hours that are determined by the length of the school day.<sup>6</sup>

To avoid conflating different levels of teacher effort with the mix of part and full time teachers, our CPS sample is restricted to teachers employed 35 or more hours a week. It is also restricted to salaried individuals aged 22-61. The SASS sample includes only teachers who report a full time appointment. Both samples only include public elementary and secondary school teachers. The CPS sample is also restricted to individuals with no self-employment income, and who were not in school, and who have at least a bachelor's degree, and to interviews in September through May to avoid typical vacation months. Washington, DC is excluded from

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<sup>4</sup> The particular hours question we use was not affected by the 1994 CPS redesign. See Kuhn and Lozano (2002).

<sup>5</sup> The probability a school is sampled in the SASS is proportional to the square root of the number of teachers in the school. As a result, the SASS oversamples large schools. Sampling weights are however provided to generate means for a nationally representative sample of teachers; these are used throughout this paper whenever means are computed.

<sup>6</sup> The wording of the required (in school) hours question in the SASS changed over time, making it a somewhat less reliable indicator of trends in effort.

the CPS sample because several of the sources for educational reform policies excluded it in their reports.

Trends in teacher work hours are reported in the top row of Table 1 for the CPS and of Table 2 for the SASS. In the CPS, pooling four adjacent sets of years (1983-86, 1987-90, 1991-94, and 1995-98) yields a sample of between 9 and 11 thousand teachers in each of those four periods. These data show a fairly steady increase from about 43 hours in the early 1980s to about 44 hours in the late 1990s. The SASS, which covers over 19,000 teachers in each of four individual years (1987, 1990, 1993 and 1999) shows that extra instructional hours have risen steadily from 7.18 hours in 1987 to 9.63 hours in 1999.<sup>7</sup>

Both surveys also show that the level and change in hours varied significantly across states, suggesting a possible role for legislative effects. Figure 1 plots the average number of hours worked in the early 80s in each state against the number of hours worked in the late 90s as reported in the CPS. A solid line is drawn at 45 degrees: states along this line experienced no change in mean teacher hours over this period. In the states with the highest reported teacher hours in the late 1990s, full time teachers worked at least 5 hours per week longer than in states with the lowest hours.<sup>8</sup> Trends also varied: in four states hours rose by 2.5 or more while in 7 states teacher hours actually declined by half an hour or more.

One potential explanation for the trend in teacher hours is demographic changes in the teaching workforce or changes in school characteristics. For example, if newly hired teachers work longer hours and the share of newly hired teachers increased over this period, changes in the share of new hires may explain some of the trend in hours. To assess the impact of

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<sup>7</sup> As noted the wording of the question about hours spent in school has changed, making it difficult to compare total hours across years, but it appears that most of the increase in total hours is due to an increase in hours spent after school in instructional activities.

compositional changes, Tables 1 and 2 report average teacher characteristics for our CPS and SASS samples respectively. According to Table 1, teachers became older, more female, and fewer of them taught in secondary schools. There was little change in the share of teachers who are nonwhite. The fraction of teachers covered by a union eroded over this period, even though there have been few legal changes to affect the status of unions since 1983.<sup>9</sup> According to Table 2, despite the aging of the teacher workforce, there was an increase in the share of newly hired teachers, leading to an erosion of average teacher experience. At the same time there was a rise in the share of minority students and in students receiving free lunches, and a decline in the pupil-teacher ratio.

Tables 3 and 4 report coefficients from teacher work hour regressions in each of the cross sections described in Tables 1 and 2. Because the percent covered by union contracts is a state/year level mean<sup>10</sup>, standard errors in these and all subsequent regressions in this paper are adjusted for possible dependence of observations within each state/year cell following Moulton (1986). The CPS results indicate that female teachers tend to work fewer total hours, particularly in the early periods, with no statistically significant difference in the late 1990s. In the SASS, female teachers work about 1.7 hours more than male teachers in after-school instructional activities, something that remained unchanged since 1987. Gender differences in after-school hours with students (e.g., coaching) disappear by the later periods, leading to a convergence in total hours.

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<sup>8</sup> In each of the four SASS survey years, the correlation across states between CPS and SASS measures of total teacher hours is between .7 and .8. Clearly, these differences across states in mean teacher hours reflect more than just sampling error.

<sup>9</sup> The only three substantive changes are the introduction of right to work laws in Idaho in 1986, Texas in 1993, and Oklahoma in 2001.

<sup>10</sup> We chose to use the statewide mean of union coverage rather than individual union coverage because of concerns that the effects of union strength in a state were more likely to “spill over” to all public school teachers in the state.



Both surveys also show that nonwhite teachers tend to work fewer hours, and that new teachers work longer hours. In the SASS, teachers with three or less years of experience work over an hour longer after school than more experienced teachers, and in the CPS younger teachers (ages 22-25) tend to work longer hours than teachers in the middle of their careers, although this effect is not statistically significant. In neither survey does holding an advanced degree appear to affect hours. Secondary school teachers work longer total hours, but this appears to be due to their extra work after school with students in activities like coaching or directing the school play. Extra instructional hours are lower for secondary school teachers.

The hours regressions in Tables 3 and 4 also include the percentage of teachers in the respondent's state and year who report that they are union members or are covered by a collective bargaining agreement in the CPS survey. Unions may attempt to raise the number of full time teachers relative to part time teachers, but at the same time may work to reduce the hours of full time teachers. Schools with stronger teachers unions may have difficulty firing teachers that exert less effort. Unions may also be associated with more free periods for preparation<sup>11</sup> or smaller classes, as Caroline Hoxby has argued (1996).

The percentage of teachers who are covered by a union agreement in a state is negatively associated with work hours in the early periods of both surveys. However, in both surveys this negative correlation evaporates by the end of the time period. In the CPS the negative coefficient declines in magnitude and significance over time. In the SASS, the effect of unionization is initially negative, but becomes monotonically larger and more positive in each wave.<sup>12</sup> Even though—as we show below—changes in union coverage cannot explain changes in

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<sup>11</sup> This mechanism seems particularly relevant to our SASS measure of hours, since time spent preparing during school hours can substitute for time spent after school hours doing the same thing.

