Flexible Wages, Bargaining, and the Gender Gap*

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September 4, 2020

Abstract

Does flexible pay compensation penalize women? We study the gender wage gap among public-school teachers in Wisconsin, where a 2011 reform gave school districts the autonomy to set teachers' pay more flexibly and allowed for individual negotiations. Using quasi-exogenous variation in the timing of introduction of flexible pay driven by the expiration of pre-existing collective-bargaining agreements, we show that flexible pay increased the gender pay gap among teachers with the same credentials. This gap is larger for younger teachers and absent for teachers working under a female leader. Survey evidence shows that the gap might be driven by women not engaging in negotiations over pay, especially when the counterpart is a man. This gap is not driven by gender differences in job mobility, ability, or a higher demand for male teachers. We conclude that environmental factors are an important determinant of the gender wage gap in contexts where workers are required to negotiate.

JEL Classification: J31, J71, J45
Keywords: Gender wage gap, Flexible pay, Teacher salary, Bargaining

*We thank Jaime Arellano-Bover, Marianne Bertrand, Judy Chevalier, Nicole Fortin, Rob Jensen, Matt Notowidigdo, Jessica Pan, Ben Polak, Fiona Scott Morton, and seminar and conference participants at the 2020 ASSA Meetings, Yale, McGill, the Online Economics of Education Seminar, the Online Economics of Discrimination Seminar, and the NBER Summer Institute (Personnel) for useful comments. Calvin Jahnke, Kate Kushner, Rohan Angadi, and Nidhaan Jain provided excellent research assistance.

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1 Introduction

Women are often believed to be reluctant to negotiate for higher pay. This could give a workplace advantage to men and exacerbate gender gaps in pay (Sandberg, 2013).[1] A body of evidence from laboratory settings generally supports this hypothesis, finding that women avoid situations in which they have to negotiate or bargain (Babcock and Laschever, 2003; Dittrich et al., 2014; Exley et al., 2019). Whether the differences found in the lab translate to non-experimental settings has been difficult to study, though, as workers can sort into jobs based on whether negotiating is required.[2] Yet, as individually based compensation becomes more prevalent even in labor markets traditionally characterized by rigid pay schemes (such as the public sector), understanding whether more flexible pay schemes disadvantage women is important to close the gender wage gap.

In this paper we use the passage of Wisconsin's Act 10, a state bill which dramatically redefined the rules of collective bargaining for public sector employees, to test whether and how individual pay negotiations affect the gender wage gap. We focus our analysis on public-school teachers, a class of workers whose pay used to be strictly based on seniority and academic credentials using rigid schedules that districts negotiated with the teachers' union. After Act 10 unions lost the authority to bargain over these schedules. Instead, upon the expiration of pre-existing collective bargaining agreements (CBAs), districts became free to adjust teacher pay on an individual basis and without union consent. Some districts adopted a flexible pay scheme, with salaries set differently for each teacher ("flexible-pay" districts; Biasi, 2020).[3] Others instead chose to keep a seniority-based pay schedule ("seniority-pay" districts). Even in these districts, however, teachers could negotiate their placement on the schedule.

Using variation in the timing of expiration of CBAs pre-dating Act 10, driven by long-standing differences in districts' negotiation calendars, we estimate the effect of the introduction of flexible pay on the difference in salaries between observationally similar male and female

[1] The "Lean In" movement advocated for women to promote themselves in the workplace and ask for promotions and pay raises.

[2] For example, Card et al. (2015) find that women are underrepresented in firms with a high bargaining surplus. Studying US real estate transactions, Goldsmith-Pinkham and Shue (2020) find that women pay more for housing properties and sell them for less than men. Using data from Denmark, Andersen et al. (2020) confirm that a gender gap in real estate negotiation outcomes exists; however, they find it is due to differences in the types of property men and women demand. In this paper, we are able to overcome some of the obstacles of measuring gender differences in negotiations by holding constant the employer-employee match (Wisconsin public schools) and testing for differences in outside options.

[3] Biasi (2020) shows that pay dispersion increased in flexible-pay districts among teachers with the same seniority and credentials.

teachers. While no gender pay gap existed before Act 10, the introduction of flexible pay led to a one percent decline in women's salaries relative to their male counterparts. Although small in dollar terms, this gap is significant when compared to the limited pay variation that exists among teachers with the same credentials: It corresponds to 10 percent of a standard deviation of pre-Act 10 conditional salaries and 10 percent of the average salary increase associated with acquiring a Master's degree. The gap is also twice the post-Act 10 difference in pay associated with a one-standard deviation higher value-added (Biasi, 2020).

Our estimates of the gender wage gap are robust to controlling for teacher characteristics, teaching assignment (school, grade, and subject), as well as district and time effects. In addition, they are robust to accounting for changes in the composition of the teaching body across districts (driven, for example, by early retirement; see Biasi, 2019) and for endogenous assignment to the treatment (driven by teachers moving across districts to contrast the effects of flexible pay). Perhaps surprisingly, the gap is present both in districts that explicitly adopt flexible pay and in those that maintain a seniority-based schedule. However, in seniority-pay districts, the gap is largely driven by male teachers being placed on higher steps of the salary schedule compared to similar women.

Aggregate estimates of the gender wage gap mask substantial heterogeneity across teachers, schools, and districts. First, flexible pay appears to penalize young and inexperienced teachers the most. While the gap is 0.7 percent for teachers with more than 15 years of seniority, it is larger at 1.5 percent and more persistent over time for teachers with less than five years of seniority. Similarly, the gap is smaller for teachers aged 45 and older and larger for teachers aged 30 and younger. These estimates imply that, if the gap persisted over time, flexible pay would lead women to lose an entire year's pay over the course of a 35-year career.

Second, the gender wage gap is related to the gender composition of schools' and districts' leadership. In schools with a male principal the gap is 0.4 percent. It is instead is zero in schools with a female principal. Similarly, the gap is 0.7 percent in districts with a male superintendent and zero in districts with a female superintendent. These findings are in line with recent evidence on the link between the gender composition of management and women's careers (Casarico and Lattanzio, 2019; Langan, 2019; Cullen and Perez-Truglia, 2020).

The existence of a relationship between the gender wage gap and the gender composition of leaders points to a role for bargaining in explaining the gap. To test this mechanism directly, we ran a survey with all current public school teachers in Wisconsin. We asked respondents

whether they have ever negotiated their pay or plan on doing so in the future. We then asked why teachers who had not negotiated chose not to do so and whether those who did were successful. We also collected information on teachers' knowledge about their colleagues' salaries and measures of socio-emotional skills as proxies for their bargaining ability. The survey allows us to test whether women avoid bargaining (in some contexts more than others) or whether they bargain at the same rate as men, but obtain a lower payoff or are punished when doing so.

Teachers' responses indicate that women are between 12 and 20 percent less likely than men to have negotiated their pay at various points in their careers and 13 percent less likely to anticipate negotiating in the future. These estimates suggest that the observed gender differences in the likelihood of bargaining might be an important determinant of the gender wage gap. The magnitude of this effect is significant: An 8 percentage points difference in the likelihood of negotiating, combined with an aggregate wage gap of one percent, suggests that differences in bargaining could lead to a wage gap as large as 12 percent.

Our findings also outline an important role for the bargaining environment on teachers' decision to negotiate and, ultimately, on the gender wage gap. In line with our earlier results, we find that gender differences in negotiating behavior are entirely driven by teachers working under a male superintendent, whereas men and women who work under a female superintendent are equally likely to negotiate their salaries. Furthermore, women are 82 percent more likely than men to report that they do not feel comfortable negotiating their pay. This in turn suggests that creating an environment in which all teachers feel comfortable discussing their pay could potentially close a significant part of the observed gender gap. Instead, differences in information on colleagues' salaries, a lower bargaining ability, or differences in the perceived returns to negotiating do not explain these differences.

One limitation of our setting is the inability to link our survey answers to administrative records, which prevents us from exactly estimating the portion of the post-Act 10 wage gap generated by differences in bargaining. To make progress we test for a range of other possible determinants of the gap, unrelated to bargaining. First, we study whether the gap is explained by gender differences in teaching quality. If districts use their acquired flexibility to compensate teachers with higher value-added, a gender gap in pay could arise if women are less effective than men at teaching. The data does not support this hypothesis: Women have a slightly higher value-added both before and after Act 10, and controlling for value-added leaves the estimate

for the gender pay gap unchanged.[4] Furthermore, the returns to having a high value-added become positive after the introduction of flexible pay for men, but not for women. This suggests that women are not as rewarded for their teaching ability as men are.

A second explanation relates to differences in job mobility and the returns to moving. Biasi (2020) shows that the introduction of flexible pay after Act 10 was followed by an increase in cross-district movements, associated with an increase in pay. If women are less likely than men to move or are more constrained in their location choice, they might be unable to increase their pay by changing job. They might also garner fewer outside offers, which would lower their bargaining power in wage negotiations. Women might also experience lower returns from moving (Loprest, 1992), which could further undermine their bargaining power. We find that, after the introduction of flexible pay, women are only slightly less likely to move than men across (but not within) commuting zones and receive only 2/3 of the returns from moving that men get. However, since movements are rare events, these differences play only a small role in explaining the total wage gap caused by flexible pay; the gap is still large at 0.9 percent for teachers who never move. To explore whether the (unobserved) number of job offers might play a role in explaining the wage gap, we proxy job offers with the number of schools in a teacher's commuting zone and find that the wage gap is largest in areas with more schools. This suggests that men might be able to use outside job offers to bid up their salary at their current school. Once more, this finding points to an important role for bargaining in shaping the observed gender wage gap.

Finally, the gender wage gap could be driven by a higher demand for male teachers. To explore this possibility we identify two instances in which this demand should be higher: Schools where men are scarcer and schools enrolling a higher share of male students (where men could serve as role models for boys). The gap is actually smaller in schools where men are scarcer. It is larger among schools with a very high fraction of male students, yet this share explains a very small portion of the overall gap. While only suggestive, these findings contrast the hypothesis that a higher demand for male teachers is a significant determinant for the gender wage gap.[5]

Taken together, our results suggest that while flexible pay could be beneficial to incentivize workers to exert more effort, it can be detrimental for the outcomes of some subgroups of the

[4]This is in contrast with evidence from three performance pay programs for teachers in North Carolina (Hill and Jones, 2020). There, female teachers' value-added declines with the introduction of performance pay, while men's remains relatively flat. We do not find evidence of this and argue that this does not appear to drive the gender pay gap in our setting.

[5]It is possible that schools with a higher fraction of male teachers before Act 10 are those with higher demand for male teachers after Act 10 because and pay higher salaries to men to attract them. Yet, this higher demand would have to be correlated with the gender of principals and superintendents to explain the gap.

workforce. Workplace environmental factors (rather than gender differences in bargaining ability) are likely explanations for the observed disparities in negotiating outcomes between men and women, even in a female-dominated occupation like public-school teaching. Our findings also highlight how institutions, such as unions, can play a role in closing the gender wage gap.

Our paper contributes to several literatures on gender inequality in the labor force. A mainly experimental literature has shown that women are less likely than men to negotiate, giving credence to the idea that women should bargain more (Babcock and Laschever, 2003; Leibbrandt and List, 2014; Dittrich et al., 2014). One notable exception is Exley et al. (2019), who also find a gender bargaining gap but also show that women select into bargaining when the returns from doing so are positive. This implies that forcing women to bargain can perpetuate, rather than close, gender gaps in pay. Our paper confirms these findings by showing that a gap emerges when workers are required to negotiate their pay, and it sheds light on the mechanisms at play.

In addition, we contribute to a growing body of evidence on the impact of the gender composition of firms' leadership on women's career outcomes, which has so far found mixed results. While studies of the effects of gender quotas for firm boards generally do not find any positive impact for women in other parts of the organization (Bertrand et al., 2019; Maida and Weber, 2019), other works have unveiled a positive impact of having a female non-board manager on women's careers (Sato and Ando, 2017; Casarico and Lattanzio, 2019; Bhide, 2019; Langan, 2019). An advantage of our context is that we are able to look at different types of school leaders who carry on different functions: School principals are responsible for evaluating and managing teachers, whereas district superintendents are involved in the negotiations and ultimately decide over teachers' pay. We find that women lose the most when they negotiate with male leaders, a result that points to female representation in leadership as a way to combat gender inequality in the workplace (Matsa and Miller, 2011; Athey et al., 2000; Langan, 2019).

Our paper also relates to the literature on the effects of changes in pay schemes on workers' outcomes. Most of this literature (especially the one on teachers) has studied the effects of various forms of performance pay on employees' selection and incentives (for example Lazear, 2000a,b; Bandiera et al., 2005; Neal et al., 2011). We focus instead on the gender wage gap as a possibly unintended consequence of a new pay scheme, designed to allow employers to pay higher salaries to more productive workers, which also rewards behaviors and actions (such as negotiating) that men and women might be differentially more likely to engage in.

Lastly, our results speak to the literature on unionization and the gender pay gap.[6] Existing studies have explored the relationship between unionization and gender inequality in wages. Comparing the US with other OECD countries, Blau and Kahn (1992, 1996) find that a lower unionization rate explains why the US has a larger gender wage gap relative to other countries. However, these works are generally unable to fully control for worker sorting and productivity and lack a proper control group, which prevents them from establishing causal links.[7] Following teachers over several years allows us to account for sorting and teacher ability, and to estimate a precise and negative impact of de-unionization on the gender gap in this setting.

The remainder of the paper is organized as follows. Section 2 discusses the history of teacher pay in Wisconsin and how Act 10 affected teacher salary rules. We describe the data used in our analysis in section 3 and show the main results in section 4. Section 5 describes our survey and its results. We explore alternative mechanisms in sections 6, and section 7 concludes.

2 Institutional Background: Teacher Pay and Act 10

Salaries of US public school teachers are generally determined using a salary schedule, which specifies pay for each employee based on her seniority and academic credentials. A schedule is designed as a matrix: Increases in pay stem from movements along its rows or "steps," which correspond to increases in seniority, and columns or "lanes," which correspond to acquiring additional credentials (such as Master's or a PhD).

In states where teachers are authorized to collectively bargain with school districts, these schedules are negotiated between each district and the teachers' union.[8] Collective-bargaining agreements (CBA) typically do not allow for individual pay adjustments; this implies that seniority and credentials (along with "overtime" or extra-curricular activities, for example coaching a sports team) are the only determinants of salaries and pay is unrelated (at least directly) to teacher effectiveness (Podgursky, 2006).

[6] A large literature has documented a negative relationship between unionization and income inequality in the US (Card, 1996; Dinardo et al., 1996; Farber et al., 2018). Fortin and Lemieux (1997) argue that deunionization impacted pay inequality among men but that the minimum wage was more important for women's pay. See also Card et al. (2020) for a comparison of Canada and the U.S.

[7] Controlling for variables like sorting is especially important given the recent work by Farber et al. (2018) that shows that sorting into unions has varied substantially over time. In this paper, we make use of the fact that Act 10 was relatively unanticipated to look at the impact on individuals who have already sorted into teaching. In addition, we can track individuals who leave teaching following Act 10.

[8] In states without collective bargaining (such as Georgia or North Carolina), salary schedules are generally established at the state level.

2.1 Wisconsin's Act 10

Until 2011, salaries of all teachers in Wisconsin were set on a schedule, which districts negotiated with the union. [9] These schedules were a key part of CBAs and listed in each district's employee handbook, a document that describes rights and duties of all district employees.

The rules disciplining teacher pay dramatically changed on June 29, 2011, when the state legislature passed the Wisconsin Budget Repair Bill in an attempt to close a projected $3.6 billion budget deficit. The bill, which became known as Act 10, introduced a series of changes to the powers and duties of all public sector unions, including teachers' unions. First and most importantly, the Act limits the scope of collective bargaining: While before Act 10 unions could negotiate the entire salary schedule, after the Act negotiations must be limited to base salaries. Second, Act 10 requires unions to recertify every year by obtaining the absolute majority of all members' votes in yearly elections. Third, it limits the validity of newly stipulated CBAs to one year; and lastly, it prohibits automatic collection of union dues from employees' paychecks.[10]

The Act also contained a number of budget-cutting rules for public school districts. It required them to stop paying the employees' share of retirement contributions (amounting to 5.8 each employee's annual salaries) and to reduce health insurance premiums by increasing employees' contributions and by choosing cheaper plans. An amendment to Act 10 (Act 32 of July 2011) also reduced state aid to school districts and decreased their revenue limit.[11]

Implications For Teacher Pay With the end of collective bargaining school districts became free to set teacher pay more flexibly. While until 2011 pay depended exclusively on seniority and academic credentials, after Act 10 districts could reward teachers for other attributes without union consent. Using information collected from districts' employee handbooks, Biasi (2020) shows that different districts used this flexibility in different ways: As of 2015, approximately half of all districts were still setting pay using a schedule exclusively based on experience and education, whereas the remaining half had discontinued the use of such a schedule. Even within these two groups the specific pay schemes adopted by the districts varied: Some linked pay to evaluations made by a teacher's principal or peers, others instead sought to attract or retain

[9] In 1959, Wisconsin became the first state to introduce CB for public sector employees (Moe, 2013). Since then, teachers' unions have gained considerable power and have been involved in negotiations with school districts over key aspects of a teaching job.