<sup>12</sup> The effect of unions on total hours, as reported in the SASS, is more similar to the CPS results: unions consistently have a negative effect on total hours, and this effect dissipates over time.

teacher hours over the last twenty years, this change in the union coefficient suggests that a change in union *policy* towards teacher hours may have played a role. Possible reasons behind such a policy change—in particular, certain forms of parental pressure that are not captured by our school reform measures—are explored in Section 5 of this paper.<sup>13</sup>

The SASS results in Table 4 also indicate that school characteristics affect extra instructional hours. Hours are lower for teachers in rural areas and towns than in cities and suburbs. Hours also tend to be higher in schools with higher pupil teacher ratios. One of the strongest predictors of extra instructional hours is the percentage of students who are eligible for free lunches. An additional ten percent of students receiving free lunch is associated with a reduction of 10 to 15 minutes of extra instructional hours each week. This means that teachers in schools one standard deviation below the free-lunch mean (i.e. schools where 3 percent of students receive free lunch) work nearly 40 hours more each year than teachers in schools one standard deviation above the mean share receiving free lunch (50 percent of students receive free lunch). The percentage of students who are minorities does not have an additional impact.

How much of the trend in hours can the compositional changes in teacher and school demographics explain? The Oaxaca decomposition provides bounds for the potential effect of characteristics, using the change in teachers' average characteristics multiplied by either the coefficient vector in the first period  $((\bar{X}_4 - \bar{X}_1)\hat{\beta}_1)$  or the final period  $((\bar{X}_4 - \bar{X}_1)\hat{\beta}_4)$ . Using means from Table 1 and regression coefficients from Table 3, Oaxaca decompositions on the CPS data indicate that the change in teacher characteristics explains at most 4 percent of the increase in hours over this entire period.<sup>14</sup> In large part, this was because teacher characteristics

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<sup>13</sup> In an earlier draft of this paper, we examined interaction effects between union coverage and various reform measures. Overall, the change in the effect of unions on hours was *not* correlated with the adoption of education reforms in a state.

<sup>14</sup> Detailed results available on request.

were relatively stable over this period. The decline in teacher unionization generates the largest predicted increase in hours: had all else remained the same, the decline in unionization could account for 12 percent of the actual rise in hours. However, changes in other characteristics offset even this part of the decline. Similar trends are present in the SASS data, where the change in teacher characteristics explains at most 3 percent of the observed hours increase. Overall, therefore, changes in measured teacher and school characteristics do not appear to explain much of the increase in teachers' total hours or after-school hours.

### **3. Education Reform Policies**

The rise in teacher hours raises the question of whether education reforms enacted during this period have resulted in greater workloads for teachers. During this period, a number of reforms were enacted. Four types of reforms seem especially likely to affect teachers' hours: standardized testing with scores publicly reported by school, laws imposing sanctions on schools with low levels of student performance, laws mandating financial rewards for schools where students perform at high levels, and charter school laws. Prior to 2001, these laws were set by states. The federal "No Child Left Behind" Act of 2001 imposes similar accountability reforms on all schools, requiring public test scores reports and school choice for students in persistently "failing" schools.

The underlying premise of these accountability reforms seems to be that reporting, rewarding, and penalizing schools based on results will promote greater effort on the part of teachers and schools. As *Education Week* put it in their 1999 review of accountability plans,

“The assumption seems to be that if performance is the problem, what's missing is the will: Find the right combination of carrots and sticks, and effort and achievement will follow.”<sup>15</sup>

Proponents of charter school laws also argue that competition from charter schools will increase performance in regular schools as well. If school choice plans do induce competition in the form of increased effort, hours should be one indicator. Charter schools also allow for non-union contracts, and the reduction in the role of unions may also affect hours. Alternatively, choice plans may simply allow parents to satisfy different preferences along other dimensions, and hours might not be sensitive to these policies. Hoxby (2002) claims that teachers work longer hours in areas with greater school choice.

As noted, most of these reform measures were introduced during the period in which teacher hours rose. Table 5 lists the number of states in each period with standardized test scores that are reported by school, with a law imposing sanctions on schools with low levels of student performance, with a law mandating financial rewards for high student performance, and with a charter school law.<sup>16</sup> The years these measures were introduced in each state are included in the appendix, along with the sources for each.

The trend towards accountability laws is clearly evident in Table 5, with almost universal testing in the late 90s. (Federal law in 1994 required some form of standardized testing.) By the late 1990s, nearly half of all states went beyond simply reporting scores and could potentially sanction schools with low student performance by taking over schools, reconstituting them or

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<sup>15</sup> <http://www.edweek.com/sreports/qc99/ac/mc/mc-intro.htm>

<sup>16</sup> Information on accountability legislation was compiled Lexis-Nexis searches for years prior to 1996, corroborated with periodic reports from the Education Commission of the States and “Legislative Updates” reported in Education Week. Education Week’s Quality Counts reports accountability laws beginning in 1997. States are coded as having sanctions if they penalize low performing schools, and are not coded as having sanctions if they simply designate low performers or provide extra funds. Information on charter school laws is from the Center for Education Reform. Details of all sources and dates are in the appendix. In a few states, a reform may be in place in one year only to be removed and then reinstated later. This is often the case when a state changes tests, for example. States are counted as having a reform for the entire period if the change is not permanent.

withholding funds. About a third gave financial incentives to schools with high student performance or large improvements. Closer inspection of individual state policies reveals a high degree of diversity in statutes (e.g., states varied in the amount of financial rewards or in the probability that sanctions were actually imposed). Charter school laws were also introduced in the 1990s and quickly gained popularity. By 1998, 34 states had passed such laws. However, most states did not have large proportions of students enrolled in charter schools by the end of the sample period.