[10] Union membership dropped by nearly 50 percent in Wisconsin in the 5 years after the passage of Act 10. See D. Belkin and K. Maher, *Wisconsin Unions See Ranks Drop Ahead of Recall Vote*, The Wall Street Journal. Retrieved from https://www.wsj.com/articles/SB10001424052702304821304577436462413999718.

[11] Revenue limits are the maximum level of revenues a district can raise through general state aid and local property taxes.

employees by negotiating raises and bonuses with each individual teacher.[12] Even in seniority-pay districts some teachers were able to increase their pay by negotiating with the district for a higher place on the salary schedule (**?**). In spite of these differences, individual wage negotiations became the common denominator among districts' post-Act 10 pay schemes.

Differences In The Timing of The Introduction of Flexible Pay The provisions of Act 10 had immediate effect on all school districts starting from the school year 2011-2012. Existing CBAs stipulated between unions and school districts before 2011, however, remained binding until their expiration. Pre-Act 10 CBAs fully regulated teacher pay with a salary schedule; as a result, districts could only use their freedom to flexibly set teacher pay after the expiration of their CBAs. In addition, after Act 10 some districts decided to unilaterally extend the validity of their CBAs by one or two additional years.

Due to differences in electoral cycles, the expiration dates of pre-existing CBAs (and of their extensions) varied across districts. Figure I summarizes these cross-district differences. While 76 percent of districts' CBAs expired in 2011 and were not extended, 18 percent expired in or were extended until 2012 (including the school district of Madison) and an additional 7 percent expired in or were extended until 2013 (including the school district of Milwaukee). Thus, approximately half of all teachers were covered by districts with CBAs that expired or were extended after 2011. Cross-district differences in expiration and extension dates introduce plausibly random variation in the timing of the introduction of flexible pay across districts, which we use in our empirical analysis.

3 Data

Our main data set includes individual-level information on the universe of public school teachers in Wisconsin. We combine these data with hand-collected information on the school districts, including the expiration dates of their CBAs and their post-Act 10 salary regimes. We also link teacher records with students' demographic characteristics and test scores in Math and Reading, which we use to calculate teacher value-added. Data are reported by school year and referenced using the calendar year of the spring semester (e.g. 2007 for 2006-07).

[12] As a result of these changes, flexible-pay districts started paying high-quality, young teachers more and reduced the growth in pay for some high-seniority teachers (Biasi, 2020).

Personnel Data We draw information on the population of Wisconsin teachers, district superintendents, and school principals from the *PI-1202 Fall Staff Report - All Staff Files* of the Wisconsin Department of Public Instruction (WDPI) for the years 2006-2016. These files contain individual-level records of all individuals employed by the WDPI in each year and include personal and demographic information, highest level of education, years of teaching experience in Wisconsin, and characteristics of job assignments (school identifiers, grades and subject taught, and full-time equivalency (FTE) units).[13] The data set also includes total salaries and fringe benefits for each teacher. We restrict our teacher sample to non-substitute teachers and assign those employed in multiple districts and schools in a given year to the district-school with the highest FTE.[14] We express salaries in FTE units, so that the salary of each teacher corresponds to a full-time position regardless of her actual hours. The characteristics of male and female teachers are summarized in Table I, separately for the years preceding and following Act 10.

Pre-Act 10 CBAs We collected information on districts' CBAs from multiple sources, including districts' union contracts set to expire around 2011, local newspaper articles, and school board meeting minutes. Newspaper articles reported on the negotiations taking place and offered enough information to discern when the CBA was slated to expire. Several articles also mentioned that the uncertainty surrounding Act 10 influenced many districts to extend their CBA for one or two years. School board meeting minutes describe whether the contract was set to expire in 2011, whether an extension was granted, and for how long. When possible, we prioritize data from union contracts, complementing it with the other two sources when unavailable. We were able to successfully find information on the expiration and extension dates for 211 out of 428 school districts, enrolling 78 percent of all teachers. For the remaining 217 districts with missing information, we assume the that the CBA expired in 2011 and no extension was granted; our main results are robust to the exclusion of these districts.

Employee Handbooks and Salary Schedules To better understand how districts used their flexibility in setting teacher pay after the expirations of their CBAs, we gathered information on post-Act 10 pay schemes from employee handbooks, available on districts' websites for 224

[13]Salary figures include pay for extra duties (such as serving in committees or acting as sports coaches), which we do not observe in the WDPI staff data. We address this limitation in Section 4.7.

[14]We exclude long- and short-term substitute teachers, teaching assistants and other support staff, and contracted employees since salaries for these workers are calculated differently from those of permanent teachers. We were notified by the WDPI of mistakes in salary reporting for teachers in the district of Kenosha for all years and for in Milwaukee for 2015. We therefore discard these data.

out of 428 districts for the year 2015 (in total, these districts enroll 83 percent of all students).[15] Following Biasi (2020), we classify a district as "seniority-pay" if its 2015 handbook contains a salary schedule and does not mention rewards for performance or merit, and as "flexible-pay" otherwise. If a handbook contains a schedule but mentions bonuses linked to performance, we classify the district as flexible-pay.

Student Test Scores and Demographic Information Test scores data are available for for all students in grades 3 to 8 and for the years 2006-2017, and include math and reading scores from the Wisconsin Knowledge and Concepts Examination (WKCE, 2007-2014) and the Badger test (2015-2016), together with demographic information including gender, race and ethnicity, socio-economic (SES) status, migration status, English-learner status, and disability.[16]

3.1 Value-Added

We measure teachers' quality using value-added (Rivkin et al., 2005; Kane and Staiger, 2008; Chetty et al., 2014), an estimate of each teacher's contribution to the growth in achievement. The starting point is the following model of achievement:

$$A_{kt} = \beta X_{kt} + \nu_{kt}, \text{ where } \nu_{kt} = \mu_{i(kt)} + \theta_{c(kt)} + \varepsilon_{kt} \tag{1}$$

A_{kt} is a standardized measure of test scores for student k in year t, X_{kt} is a vector of student and school-specific controls, and $i(kt)$ denotes student k's teacher in t.[17] Teacher value-added is the estimate of $\mu_{i(kt)}$, the teacher-specific component of test score residuals.

Value-added is usually estimated using datasets containing classroom identifiers, in which teachers can be linked to the students they taught. Until 2017, the WDPI did not record classroom identifiers but only teachers' and students' schools and grades. This implies that we cannot link a teacher to the actual students she taught, but only to those in her school and grade. To estimate value-added in the presence of this data limitation we follow the approach of Bi-

[15] Unclassified districts (i.e., those for which handbooks are not available) either do not have a website or do not make their handbook public. Biasi (2020) shows that districts without a website are smaller, enroll more disadvantaged students, pay lower salaries, and are disproportionately located in rural areas.

[16] The WKCE was administered in November of each school year, whereas the Badger test was administered in the spring, or the years 2007-2014 we assign each student a score equal to the average of the standardized scores for the current and the following year.

[17] The vector X_{kt} includes the following: school and grade-by-year fixed effects; cubic polynomials of past scores interacted with grade fixed effects; cubic polynomials of grade average past scores, interacted with grade fixed effects; student k's demographic characteristics (gender, race and ethnicity, disability, English-language earner status, and socioeconomic status); grade average demographic characteristics; and the student's socioeconomic status interacted with the share of low-socioeconomic status students in her grade and school in t.

asi (2020), which exploits teacher turnover across grades and schools over time.[18] With multiple years of data, turnover permits the identification of a single teacher's effect by comparing test score residuals $\bar{\nu}_{gst}$ before and after her arrival in a given grade and school. Importantly, turnover helps identify not only the effect of a teacher who switches, but also that of the teachers in her same grade and school at any point in time.

We construct value-added measures using an empirical Bayes estimator, modified to reflect the structure of the data and described in detail in Appendix B. The Appendix also shows that, although noisier than the standard estimators, our measure still explains a substantial portion of the variance in test scores, and it is a forecast-unbiased estimator of standard value-added estimates and future student achievement. We allow a teacher's value-added to differ before and after Act 10, to account for changes in effort in response to the reform. Value-added estimates are available for 23,581 teachers of Math and Reading in grades 4 to 8.[19]

4 The Effect of Flexible Pay On The Gender Wage Gap

We begin our analysis studying the impact of flexible pay on the gender gap in teachers' salaries. We then look at heterogeneity in the gap based on teachers' age and seniority, districts' salary structures, and the gender composition of schools' and districts' leadership.

4.1 Empirical Strategy

To identify the effects of flexible pay on the differences in salaries between men and women we take advantage of the fact that, following Act 10, districts were only allowed to use flexible pay after the expiration of existing CBAs.

The timing of these expirations varied across districts (Figure I), reflecting long-standing misalignments in the negotiation calendars. For example, while most districts typically negotiated agreements bi-yearly on odd years, the school district of Janesville negotiated contracts in March 2008 and September 2010.[20] Off-calendar districts (i.e., those with expiration dates after 2011) include both large, urban districts like Milwaukee and Madison, and smaller, suburban or rural districts like Clintonville and South Milwaukee. Off-schedule districts (those with CBAs expiring after 2011) are more likely to be located in suburban areas and serve a larger share

[18] Rivkin et al. (2005), who face a similar challenge using data from Texas, also use teacher turnover to identify the variance of teacher effects.

[19] These include 19,187 teachers in 224 flexible-pay and seniority-pay districts. We exclude grade 3 to be able to control for past test scores when estimating value-added.

[20] See https://www.schoolinfosystem.org and https://www.tmcnet.com.

of Black students (Table II, columns 1-3); these differences, however, are largely driven by the Milwaukee Public Schools district.

After the CBAs expired, 100 school districts (23 percent) decided to extend the validity of their agreements by one or two years, primarily to gain more time to design the new pay schemes. While the timing of expiration of CBAs can be considered as good as random, the enactment of an extension was a deliberate choice of each district. Districts with an extension are larger, have lower revenues, and are more likely to be located in urban and suburban areas (Table II, columns 4-6).

In our analysis we make use of variation in the timing of the introduction of flexible pay driven by the expiration of both CBAs and their extensions. Although only the former can be considered completely random, as long as the reasons that induced school districts to opt for an extension are not directly related to the differences in salaries between men and women, this strategy allows us to estimate the effects of flexible pay on the gender wage gap. Nevertheless, our estimates are robust to ignoring the variation driven by the extension, as well as using the timing of CBA expirations as an instrument for CBA extensions.

4.2 Evolution of Salaries for Men and Women Over Time

Before Act 10, salaries were determined by attributes such as experience, academic credentials, and teaching assignment (i.e., grade level and subject) and followed a strict pay schedule.[21] Following the expiration of CBAs, districts acquired the freedom to pay different salaries to teachers with the same experience, credentials, and teaching assignment. To understand the implications of flexible pay for the gender wage gap, we start by studying the change in salaries of observationally identical men and women after the expiration of CBAs or their extensions.[22] We employ the following event study design:

$$\begin{aligned}\ln(w_{it}) \quad = \quad & \beta_1' X_{it} + \beta_2' X_{it} \times postext_{j(it)t} + \gamma_1' T_{it} + \gamma_2' T_{it} \times postext_{j(it)t} + \theta_{j(it)} \\ & + \theta_{j(it)} \times postext_{j(it)t} + \tau_t + \tau_t \times Y^{exp}_{j(it)} + \tau_t \times Y^{ext}_{j(it)} + \sum_{s=-4}^{5} \delta^g_s G^g_i \mathbb{1}(t - Y^{ext}_{j(it)} = s) + \varepsilon_{it}\end{aligned} \tag{2}$$

[21] On average, women earned 0.9 percent less than men prior to Act 10 (Table AI, column 1). Accounting for experience, qualifications, and teaching assignment, however, completely eliminates this difference (column 5).

[22] Panel A of Appendix Figure AI shows the evolution of raw nominal salaries of male and female teachers between 2007 and 2016. Salaries of men and women are similar and increase at a steady rate until 2011. After Act 10, the growth in salaries stops abruptly, and especially so for women. A similar pattern emerges if we plot raw salaries by time-to-expiration of a CBA, instead of by year (Panel B).

where $\ln(w_{ijt})$ is the natural logarithm of the salary of teacher i working in district j in year t. The vector X_{it} contains indicators for teacher i's highest education degree and for years of experience. Alone ,interacted with an indicator for the years following a CBA expiration or extension ($postext_{jt}$), these fixed effects allow us to account for compositional changes in the sample of teachers over time that could affect salaries. The vector T_{it} contains indicators for i's grade level (elementary, middle, and high school) and subject (Math, Reading, English, and Science); alone and interacted with $postext_{jt}$, they allow us to account for the possibility that districts used their flexibility to raise pay for teachers in certain subjects or grades. The vector θ_j contains district fixed effects, allowing us to account for district-specific components of salaries that are fixed in the periods before (θ_j) and after a CBA expiration or extension ($\theta_j \times postext_{jt}$). Year fixed effects τ_t, alone and interacted with expiration and extension year fixed effects Y_j^{exp} and Y_j^{ext}, control for time-specific factors that are common to all districts whose CBAs and extensions expired in the same year. The variable G_i^g is a gender indicator (where g denotes the gender), and it is interacted with indicators for years since the expiration of a CBA or its extension. In this equation, the coefficient δ_s^g gives the relative change in salaries of individuals of gender g, conditional on all the other determinants of salaries, in a window around the expiration of a CBA.

Estimates of δ_s^g are shown in Figure II, separately for men and women. In the years leading to a CBA expiration, the conditional salaries of men and women were on similar, flat trends. Five years after the expiration, however, women's salaries had fallen by 0.3 percent relative to the year prior to the expiration, whereas men's salaries had increased by 0.7 percent (both estimates are significant at the 1 percent level). The pattern is similar when we only use CBA expirations and ignore the extensions (Figure AII). While small in an absolute sense, these changes appear significant when compared with the limited variation in conditional salaries among Wisconsin public school teachers prior to Act 10. In particular, a 0.7 percent increase in salaries for men corresponds to 7 percent of a standard deviation of pre-Act 10 conditional salaries and 6 percent of a standard deviation of post-Act 10 salaries, and it is equivalent to the value of an additional year of seniority.

4.3 The Gender Gap in Salaries

The differential trends in the salaries of men and women following the expiration of districts' CBAs gave rise to a gender gap in pay. We quantify this gap with an event study of the form:

$$\begin{aligned}\ln(w_{ijt}) &= \beta_1' X_{it} + \beta_2' X_{it} \times postext_{j(it)t} + \gamma_1' T_{it} + \gamma_2' T_{it} \times postext_{j(it)t} + \theta_{j(it)} \\ &+\theta_{j(it)} \times postext_{j(it)t} + \tau_t + \tau_t \times Y_{j(it)}^{exp} + \sum_{s=-4}^{5} \delta_s Female_i \times \mathbb{1}(t - Y_{j(it)}^{ext} = s) + \epsilon_{it}\end{aligned} \tag{3}$$

where all variables are defined as before and the variable $Female_i$ equals one if the teacher is female. In this equation, estimates of the coefficients δ_s give the differential impact of flexible pay on the salaries of women relative to men.

Estimates of δ_s, shown in Figure III, indicate that a significant gender pay gap appeared right after the introduction of flexible pay. Two years after the expiration of a CBA or its extension, women earned 0.4 percent less than men with equivalent years of experience and qualifications; this gap widened over time time, reaching one percent five years after the expiration. This estimate implies that women earned \$540 per year less than men. While small in percentage terms, this gap corresponds to 10 percent of a standard deviation of conditional salaries prior to Act 10 (equal to \$5,302), and to 57 percent of the standard deviation increase following the CBA expiration (equal to \$670).