A common feature of all of the reforms described above is that, in our reading, the connection between individual teacher performance and individual teacher compensation in most states is weak. Incentive plans may give more money to a high performing school, but individual teachers are not generally targeted. Furthermore, the links between teacher effort, student outcomes, and the incentives and sanctions seem tenuous at best. The most common form of accountability plans base incentives and sanctions on levels of student achievement. These may target schools with high levels of student effort and ability, rather than identifying schools with high levels of “value added” by teachers. In states that do compare students’ gains or average scores over time, Kane and Staiger (2002) find that small class sizes may produce performance measures that are influenced significantly by sampling error. The connection between teacher effort and receiving a reward may therefore not be tight. In these cases, it is unclear how much effect an accountability plan would have on teachers’ incentives.

Even if teacher effects on students’ test scores can be clearly measured, critics of accountability reforms argue that the link with teacher effort may still be weak. Some argue that teachers may simply “teach to the test” and omit more challenging material. Accountability laws accompanied by detailed state content standards may also reduce lesson preparation time if the

standards are highly prescriptive. Additionally, accountability laws may only affect teachers on the critical margins. Teachers whose school's performance levels are close to the critical values that trigger sanctions or incentives may alter their behavior, but teachers farther from the margins may have no real incentive to change. Teachers may also reallocate their attention to focus on students are near critical thresholds, but not increase their effort overall. Jacob (2002) and Figlio and Getzler (2002) provide evidence that suggests these types of responses.

#### **4. Effect of Reform Policies on Teacher Hours**

To assess the effects of state-level programs on teacher hours, Table 6 presents estimates of various regression models that pool data from all years of our CPS data, from 1983 to 1998. The regressions include all the control variables in Table 3 plus an indicator for the presence, in that state and year, of one of the four following types of education reform: charter schools, incentives, sanctions, and testing. Because many states introduced several reforms simultaneously, separate regressions are run for each type of reform.<sup>17</sup> Row 5 attempts to estimate an overall effect of reform using an indicator that assigns a value of .25 to each individual reform, then sums these values. Thus the coefficient on this indicator compares a state with all four reforms in place to one with none.

The first column of Table 6 shows estimates that do not control for state or year fixed effects; they show generally positive and significant coefficients. The charter school coefficient in column 1, for example, indicates that the presence of charter school legislation in a public school teacher's state is associated with .59 more hours of work per week. However, this could also reflect fixed, unobserved differences between states that have little to do with a causal effect

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<sup>17</sup> Regressions including all three reform measures tend to produce results that are even more muted for each measure.

of school reform laws. Accordingly, the specification in column 2 includes state fixed effects. All four reforms (and our aggregate reform measure) remain positively (and significantly) correlated with hours; in fact the estimated effect of reforms increases in three of five cases when state fixed effects are added. However, these coefficients could reflect –at least in part-- the common time trend in hours and the introduction of accountability laws. When year fixed effects are added to the specification in column 3, there are no significant effects of any kind of reform legislation on hours: the positive estimated effect of reforms appears to be an artifact of a time trend that is common to *all* states, whether they implement reforms or not.

A remaining possibility is that the introduction of school reform legislation is correlated with unobserved state-specific shocks to teacher hours that are not constant through time. For example, states with deteriorating student achievement or teacher effort may be more likely to enact educational reforms earlier. This could disguise a true, positive causal effect of reforms on hours in our data. Alternatively, socially-conservative states may be most likely to pass school reforms and also have the smallest rate of increase of women’s work hours over time. Since teachers are disproportionately women, this, too, could induce a spurious negative correlation between the introduction of education reforms and the increase in teacher work hours. In the final column (number 4) of Table 6 we address this issue by replacing the 15 year effects by a set of state-specific, quadratic time trends (100 variables in all). Again, none of the reforms has a significantly positive effect, the point estimates fall even further, and are in most cases quite close to zero.

While our point estimates in columns 3 and 4 of Table 6 are all relatively close to zero, and nearly as many are negative as positive, it is still legitimate to ask whether our estimates can conclusively rule out a positive effect of reforms on teacher hours of substantial magnitude.

Previous results showed that total teacher hours increased by about one hour between 1983 and 1998, little of which is explained by changes in teachers' observed characteristics. Between 1983 and 1998, the mean of the row-5 policy variable among teachers in our data increased from .118 to .714. Thus, in order for the policy changes that occurred to explain the one-hour increase in teacher hours that occurred, the coefficient in row 5 would need to be  $1/(\.714-.118)$ , or 1.68. This figure is clearly outside the 99 percent confidence interval of our preferred point estimates in columns 3 and 4. In fact, based on these statistics we can state with 95% confidence, that the total effect of all the education reforms enacted between 1983 and 1998 was to raise teacher hours by no more than a half hour per week.

Table 7 reports results parallel to Table 6 using the SASS data set. Since only 4 years of SASS data are available, column (4) uses only a linear time trend. Overall, the results are similar, and if anything are less supportive of a positive effect of education reforms on teacher hours. Again, several of the reforms have significantly positive effects when only state fixed effects are included. However, these effects are almost entirely due to a common time trend in hours and charter school legislation. In fact, six of the eight coefficients in the preferred specifications of columns (3) and (4) are negative. Using row 5 to pose the same question as in the previous table, we note that after-school hours rose by 2.5 over our sample period. For the policy changes to explain all of this increase, a coefficient of  $2.5/(\.659-.282)$ , or 6.63 would be required. We can easily rule this out at a 99% confidence level in both specifications; in fact at this level of confidence we can rule out a scenario in which the policy changes explained as little as 11 percent of the increase that occurred.

Finally, in both Tables 6 and 7 it is worth noting that the coefficients of the other, "control" variables –not reported but available on request-- behave much as in the pure cross-section



regressions of Tables 3 and 4. The pupil-teacher ratio is significantly positively related to teacher hours in both estimates, with estimates clustering around .2 in the CPS and .03 in the SASS. The effects of teachers' and schools' characteristics are similar to those reported in the cross-sections.

A number of checks to ensure the robustness of the Table 6 and 7 findings were conducted. One concern was that many reform measures are quite recent, and there is less time to observe the effects for recently enacted measures. To check whether reforms take time to take effect, we replaced the indicator for the presence of a reform with a cumulative index variable for the number of years a reform has been in place.<sup>18</sup> This variable is always zero in a state that never implements the particular reform. Under this alternative specification, the results were little changed, with one exception. In the CPS data, charter school laws had significantly positive effects on teacher hours in the specifications with year and state fixed effects. Because charter school laws are relatively new, and because the growth of charter schools also occurs with a lag, this specification may be the most appropriate for charter school laws. However, in the regressions with state specific quadratic time trends, the effect of charter school laws was essentially zero (coeff = -.02), suggesting that this result is not stable across different specifications.