These results are summarized in Table III, where we pool all years together and estimate

$$\begin{aligned}\ln(w_{ijt}) &= \beta_1' X_{it} + \beta_2' X_{it} \times postext_{j(it)t} + \gamma_1' T_{it} + \gamma_2' T_{it} \times postext_{j(it)t} + \theta_{j(it)} \\ &+\theta_{j(it)} \times postext_{j(it)t} + \tau_t + \tau_t \times Y_{j(it)}^{exp} + \delta_0 Female_i + \delta Female_i \times postext_{j(it)t} + \epsilon_{it}\end{aligned} \tag{4}$$

Estimates of δ_0 indicate that, before a CBA expiration, women and men earned similar salaries conditional on observables. In the five years following the expiration of a CBA or of its extension, however, salaries of women became 0.3 percentage points lower than salaries of men (Table III, column 1, significant at 5 percent). Allowing the coefficient δ to vary for each of the years following an extension indicates that the gap was largest five years after the expiration, at 0.8 percent (column 2). The gap is robust to only using CBAs expirations, ignoring the extensions (columns 3 and 4), and to instrumenting the dates of CBA extensions with the dates of CBA expiration (columns 5 and 6).

4.4 The Gender Wage Gap Across Districts With Different Pay Schemes

While all districts became free to negotiate pay with individual teachers after the passage of Act 10, some districts chose to continue setting pay on a schedule based on seniority and academic credentials. If the use of a schedule prevents districts from using discretion in setting teacher pay, we should not see any gender wage gaps in seniority-pay districts. We test this hypothesis in Figure AV, which shows estimates of the coefficients in equation (3) obtained separately for flexible-pay and seniority-pay districts. In contrast with the hypothesis, the gender wage gap is similar in flexible-pay and in seniority-pay districts. The former see a 0.6 percent increase in the difference in salaries between male and female teachers five years after a CBA extension (significant at 1 percent), while the latter experience a 1.2 percent increase in this difference (the difference in these two estimates, however, is not statistically different from zero, as shown in column 3 of Table IV).[23]

What explains the rise of a gender wage gap in districts that continued to use a salary schedule? Before Act 10, unions were fully involved in the negotiations on the schedules and guaranteed that no individual-level adjustments could take place. Act 10 prevented union involvement in wage setting; even in seniority-pay districts teachers could bargain for higher wages through a placement on a higher "step" or "lane" of the salary schedule. If this is what explains the gender wage gap for seniority-pay districts that emerges in Figure AV, we would observe the salary returns to (actual) seniority and education to be higher for men compared with women after a CBA expiration. In line with this hypothesis, Appendix Figure AIII shows that while in the years prior to an expiration men and women with the same experience earn the same, after Act 10 and the expiration of CBA extensions women in seniority-pay districts earn less than men at almost all levels of experience.

Next, we test whether the gap that arose in seniority-pay districts can be explained by men obtaining a higher placement on the salary schedule compared with observationally similar women. We do so by allowing for the returns to experience to differ between men and women after Act 10, in practice estimating experience- and education-specific gender gaps.[24] The results of this test are shown in the bottom panel of Figure AV; for exposition, we plot the gender gap

[23] In columns 1-3 of Table IV we pool together years before and after a CBA extension and re-estimate equation (4) separately for flexible-pay and seniority-pay districts. This exercise reveals an increase in the gender wage gap equal to 0.3 percent in flexible-pay districts and 0.6 in seniority-pay districts; the difference in these two estimates, however, is not statistically different from zero (column 3).

[24] To do this we augment equation (3) to include fixed effects for the years of experience and for having a master's or higher degree, interacted with an indicator for female and an indicator for years following a CBA expiration or extension and allowing these effects to be different before and after a CBA extension.

for teachers with 3 or 4 years of experience and a Master's degree (Figure AIV shows the same estimates for teachers with 19 or 20 years of experience). Allowing for gender-specific returns to experience and education completely closes the gender gap in seniority-pay districts. In flexible-pay districts, however, the gap remains large at 1.2 percent five years after an extension.[25] This confirms that, even in seniority pay-districts, negotiations play an important role in determining a teacher's pay in the aftermath of Act 10.

4.5 Differences by Age and Seniority

Existing works have shown that the gender wage gap tends to grow over time, arguably due to child-bearing and family obligations which lead women to decrease their worked hours (see Zeltzer, 2020, for a study of physicians).[26] Unlike other jobs, teaching has fairly standard hours and is thought to be a "family friendly" occupation since its work hours coincide with children's school hours. This implies that findings from other occupations might not hold for public-school teachers. Nevertheless, aggregate estimates of the gender wage gap might mask substantial heterogeneity by age and seniority, if older or more experienced teachers have better negotiating skills.

We investigate this possibility in Figure IV, which shows estimates of δ_s in equation (3) obtained separately for teachers with less than five and more than 15 years of seniority (Panel A), and for those aged 30 and younger and 45 and older (Panel B). The gender wage gap is larger and more persistent for less experienced teachers, and equal to 1.5 percent five years after the expiration of a CBA or its extension (significant at 1 percent). For more experienced teachers, it is smaller at 0.7 percent (significant at 1 percent). These estimates correspond to 12 and 8 of the pre-Act 10 standard deviation in salaries, respectively, and to 140 and 63 percent of its post-CBA expiration increase. The gender pay gap is also larger and more persistent among younger teachers compared with older ones.

These results suggest that young women might be more likely to opt out of bargaining or to have lower returns to bargaining, possibly because they have a lower bargaining ability or there is less information about them for evaluation. A possible explanation for a larger gender wage gap for younger teachers is that women in childbearing age might be more likely to work fewer hours or be on maternity leave. However, all our estimates account for FTE units by

[25] Columns 4-6 of Table IV summarize these findings.

[26] Gayle and Golan (2012) suggest that a weaker labor market attachment among women could account for the gender earnings gap at early ages. We show, however, that our results remain even when we restrict our sample to teachers who never quit in our study period.

distinguishing between part-time and full-time teachers.[27] In Section 4.7 we also show that our estimates hold when we restrict the sample to teachers observed at least four years before and after a CBA expiration, which implies that we exclude women who are on maternity leave in a given year. It is thus unlikely that the results are driven by differences in hours worked or maternity leave.

4.6 The Role of School and District Leadership

Studies of other workplaces have found a positive correlation between the presence of female management and women's career outcomes (Casarico and Lattanzio, 2019; Langan, 2019). In fact, Cullen and Perez-Truglia (2020) also show that women's career trajectories are slower compared with men's when workers have a male manager. To explore whether the gender composition of schools' and districts' leadership influences women's success in our context, we test whether the gender wage gap is related to the gender of school principals and district superintendents. Principals and superintendents serve distinct roles in the public school system. Superintendents are district administrators in charge of hiring all staff and ultimately deciding on workers' pay. Principals manage individual schools, have closer interactions with teachers relative to superintendents, and are responsible for assessing teachers through a combination of objective and subjective evaluations (**?**Biasi, 2020).

Principals We first test whether the existence of a salary gap after Act 10 is correlated with a school's principal's gender. Figure V, Panel A, shows results from estimating equation (2) separately for teachers with male and female principals in the years preceding Act 10.[28] The change in the gender pay gap is larger in schools with a male principal, and equal to 0.7 percent five years after the expiration (solid line, significant at 1 percent). In schools with a female principal, the change in the gap is more contained and indistinguishable from zero (dashed line). These results are summarized in column 1 of Table V, and indicate that teachers in schools with a male superintendent prior to a CBA expiration have a 0.4 percentage points larger gap (significant at 10 percent). Because principals are largely responsible for evaluating teachers and less involved in salary negotiations, a possible explanation for this result is that male principals evaluate women more negatively than men.

[27] Since hours are set in K-12 teaching, all full-time teachers work the same number of hours. Part-time teachers work 50 percent of a FTE.

[28] We use the preceding years to estimate an ITT to avoid the possible endogenous moving of principals after Act 10. However, the results are robust to using principals in the current year.

Superintendents Next, we re-estimate equation (2) separately for teachers in districts with male and female superintendents in the years before a CBA expiration. The estimates reveal a larger gender gap for teachers in districts with a male superintendent (Figure V, Panel B). Specifically, in districts managed by a man the gap is more than 0.8 percent larger five years after a CBA expiration compared with before (solid line). In districts with a female superintendent, on the other hand, the change in the gap is indistinguishable from zero (Figure V, dashed line). These results are summarized in columns 4-6 of Table V, and indicate that teachers in districts with male superintendents prior to a CBA expiration experience a 0.6 percentage point larger gap (significant at 5 percent).

This finding suggests that women are not just on average worse at bargaining than their male counterparts; rather, the gender of the other negotiating party matters. In particular, the fact that no salary gap exists when the superintendent is female suggests that women are either better able to negotiate with other women (or men are worse at negotiating with women), or that they experience backlash when they try to negotiate with men. We explore these possibilities in Section 5.

It is also possible that schools headed by female principals or districts headed by female superintendents are different along a host of characteristics. If some of these are related to the gender pay gap, they could be driving the observed relationship between the gap and the gender of school and district leaders. In Figure V we control for observable teacher characteristics, such as experience, credentials, grade, and subject, which implies that these estimates are not affected by differences in workforce composition among schools and districts led by women relative to men. Appendix Table AV also shows that there are no differences in teacher quality or attrition based on the gender of school leadership.

4.7 Additional Robustness Checks

Accounting for Compositional Changes Following Act 10, retirement rates spiked among Wisconsin teachers (Biasi, 2019; Roth, 2017). To ensure that our results are not driven by changes in the overall composition of the male and female teaching body across districts with different CBA expiration dates, we conduct two additional checks.

First, we restrict our analysis to a balanced panel of teachers in the eight years surrounding each expiration. This allows us to only use, in estimation, teachers who do not retire nor leave

the sample.[29] This restriction yields an estimate of the gender wage gap equal to 0.4 percent (Table AII, column 1, significant at 1 percent). Second, we re-estimate equation (4) controlling for teacher fixed effects. The corresponding estimate is robust at 0.4 percent (Table AII, column 2, significant at 1 percent).

Accounting for Endogenous Switches Across Districts Biasi (2020) shows that the passage of Act 10 was followed by an increase in teacher movements across districts. If these movements are driven (entirely or partly) by teachers' responses to the rise of a gender wage gap driven by flexible pay, the assignment of teachers to the policy change would be endogenous. To gauge the impact of endogenous assignment on our main estimates, we estimate the intent-to-treat (ITT) by assigning teachers to the district they taught in the year prior to the passage of Act 10. A teacher is then considered exposed to flexible pay the year their original district's CBA expires, regardless of whether they have moved from that district.[30] ITT estimates, shown in column 3 of Table AII, are slightly larger than in our main specifications in Table III and equal to 0.6 percent, suggesting that cross-district movements –if anything– lessen the impact of Act 10 on the gender wage gap. We study the role of teacher mobility for the gender wage gap in Section 6.2.

Allowing for Different Salary Schedules Across Districts Next, we allow for the possibility that the gender wage gap that followed the expiration of districts' CBAs reflected changes in the salary schedules used by districts after Act 10. We do so by allowing the parameters β_1 and β_2 in equation (3) to be district-specific. These results, shown in column 4 of Table AII, indicate that a gender gap remains (and becomes larger at 0.7 percent) even when controlling for district-specific schedules.

Controlling for Extra Duties If flexible pay is associated with a higher compensation for extra duties (such as coaching a sports team) and men are more likely to take on these duties, our estimates of the gender wage gap might be affected by our inability to fully observe (and control for) these duties. To partially account for this data limitation, we collected information on the names of all sports coaches in Wisconsin schools as of 2017 from the Wisconsin Interscholastic Athletic

[29] Results are unchanged (although noisier due to a much smaller sample size) if we use the full ten years.

[30] This strategy is similar to Yagan (2019), who estimates the effects of local unemployment rates on employment during the Great Recession (2007-2009) assigning local rates to workers based on workers' location in January 2007.

Association and linked this information to our teacher data.[31] This allows us to control for one of the most common and gender-skewed extra duties (only 34 percent of women serve as coaches in our data). Our estimates of the gap are unchanged when we exclude coaches or control for an interaction between indicators for coaches and for years after an expiration (Appendix Figure AIX). This indicates that extra duties are unlikely to explain the gender differences in pay that followed Act 10.

5 Avoiding Bargaining or Being Punished? A Survey

We have shown that a salary gap emerged between male and female Wisconsin teachers following the introduction of flexible pay. The fact that the gap is concentrated among young and less experienced teachers, as well as in districts with male principals and superintendents, suggests that bargaining plays a role in driving this gap. Administrative staff and salary data, however, do not allow us to test directly whether women chose not to bargain following Act 10 (and if so, why) or whether they bargained but were less successful or penalized for doing so.[32] Distinguishing between these explanations is crucial for policy. For example, if women chose not to bargain because they underestimated the returns to doing so, providing them with this piece of information could close part or all of the gender pay gap. Alternatively, if women were less successful at bargaining because they tend to have worse negotiating skills than men, a solution could be to provide them with the appropriate training (Ashraf et al., 2020).

To test among these possible hypotheses we surveyed current Wisconsin public school teachers. We asked teachers whether they had ever bargained their salary in their current and past position (and if not, why) and about their intention to bargain over pay and other aspects of their job in the future. We also asked them whether they have information on their colleagues' salaries and whether they know someone who has negotiated their pay. Finally, we used questions from social psychology to create a measure of negotiating skills. Answers to these questions allow us to study the mechanisms underlying the salary gap.

[31] This information is available at `https://www.wiaawi.org`. We were able to link information on 5,170 coaches, 82 percent of whom teach in middle or high school. Since we observe this information only for 2017, we assume a teacher was a coach for our entire study period if she was a coach in 2017.

[32] The literature has found that women are less likely to negotiate their salaries than men (Babcock and Laschever, 2003; Cardoso and Winter-Ebmer, 2010; Leibbrandt and List, 2014), but that they may be correct in doing so: an experiment by Exley et al. (2019) shows that women correctly select into bargaining, choosing to do so only when they know they will have a positive payoff.

Survey Details and Sample Description The survey questionnaire is in Appendix C. We sent an invitation to fill in the survey (shown in Appendix Figure CI) via email to 39,081 teachers employed in the 284 Wisconsin districts which make teachers' emails available on their websites.[33] A total of 3,156 teachers responded to our survey, with a response rate of 13 percent. The gender and age distributions of the respondents closely resemble those of the teacher population (Appendix Figures AXV and AXVI).

5.1 Gender Differences in Negotiation Experiences and Attitudes

Table VI summarizes men and women's responses to the the survey questions. The main result is that women are less likely to have negotiated their pay with previous and current employers. For example, 38 percent of men and 30 percent of women report having negotiated with past employers. Women are also 8.3 percentage points less likely to have negotiated at the start of their current job (with 30.6 percent of men and 22 percent of women) and 4.0 percentage points less likely to have negotiated after the start of their current job.

If a teacher reported having negotiated, we asked whether the negotiation was successful. Conditional on having negotiated, women are 13 percentage points less likely than men to state that the negotiation was successful. If instead they did not negotiate, we asked for the reasons behind this choice. Two answers stand out: Women are more likely than men to state that they were not comfortable negotiating (with a gender difference of 10.5 percentage points or 83 percent), that they thought it would be useless (2.2 percentage points or 35 percent), or that they were already satisfied with their pay (3.6 percentage points or 24 percent).

Most of our questions concern negotiations over pay. It is possible, however, that women are more inclined to negotiate other job aspects beyond pay. To explore this possibility we asked teachers about the likelihood that they will negotiate salaries, classroom assignment, and non-teaching duties in the future. The data confirm that gender differences in bargaining disproportionately affect wage negotiations. While women are 19 percent less likely to report that they will negotiate their pay, they are only 5 percent less likely to negotiate non-teaching duties and slightly more likely than men to negotiate their classroom assignment.