Alternatively, reforms potentially might have their biggest impact on hours in the years immediately following passage of the new law. Hours might be high initially as teachers change lesson plans and make other instructional adjustments. In later years hours might then return back to their original levels. To check whether these policies have a temporary effect, we coded

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<sup>18</sup> Of course, reforms may take only a few years to achieve their full impact and then may not produce any more incremental increases in teacher hours. Capping the cumulative index of the number of years a reform is in place to reflect this produces results similar to those reported above.

a reform as “1” only in the first three years following the passage of a new reform and as zero in all other years. None of the reforms ever had a significantly positive coefficient.

As noted, most individuals appear twice in our CPS MORG sample, with interviews that are one year apart. However, because the CPS does not identify individuals, the standard errors cannot be corrected precisely to account for multiple observations of each person. To place bounds on the possible importance of this issue, we took the extreme approach of dropping all individuals who were being interviewed for the first time, effectively halving the sample but ensuring that no person appeared more than once in our data. Most of the coefficients were not changed dramatically, and standard errors were still low enough to rule out effects of the legislation on hours similar to those ruled out in our discussion of both Tables 6 and 7.

## **5. What *Does* Explain the Increase in Teacher Work Hours?**

It is clear from our data that full-time public school teachers experienced a steady increase in their work hours during the last two decades of the twentieth century. We have also argued, so far, that neither changes in the observed characteristics of teachers, nor the education reform policies enacted during this period, can account for this increase. Why then are teachers now putting in more hours?

While it is not the goal of this paper to provide a final answer to this question, we provide two pieces of evidence in this section that may shed some light on this issue. First, to put the time trend in teachers’ work hours into context, Figure 2 plots mean teacher hours from our CPS data against those of three alternative comparison groups: the average hours of workers who are not teachers; the average hours of female nonteachers; and the average hours of nonteachers with similar observed characteristics to teachers. In all these cases we restrict attention –as we did

among teachers-- to full-time workers (35 or more hours per week). Details of how the latter series was constructed are provided in Appendix 2; essentially we construct a “basket” of nonteachers with a similar age, sex, education, union, etc. mix to teachers, allowing that mix to change over the years to mirror changes in the mix of the teacher population.

It is clear from Figure 2 that the increase in teacher hours during our sample period was similar to that experienced by most other workers. In fact, relative to nonteachers, teachers’ hours increased more slowly, and certainly more slowly than the hours of nonteaching women. However, in a comparison not included in Figure 2, other public sector workers appeared to have even slower rates of increase. In sum, the recent increase in teacher work hours is not at all exceptional when seen in the context of changes in work hours among comparable groups in the labor market.<sup>19</sup> The increase in teacher work hours over this period may therefore be driven simply by the same unmeasured factors that led to a general, secular increase in hours. Factors such as the increased ease of substituting market inputs for nonmarket inputs to home production come to mind.

Because teachers are disproportionately women, the above argument raises the question of whether the increase in teacher hours is driven by secular changes in labor force commitment common to women specifically. To explore this hypothesis more closely, we conducted a series of regressions of the long-term change in teacher hours on long-term changes in the hours of various comparison groups across the 50 states over this period. These are reported in Table 8, separately for male teachers (columns 1-3) and female teachers (columns 4-6). To understand this table, note that column 1 regresses the change in the hours of male teachers on those of male

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<sup>19</sup> The discussion of hours changes relative to different groups of nonteachers raises the possibility of using them more formally as a control group in a double- or triple-difference estimation strategy. We considered, then rejected this approach on the grounds that teachers in other states (but with different reform provisions) seemed a more natural control than private-sector workers, or even police or firemen, in one’s own state.

nonteachers. The coefficient is  $-.67$ , indicating a negative but statistically insignificant correlation. Hours changes of female teachers are also negatively and insignificantly correlated with hours changes of male nonteachers (column 4). In contrast, looking across states the secular change in the hours of both male *and* female teachers is positively correlated with changes in female nonteachers' hours (columns 2 and 5). The fact that this correlation also applies to *male* teachers rules out the simple hypothesis that the increase in teacher hours is driven by changes in the labor force commitment of all women.<sup>20</sup>

An example of a hypothesis that would be more consistent with the results in Table 8 would be a “parental pressure” story. In such a hypothesis, mothers working longer hours would insist on harder-working teachers, regardless of the teacher's gender. For instance, the increase in mother's work hours may decrease the number of hours they spend in the home production of education, which in turn raises their demand for “school production” as a substitute.<sup>21</sup> To explore this hypothesis a little further, columns 3 and 6 restricts the comparison group of female nonteachers to women between the ages of 35 and 50, when they are most likely to have school aged children.<sup>22</sup> The correlation between the hours of this group and those of both male and female teachers is now positive and statistically significant.

## 6. Conclusion

The average weekly work hours of teachers have risen steadily since 1983, with an overall increase of about an hour per week. The hours teachers spend after school without students

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<sup>20</sup> Note that hours increased among *both* male and female teachers over our sample period. Disaggregating row 1 of Table 1 by gender shows an increase in total hours of 0.55 hours for men, versus 1.13 hours for women. Disaggregating row 1 of Table 2 yields essentially identical increases in after-school instructional hours of 2.3 for both male and female teachers.

<sup>21</sup> Flyer and Rosen (1997) present a similar argument in explaining the rise in the number of teachers per student.

<sup>22</sup> In the 1990 Census, about 63 percent of women in this age group who work at least 35 hours per week have children over the age of 5 living with them.

increased even more, rising about two and a half hours per week—a 34 percent increase. Considering these trends in the light of the recent explosion of education reforms across U.S. states, it is tempting to conjecture that greater “incentivization” in teachers’ employment contracts induced by these reforms has, at least in part, induced America’s teachers to put in a few extra hours, especially grading papers or preparing better lessons after school.

According to the results in this paper, succumbing to the above temptation would lead a researcher astray. Once we adjust for a common time trend in teacher hours across *all* states, we can detect no association between the adoption of any of four distinct types of reforms—charter schools, incentives, sanctions, and testing—and changes in teacher work hours. Further, our estimates allow us to reject with 99 percent confidence a total effect of all the reforms adopted between 1983 and 1998 on the teacher work week in excess of (plus) one hour. An effect of 30 minutes can be ruled out with 95 percent confidence. Finally, we can say with 99 percent confidence that reforms account for less than less than 11 percent of the 2.5-hour increase in teachers’ mean after-school instructional hours.

We conjecture that the lack of an effect of education reforms on teacher hours may be due to the weak connection between individual teacher effort and rewards that characterize most of the reforms that have been implemented: when examined closely one would not necessarily *expect* these reforms to have much of an effect on individual teachers. While reforms with more high-powered incentives might of course be more successful in increasing teacher effort, it is of course also worth noting that high-powered incentives may have other disadvantages that would need to be considered when adopting such policies.<sup>23</sup>

What *does* then explain the increase in teacher hours over the last two decades in the U.S.? In this paper we suggest two potential hypotheses to be explored in future research. One answer

essentially invokes the same set of unobservables that caused a secular rise in nonteacher hours over this same period: the increase in teachers' hours was in fact smaller than the hours increase among a comparable group of nonteachers, and is in that sense, nonremarkable. Second, we note that secular increases in the work hours of (both male and female) teachers across states are positively and significantly correlated with secular increases in the work hours of nonteaching women who are likely to have school-age children. This suggests a "parental pressure" hypothesis that may be worthy of further examination.

Finally, it is of course possible that U.S. education reforms have caused changes in teacher behavior that are beneficial to students, or that raise school performance indicators, without affecting teachers' work hours. Teachers could have intensified their work effort per hour without increasing the number of hours worked, or –again without increasing total hours-- could have changed the mix of activities during their day towards activities that are rewarded. Especially given the inconclusive nature of the literature to date on the effects of education reforms on students, we cannot rule these possibilities out. Indeed, an "optimistic" reading of our results would be that any increases in student performance that *were* generated by the reforms were achieved at no detectable cost in teacher workload (at least on the extensive, hours margin). Overall, however, it seems to us that the case for a beneficial effect of the reforms on students is weakened, rather than strengthened by the lack of a detectable effect on teachers' measured inputs to the education process.

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<sup>23</sup> See Jacob (2002), Figlio and Getxer (2002) Jacob and Levitt (2003) for examples.

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## Appendix 1: Education Reform Policies

**Table 1A : Year Reform Measure Enacted**

	Incentives	Sanctions	Testing	Charter School
<b>Alabama</b>		1995	1983	
<b>Alaska</b>			1989	1995
<b>Arizona</b>			1983	1994
<b>Arkansas</b>		1983	1991	1995
<b>California</b>			1983	1992
<b>Colorado</b>			1996	1993
<b>Connecticut</b>	1988	1988	1983	1996
<b>Delaware</b>			1983	1995
<b>Florida</b>	1991	1991	1983	1996
<b>Georgia</b>	1985	1985	1983	1993
<b>Hawaii</b>			1983	1994
<b>Idaho</b>			1984	1998
<b>Illinois</b>		1991	1986	1996
<b>Indiana</b>	1987		1986	2001
<b>Iowa</b>				
<b>Kansas</b>			1983	1994
<b>Kentucky</b>	1990	1984	1996	
<b>Louisiana</b>			1987	1995
<b>Maine</b>			1985	
<b>Maryland</b>	1996	1994	1983	
<b>Massachusetts</b>		1993	1996	1993
<b>Michigan</b>		1993	1983	1993
<b>Minnesota</b>			1996	1991
<b>Mississippi</b>			1983	1997
<b>Missouri</b>		1998	1995	1998
<b>Montana</b>			1992	
<b>Nebraska</b>				
<b>Nevada</b>		1997	1983	1997
<b>New Hampshire</b>	1996		1993	1995
<b>New Jersey</b>	1996	1988	1983	1996
<b>New Mexico</b>	1989	1990	1983	1993
<b>New York</b>		1996	1983	1998
<b>North Carolina</b>	1995	1995	1983	1996
<b>North Dakota</b>			1990	
<b>Ohio</b>		1989	1989	1997
<b>Oklahoma</b>			1986	1999
<b>Oregon</b>	1997		1984	1999
<b>Pennsylvania</b>	1997		1991	1997
<b>Rhode Island</b>			1987	1995
<b>South Carolina</b>	1984	1984	1983	1996
<b>South Dakota</b>			1985	
<b>Tennessee</b>			1983	
<b>Texas</b>	1994	1989	1990	1995
<b>Utah</b>			1990	1998
<b>Vermont</b>		1997	1991	

<b>Virginia</b>			1988	1998
<b>Washington</b>	1995	1988	1983	
<b>West Virginia</b>			1983	
<b>Wisconsin</b>			1989	1993
<b>Wyoming</b>			1998	1995

Date refers to the first appearance since 1983. 1983 dates may indicate policies that predate 1983.

Sources for date reform policy was enacted:

Charter school laws:

- Center for Education Reform ([www.edreform.com/charterschools/](http://www.edreform.com/charterschools/)) lists year charter schools were permitted for each state.

Incentives and Sanctions:

- Todd Ziebarth, *Rewards and Sanctions for Schools and School Districts*, Education Commission of the States, (1999 and 2001) lists statutes, public bills, and legislative acts for accountability laws.
- The original date for the law was taken from a Lexis-Nexis search for the current code or act.
- Laws that preceded currently enacted legislation were taken from the history of the law or when unavailable from searches of monthly "Legislative Updates" in *Education Week*.