We also collected information on other individual-level determinants of the likelihood to

[33] These include 215 districts with CBA expiration dates in 2011, 46 in 2012, and 22 in 2013, as well as 65 flexible-pay and 80 seniority-pay districts. We did not explicitly ask teachers to disclose their school district; we obtained this information by sending out different surveys to teachers in different districts. The survey was sent out on March 5, 2020; two reminder emails were sent in the following 14 days to the teachers who had not responded. The survey was closed on May 7th, 2020.

negotiate, such as perceived returns to bargaining, bargaining ability, and self-confidence. In our data women are 29 percent less likely than men to know their colleagues' salaries and 14 percent less likely to know someone who negotiated their pay. This could lead women to underestimate the returns to bargaining.[34] No gender differences exist in measures of socio-emotional skills, which we use as proxy for bargaining ability and which include being able to assess how people feel and to read subtle signals in other people's behavior (Sharma et al., 2013).[35] Women are, however, 13 percent less likely to state that they are confident talking to people they don't know. Lastly, women in our data tend to value themselves less than their male colleagues, and they are 12 percent less likely than men to report that their performance is above average.[36]

Controlling for Teachers' and Districts' Attributes A simple comparison of men's and women's answers indicates that women are less likely than men to negotiate their pay. We now test whether these differences remain once we control for teachers' and districts' observable characteristics. Specifically, we control for district fixed effects to account for potential differences in the negotiating environment across districts. We also control for a set of teachers' attributes such as age, knowledge of colleagues' salaries, and measures of socio-emotional skills, to gauge the extent to which the observed gaps in the propensity to negotiate is explained by teachers' bargaining ability or their expected returns to negotiating.[37]

Table VII presents our main results. Panel A confirms that, even controlling for district fixed effects and teacher attributes, women are 6.8 percentage points less likely to having negotiated pay with their previous employer (column 1) and 7.1 percentage points less likely to have negotiated at the start of their tenure with their current employer (column 2). There is no significant difference between men and women's likelihood of negotiating after the start of their tenure with their current employer.

We also find that, among teachers who have negotiated in the past, the likelihood of success is lower for women than for men. Controlling for district fixed effects and teacher attributes, women are 8 percentage points less likely to report that salary negotiations with their current employer at the start of the relationship were successful (Table VII, panel B, column 3).

[34] In our survey less than one-third of all teachers state that they know their colleagues' pay. This is in spite of the fact that this information is publicly available on the WDPI's website (available at https://dpi.wi.gov).

[35] These skills are drawn from the literature on individual differences in negotiating and negotiating outcomes. For an overview, see Sharma et al. (2013).

[36] This finding is in line with Exley and Kessler (2019), who show that women are less likely to self-promote themselves in professional contexts, in part because they underestimate their performance.

[37] Estimates obtained controlling only for district fixed effects, but not for teacher attributes, are shown in Table AVI.

In Panel C we test for gender differences in the reasons for the choice of not negotiating at the beginning of their current employment relationship.[38] Controlling for district effects and teacher attributes, we find that women are 6.5 percentage points (31 percent) more likely than men to say that they were not comfortable negotiating (column 2), but 4 percentage points less likely to state that they are satisfied with their pay (column 5). Women are also slightly more likely than men to claim that they thought negotiating was useless (2.4 percentage points or 11 percent, column 3), although this difference is not statistically different from zero.

Lastly, in Panel D we explore the likelihood that women will negotiate in the future. Our estimates confirm that women are 12 percent less likely than men to plan on negotiating their pay in the future (with an estimate for *Female* equal to -0.475, column 1, significant at 1 percent). Women are also slightly more likely to negotiate their teaching assignment (column 2) as likely as men to negotiate other non-teaching duties (column 3). These results indicate that the reluctance of women to bargain is limited to negotiations over pay.

5.2 The Role of Superintendents' Gender

In Section 4.6 we have shown that the gender wage gap is larger among teachers who work under a male principal or superintendent. We now investigate whether the propensity to negotiate is related to the gender of the district's management.[39] We find that the observed gender differences in bargaining are largely driven by teachers working under a male superintendent. Simple comparisons of means indicate that women are 19 percent less likely to negotiate their pay in the future under a male superintendent, but as likely as men to do so where the superintendent is a woman (Table VI). Controlling for district and teacher attributes confirm that women who work under a female superintendent are 8.6 percentage points more likely to have negotiated with their current employer after the start of the employment relationship, relative to men and women with a male superintendent (Table VIII, column 2) and 7.5 percentage points more likely to state that they will negotiate their pay in the future (column 3).

Instead, we do not find evidence that negotiating with a female superintendent is associated with a higher likelihood of women stating that their negotiations were successful (Panel B). We also do not find any association between the gender of the superintendent and the reasons teachers give for not negotiating (Panel C). It should be noted, however, that the coefficients for

[38] The results are similar if we instead look at reasons for not negotiating with a past employer.

[39] We assign superintendents' genders to districts using information from 2016. To ensure confidentiality, we did not collect information on respondents' schools. This prevents us from investigating the role of the gender of school principals.

*Female * Female super* in these tables are estimated imprecisely, which prevents us from ruling out large positive or negative values for the point estimates.

Additional Results In Appendix Table AVII we also investigate whether individual attributes (such as knowing the salaries of colleagues and measures of self-confidence and socio-emotional skills) mediate the gender gap in the propensity to negotiate. While we find that knowing other people's pay and socio-emotional skills are positively (albeit imprecisely) related to the likelihood of negotiating, we don't find strong evidence that this relationship varies by gender: Estimates for the interaction coefficients in Appendix Table AVII (columns 1-3) are small and statistically insignificant. We also investigate the role of these attributes on the likelihood of reporting that past negotiations were successful and of stating not to feel comfortable negotiating (columns 4 and 5). Here, we find that measures of socio-emotional skills and self-confidence (as measured by the belief of above-average performance) are associated with a lower likelihood that women report feeling uncomfortable negotiating. Taken together, these results do not show evidence that individual attributes related to information, confidence, and negotiating ability have a large impact on the gender gap in the propensity to negotiate. These attributes could, however, affect female teachers' confidence in negotiating, which we are unable to observe.

5.3 Survey Results: Summing Up

The results from our survey indicate that women are less likely than men to have negotiated their pay in the past and to plan on doing so in the future. This behavior cannot be explained by a lower bargaining ability or different perceived returns to negotiating. Even if women who negotiate are less likely than men to report that the negotiation was successful, the gender difference in the propensity to negotiate holds even when controlling for socio-emotional skills as a proxy for bargaining ability. Similarly, the gap in the likelihood to negotiate does not seem to be explained by whether teachers know other people's salaries or other people who have negotiated their pay.

Our results outline an important role for the bargaining environment in determining whether teachers choose to negotiate or not. First, we find that women are significantly more likely than men to report that they chose not to negotiate because they felt uncomfortable doing so. Second, the gender gap in the likelihood of negotiating pay in the future is entirely driven by teachers working under a male superintendent; male and female teachers who work under a female superintendent are equally likely to negotiate.

While our inability to link our survey answers to administrative records prevents us from exactly estimating the portion of the post-Act 10 gender wage gap generated by the different propensity to negotiate across genders, the results from the survey suggest that women's reluctance to bargain, particularly with male superintendents, is likely an important driver of these salary differences. Creating an environment in which all teachers feel comfortable discussing their pay could potentially close a significant part of the gender wage gap.

6 Alternative Explanations for the Gender Wage Gap

To obtain a better understanding of the importance of bargaining vis à vis other explanations in explaining the gender wage gap, we test here for three alternative mechanisms: 1) gender differences in teaching quality, 2) differences in mobility, and 3) differences in the demand for male and female teachers.

6.1 Gender Differences in Teaching Quality

A possible explanation for the observed wage gap is that districts used their post-Act 10 flexibility to reward teachers for their quality, and men are better teachers than women. A simple comparison of value-added between men and women does not support this hypothesis: Women's average value-added is equal to zero both before and after Act 10, whereas men's value-added is equal to -0.002 before Act 10 and -0.001 afterwards. The gender difference in value-added is significant at 1 and 10 percent before and after Act 10, respectively (Table I).

Even if women appear to be better teachers on average, it is still possible that some men have higher quality and are compensated more after the introduction of flexible pay. We check for this possibility by testing whether the gender wage gap can be explained by differences in value-added across teachers. We do so by augmenting equation (3) to flexibly control for value-added, and we estimate:

$$\begin{aligned} \ln(w_{ijt}) \quad = \quad & \beta_1' X_{it} + \beta_2' X_{it} \times postext_{j(it)t} + \beta_3' VA_{it} + \beta_4' VA_{it} \times postext_{j(it)t} + \gamma_1' T_{it} \\ & + \gamma_2' T_{it} \times postext_{j(it)t} + \theta_{j(it)} + \theta_{j(it)} \times postext_{j(it)t} + \tau_t + \tau_t \times Y_{j(it)}^{exp} \\ & + \delta_0 Female_i + \delta Female_i \times postext_{j(it)t} + \varepsilon_{it} \end{aligned} \tag{5}$$

where VA_{it} is the value-added of teacher i in year t.