Testing:

- Education Week, *Quality Counts* (1997-2001) lists states with criterion or norm referenced tests;
- Council of Chief State School Officers, *Annual Survey of State Student Assessment Programs*, (1994-2001),

Historical information from

- Kino, Mary, *The State of Assessment Program: What are State Wide Assessment Programs Doing?* Paper presented at the Annual Meeting of the National Council on Measurement in Education (Boston, MA, April 17-19, 1990).
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## Appendix 2: Derivation of Nonteacher Hours Series

This appendix describes the creation of the fourth comparison series to teacher hours presented in Figure 2. This series estimates mean hours worked for a group of nonteachers with observed characteristics to teachers in each year. We began by estimating the following regression for all full-time employed persons (working 35 or more hours per week) who are not teachers in the entire pooled 1983-1998 CPS data:

$$H_i^N = a^N + bX_i^N + c^N S_i Y_i \quad (A1)$$

where  $H_i^N$  is the work hours of an individual nonteacher  $i$ ;  $X$  includes indicators for ages 22-25 and 51-65, female, nonwhite, an advanced degree, and month of interview; and  $S_i Y_i$  is a full set of interactions between 49 state fixed effects and 15 year effects (799 year x state effects in all).

Then we used the estimated coefficients from this regression to calculate:

$$\bar{H}_i^{NT} = a^N + b\bar{X}_i^T + c^N S_i Y_i \quad (A2)$$

$\bar{H}_i^{NT}$  is the predicted mean hours of nonteachers with the characteristics of teachers in teacher  $i$ 's state and year. It is calculated using the nonteacher regression coefficients, the state x year effects, monthly indicators, and teachers' mean characteristics  $\bar{X}_i^T$ , which gives the mean values of the age, gender, nonwhite and education dummies for teachers in that year (but not that state). To be clear,  $\bar{X}_i^T$  takes 16 distinct values, one for each of the 16 years (1983-98) of data.

Note that the specification in (A1) and (A2) restricts the state-by-year effects to be the independent of the level of observed characteristics,  $X$ . To relax this assumption we constructed several alternative measures (some regression-based, some nonparametric) that allow hours trends to be different for nonteachers with  $X$ 's more similar to teachers (e.g. a college-educated, predominantly female population) than for other nonteachers. The results were very similar.

**Table 1: Average Weighted Teacher Characteristics, CPS Sample**

	<b>1983-86</b>	<b>1987-90</b>	<b>1991-94</b>	<b>1995-98</b>
Weekly Work hours	42.88 (.065)	43.47 (.072)	43.83 (.078)	43.80 (.084)
Age 22-25	.053 (.002)	.051 (.002)	.054 (.002)	.051 (.003)
Age 51-65	.158 (.004)	.161 (.004)	.171 (.004)	.210 (.005)
Female	.664 (.005)	.684 (.005)	.709 (.005)	.719 (.005)
Nonwhite	.104 (.003)	.102 (.003)	.094 (.003)	.107 (.004)
Teacher has Advanced Degree*	.546 (.005)	.57 (.005)	.503 (.005)	.463 (.006)
Teaches in a Secondary School	.484 (.005)	.459 (.005)	.43 (.005)	.413 (.005)
Covered by Union Agreement	.790 (.004)	.775 (.005)	.759 (.005)	.751 (.005)
N	11,822	11,101	10,877	9,027

Standard Deviations in Parentheses. All means calculated using CPS individual weights.

\* Prior to 1991, schooling is reported as number of years, so individuals with more than 4 years of college are designated as having more than a BA. After 1991, the CPS records an individual's highest degree, and this category includes those with MA's or higher.

Weekly Work hours refers to usual hours of work in main job; main job is the job with highest usual hours.

**Table 2: Average Weighted Teacher Characteristics: SASS Sample**

	<b>1987</b>	<b>1990</b>	<b>1993</b>	<b>1999</b>
After school hours without students	7.18 (.142)	8.28 (.188)	9.04 (.223)	9.63 (.262)
Total experience (years)	15.24 (.332)	15.69 (.392)	15.80 (.395)	14.93 (.330)
New Teacher (1-3 yrs experience)	.090 (.006)	.102 (.008)	.115 (.008)	.161 (.005)
Female	.675 (.013)	.685 (.014)	.696 (.012)	.748 (.011)
Nonwhite	.130 (.013)	.126 (.013)	.130 (.014)	.146 (.019)
Teacher has Advanced degree	.470 (.024)	.448 (.027)	.465 (.028)	.446 (.028)
Teaches in a Secondary School	.517 (.005)	.494 (.007)	.551 (.009)	.483 (.012)
Union Coverage*	.717 (.037)	.704 (.043)	.700 (.043)	.680 (.043)
City	.265 (.023)	.254 (.020)	.258 (.025)	.241 (.021)
Town/rural	.455 (.031)	.471 (.030)	.459 (.030)	.256 (.030)
Pupil-teacher ratio (schoolwide)	16.18 (.562)	16.05 (.602)	16.54 (.636)	15.45 (.543)
Share of students receiving free lunch (schoolwide)	.276 (.012)	.307 (.015)	.322 (.014)	.360 (.018)
Share of minority students (schoolwide)	.271 (.027)	.278 (.030)	.293 (.032)	.326 (.037)
K-12 Enrollment (total for school)	790 (35.36)	771 (33.81)	798 (30.73)	810 (37.81)
N	25,506	30,116	28,436	19,415

Notes on Table 2: Standard Errors in Parentheses. All means calculated using SASS-supplied teacher weights.

\*The mean coverage rate of teachers in the individual's state, taken from the CPS.

**Table 3: Teacher Hours and Personal Characteristics: Cross-Section Regression Coefficients, CPS Sample.**

	1983-86	1987-90	1991-94	1995-98
Age 22-25	.2602 (.2459)	.7634 (.3648)	.0978 (.3978)	.6508 (.4288)
Age 50-65	.3422 (.1678)	.5168 (.1922)	.8877 (.2373)	.6405 (.2378)
Female	-.8760 (.1841)	-.9388 (.2732)	-.2268 (.2181)	-.2786 (.2169)
Nonwhite	-1.4162 (.3357)	-2.2351 (.2296)	-2.2489 (.4927)	-2.6416 (.4227)
Teacher has Advanced degree	.1928 (.1814)	.0857 (.2837)	-.3678 (.2507)	-.1768 (.2886)
Teaches in a Secondary School	.6188 (.1504)	.4384 (.1458)	.7521 (.2312)	.3807 (.2422)
Share covered by union agreement (statewide)	-2.8995 (1.1799)	-3.5384 (1.1797)	-2.2878 (1.3052)	-1.2269 (1.1958)
R <sup>2</sup>	.02	.02	.03	.02
Number of observations	11,822	11,101	10,877	9,027

Dependent Variable: Total Usual Weekly Hours at Main Job.

Standard Errors in Parentheses.

All regressions a full set of interview month and year dummies. Data from the June, July and August CPS interviews were not used.

**Table 4: Teacher Hours and Personal Characteristics: Cross-Section Regression Coefficients, SASS Sample.**

	1987	1990	1993	1999
Experience	-.0021 (.0038)	.0179 (.0066)	.0027 (.0081)	.0264 (.0081)
New Teacher	1.2259 (.2588)	1.2894 (.2729)	1.6900 (.2328)	1.3851 (.2741)
Female	1.8008 (.1031)	1.7619 (.1234)	1.8830 (.1029)	1.6633 (.1232)
Nonwhite	-.5049 (.2095)	-1.1220 (.2078)	-1.0880 (.2305)	-1.0476 (.2480)
Teacher has Advanced Degree	.1580 (.1174)	.0228 (.1589)	.2435 (.1487)	.1349 (.1984)
Teaches in a Secondary School	-.2032 (.1473)	-.9105 (.1763)	-1.0782 (.1952)	-.9737 (.2020)
% Covered by Union (statewide)	-.0621 (.5041)	1.4697 (.6052)	1.7876 (.6832)	3.6171 (.8566)
City	.1844 (.2036)	-.2003 (.1421)	-.3243 (.1989)	.2907 (.1976)
Town or rural	-.1628 (.1511)	-.4527 (.1646)	-.5059 (.1773)	-.7061 (.1666)
Pupil-Teacher Ratio	.0945 (.0284)	.0918 (.0223)	.0961 (.0388)	.0044 (.0281)
Share of Students with Free lunch (schoolwide)	-1.8295 (.2412)	-1.9537 .3997	-1.8358 (.4741)	-2.2290 (.5906)
Share Minority (schoolwide)	-.3633 (.2814)	.8429 .4031	.6380 (.4655)	.6404 (.4667)
Enrollment/100	-.0195 (.0101)	-.0125 .0156	.0092 (.0164)	.0264 (.0162)
R <sup>2</sup>	.04	.05	.05	.06
N	25,506	30,116	28,436	19,415

Standard Errors in Parentheses

**Table 5: Number of States with Reform Policy**


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	<b>1983-86</b>	<b>1987-90</b>	<b>1991-94</b>	<b>1995-98</b>
Test all students in at least one grade, report results by school	28	37	42	48
Impose sanctions on schools with low performance	4	10	16	23
Give monetary rewards to schools with high performance	2	6	8	16
Charter schools permitted	0	0	11	34

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**Table 6: Estimates of the Effect of Selected Education Reforms on Total Teacher Hours: CPS data.**

Reform:	Specification			
	Pooled Cross Sections	Adding State Fixed Effects	Adding State and Year Fixed Effects	Adding State Effects, plus State-specific Quadratic Time trends
Charter	.5946** (.1219)	.5327** (.1331)	.2406 (.2019)	.0947 (.2103)
Incentives	.3348** (.1422)	.4458** (.1661)	.0482 (.1850)	-.0254 (.3185)
Sanctions	.3739** (.1052)	.6444** (.1331)	.1952 (.1554)	.1431 (.2200)
Testing	-.3558** (.0984)	.2090* (.1279)	-.1104 (.1389)	-.2174 (.2561)
Number of reforms/4	.4660 (.4602)	1.0641** (.2118)	.2849 (.3005)	-.0231 (.5049)

Sample size for all regressions: 42,827  
Standard Errors in Parentheses. Clustered on state/year cells.

\*\* significant at p=.05

\* significant at p =.10

Each row represents the results of a *separate* regression using the one policy measure indicated.

All regressions also include dummies for teachers aged 22-25 and 50-65, indicators for female, nonwhite, secondary school teacher, advanced degree, state pupil teacher ratio, and month of interview.

**Table 7: Estimates of the Effect of Selected Education Reforms on After-School Teacher Hours: SASS data.**

<b>Reform:</b>	<b>Specification</b>			
	Pooled Cross Sections	Adding State Fixed Effects	Adding State and Year Fixed Effects	Adding State Effects, plus State-specific Linear Time trends
Charter	1.4979** (.2156)	1.4205** (.2030)	.3854** (.1748)	-.4242 (.3003)
Incentives	-.3643 (.2224)	-.2586 (.3192)	-.1616 (.1992)	-.5673** (.1692)
Sanctions	.1452 (.2199)	.7023** (.3053)	.0058 (.1743)	-.3947** (.1457)
Testing	.2914 (.3149)	.8082 (.3651)	-.3219** (.1575)	-.1348 (.3352)
Number of reforms/4	1.1430** (.3620)	2.3262** (.4736)	-.1463 (.3293)	-1.5109** (.3241)

Sample size for all regressions: 103,473

Standard Errors in Parentheses. Clustered on state/year cells.

Each row represents the results of a *separate* regression using the one policy measure indicated.

All regressions also include controls for total years of experience, indicators for secondary school teacher, 0-3 years of experience, female, nonwhite, advanced degree, school in city, town/rural, percent students minority and receiving free lunch, school pupil teacher ratio, state unionization level from CPS, and school enrollment.

**Table 8: Long-Change Regressions Across 50 States: Estimated Effect of Changes in the Mean Hours of Selected Comparison Groups on the Mean Hours of Full-Time Teachers.**

Independent Variable:	Dependent Variable:					
	1983-1998 State-Level Change in Mean Hours of:	1983-1998 State-Level Change in Mean Hours of Male Teachers			1983-1998 State-Level Change in Mean Hours of Female Teachers	
	(1)	(2)	(3)	(4)	(5)	(6)
Male Nonteachers	-.6728 (.4228)			-.1347 (.2675)		
Female Nonteachers		.6489 (.4055)			.7777 (.2316)	
Female Nonteachers, Age 35-50			.6596 (.2650)			.5847 (.1523)
R <sup>2</sup>	.12	.12	.11	.01	.19	.23

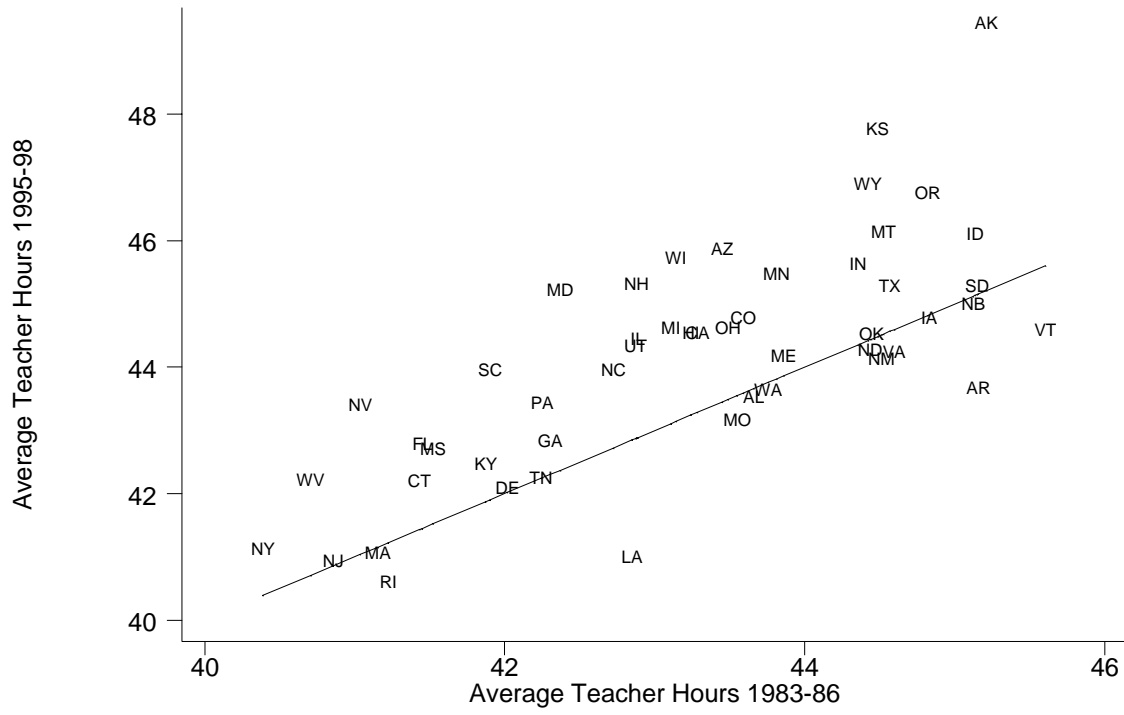
Dependent variable is the change in mean hours of teachers from 1983-1985 period to 1995-1998 period.

Sample size for all regressions: 50

Standard Errors in Parentheses.

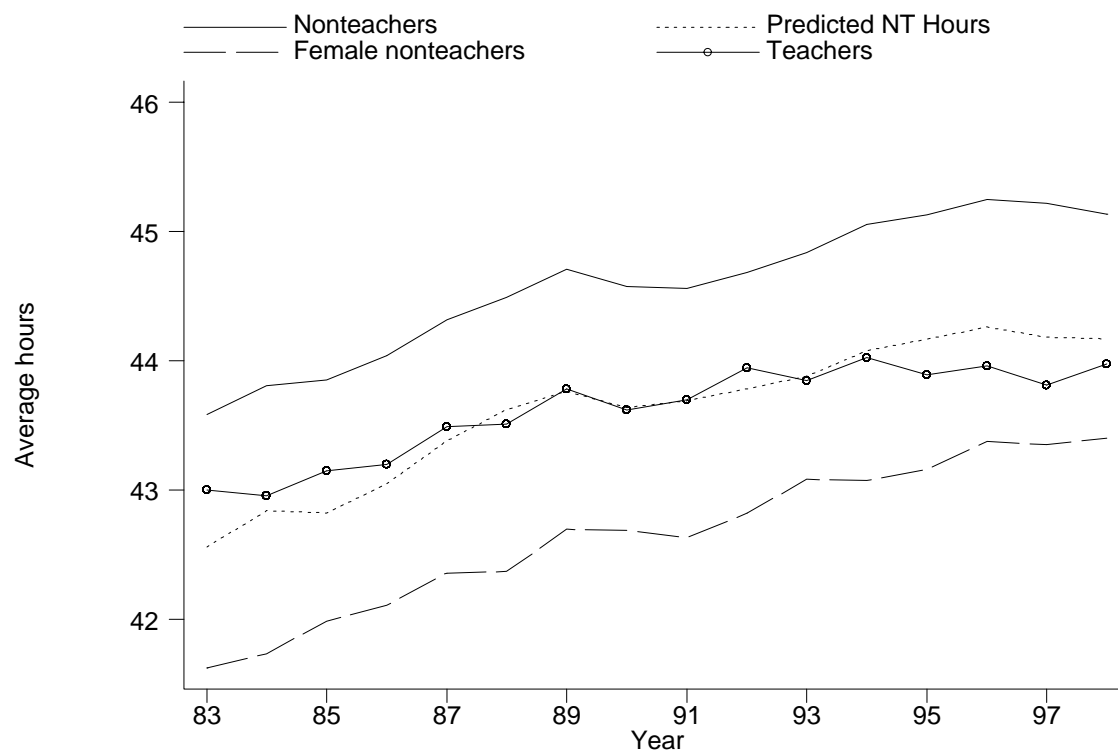
Each column represents the results of a *separate* regression.

**Figure 1: Teacher Hours Across States in Early 1980's and Late 1990's**



Source: CPS Outgoing Rotations

**Figure 2: Trends in the Average Hours of Teachers and Other Comparison Groups**



Source: CPS Outgoing Rotations