Estimates of this equation are shown in Table IX. Because value-added measures are avail-

able only for teachers in Math and Reading teaching grades 4-8, column 1 re-estimates equation (3) on this subsample. The post-extension gender wage gap remains robust at 0.4 percent (significant at 10 percent). Column 2 shows estimates of equation (5): These indicate that the gender wage gap remains stable at 0.4 percent controlling for value-added (significant at 10 percent). A positive estimate on *VA * Post Expiration* (albeit imprecisely estimated) also confirms that districts pay teachers with higher value-added more (column 2, p-value equal to 0.27). In line with Biasi (2020), the same result holds (and the estimate of the coefficient is larger) on the subsample of flexible-pay districts (column 5).

In columns 3, 6, and 9 Table IX we further explore whether the post-Act 10 returns to value-added are different among men and women, by interacting *VA * Post Expiration* with an indicator for *Female*. The coefficient on this triple interaction captures the differential returns to value-added for women relative to men after the reform. At -0.078, the estimate for this coefficient completely offsets the positive estimate for *VA * Post Expiration*, equal to 0.068 (column 3, significant at 5 and 10 percent respectively). Together, these estimates indicate that while men are compensated for having a high value-added, women are not. Importantly, however, in these equations the estimates for *Female * Post Expiration* are unchanged; this implies that even women with average value-added experience a wage penalty compared with men with the same value-added.

Movements Between Tested and Non-Tested Positions In Section 4.7 we have shown that our main results are not driven by compositional changes in the pool of male and female teachers over time. In the same spirit we also test whether our findings on the role of value-added are driven by changes in the composition of teachers in "tested" positions (for whom value-added measures can be obtained). The data show that neither the likelihood of changing teaching assignment (i.e., grade, subject, or school) nor that of switching from a tested to a non-tested position differed between men and women after a CBA expiration relative to before (Appendix Figure AVIII). This indicates that compositional changes are unlikely to explain our value-added results.

Taken together these results suggest that differences in teaching quality do not explain the gender wage gap that followed the introduction of flexible pay. It is of course possible that value-added is not the measure of quality that school and district leaders want to reward. Even this possibility, however, would not explain why we observe a larger gap in schools and districts

run by men.

6.2 Gender Differences in Job Mobility

Gender differences in cross-district mobility could influence the gap in several ways. First, female teachers might be less likely to relocate than men.[40] In this case, women would not be able to take advantage of outside offers of higher salaries from other districts. Fewer outside offers could also decrease women's bargaining power in negotiations with their current district and any other prospective employer (Caldwell and Danieli, 2018). Second, women might experience lower returns from moving (Loprest, 1992; Keith and McWilliams, 1999), either because they have fewer outside options to use in the negotiation or because they do not negotiate at all.[41]

To check whether differences in job mobility explain the gender pay gap, we start by testing whether women are less likely to move than men before and after the introduction of flexible pay. A simple plot of the share of male and female teachers who change district in each year, by time-to-expiration of each district's CBA, indicates that women are only slightly less likely to move throughout the period of analysis (Figure AX). To more rigorously test this hypothesis, we estimate

$$Moves_{it} = \beta_1 Female_i + \beta_2 postext_{j(it)t} + \beta_3 Female_i \times postext_{j(it)} + \alpha X_{it} + \theta_{j(it)} + \tau_t + \varepsilon_{it} \quad (6)$$

where $Moves_{it}$ is a dummy indicating that teacher i changed district in year t. In column 1 of Table X we estimate this equation without teacher controls (X_{it}) and fixed effects (θ_j, and τ_t). The estimate for *Female* $\times$ *post-CBA extension* is equal to 0.2 percent; compared with an average moving rate of 2.4 percent for men, this indicates that women are 9 percent less likely than men to change district after the introduction of flexible pay. Estimates remain robust when we control for district and year fixed effects (column 2) and for teachers' observables, such as experience and education (column 3). In column 4 we redefine our dependent variable to only capture movements across districts located in the same commuting zone (CZ), which do not require a relocation. A small and insignificant estimate of *Female* $\times$ *post-CBA extension* does not show

[40] Women have a lower willingness-to-commute than men, possibly because of family obligations (LeBarbanchon et al., 2020; Caldwell and Danieli, 2018; Manning, 2003). A similar argument can be applied when thinking about moving. Although they find no differences in moving rates across gender, Keith and McWilliams (1999) show that women are less likely to quit or change jobs for family reasons.

[41] Using US survey data, Loprest (1992) shows that young men's wages grow twice as much as young women's upon changing employer.

any gender differences in this type of mobility. We also do not find strong evidence of gender differences in propensity to move when splitting our sample by (i) the type of district of origin or destination (flexible-pay or seniority-pay), or (ii) teacher value-added (Appendix Table AIII). Taken together, these results indicate that women are slightly less likely than men to move under flexible pay, but only if the move involves changing CZ.

We now test whether the returns from moving differ for men and women after the introduction of flexible pay. We do so by estimating an event study of conditional salaries around each move, separately for men and women who move at least once, and focusing on moves that happen after a CBA expiration in the destination district:

$$\begin{aligned} \ln(w_{it}) &= \beta_1' X_{it} + \beta_2' X_{it} \times postext_{j(it)t} + \gamma_1' T_{it} + \gamma_2' T_{it} \times postext_{j(it)t} + \theta_{j(it)} \\ &+ \theta_{j(it)} \times postext_{j(it)t} + \tau_t + \tau_t \times Y^{exp}_{j(it)} + \tau_t \times Y^{ext}_{j(it)} + \sum_{s=-4}^{5} \delta_s \mathbb{1}(t - M_i = s) + \epsilon_{it} \end{aligned} \tag{7}$$

Here, M_i is the year in which teacher i changes district after a CBA expiration.[42] Normalizing δ_{-1} to zero, estimates of δ_s capture the change in pay for movers s years after a move relative to the year prior to the move. These estimates, shown in Figure VI, indicate that the returns from moving are larger for men: Immediately following a move, salaries of men increase by 4.2 percent whereas salaries of women only increase by 2.8 percent.

The results from these tests suggest that differences in mobility rates and the returns from moving might explain part of the observed gender wage gap. To assess the extent of this, Figure VI shows event studies of the gender wage gap around a CBA expiration separately for three groups of teachers: (i) those who never move, (ii) those who move at least once between 2007 and 2016, and (iii) those who move at least once after a CBA expiration. While the gap is slightly larger for movers post-expiration (1.4 percent five years after an expiration), it is still significant at 0.9 percent for teachers who never move. We conclude that observed mobility plays at most a small role in explaining the gender gap.

In spite of these findings, it is possible that *unobserved* mobility plays a role, and that men receive more outside offers than women because they can more credibly threaten to move (Caldwell and Danieli, 2018). We can only observe outside offers that teachers accept. We can, however, test whether the salary gap is larger in CZs with more schools, where a teacher should in principle have more options. We estimate equation 2 separately for teachers in CZs in the top

[42] For teachers who change district more than once, we consider only the first move.

and bottom quartile of the distribution of the number of schools. These results, shown in Figure VII, indicate that the salary gap is larger for teachers living in commuting zones with a large number of schools, suggesting that outside options may play some role in determining men and women's bargaining power.

6.3 Higher Demand for Male Teachers

Men are underrepresented in the teaching profession, especially in elementary schools. A high demand for male teachers could have bid up their salaries once Act 10 allowed for individual negotiations. If this explanation holds, we would expect the gender wage gap to be larger in schools or districts with a higher demand for men. For a proper test of this hypothesis we would need to observe the demand for male and female teachers, which is not possible given our data. Instead, we conjecture two instances in which the demand for men could be higher and test whether the gender wage gap is larger in these cases.

The first instance are schools enrolling a higher share of boys. If male teachers act as role models for male students, these schools should have a higher demand for men and a larger gap. Our data confirm this hypothesis: The gap is significantly larger at 2.3 percent in schools with 54 percent or more male students (the top 5 percent of the distribution) compared with those with 48 percent or fewer males (the bottom 5 percent, Figure AXIII).[43] Because the variation in the share of male students is rather limited, however, controlling for this variable leaves our main estimate of the gender wage gap unchanged at one percent five years after a CBA expiration (Figure AXIV).

The second instance consists in schools and grades where men are scarcer, such as elementary schools (where men are only 20 percent of the teacher population, compared with 40 percent for middle and high schools). In contrast with the hypothesis, the gap is significantly smaller for teachers in elementary schools (0.4 percent after five years) compared with those in high schools (1.1 percent after five years, Figure AXI). The gap is also smaller in districts that had more than 30 percent male teachers before Act 10 (the 75th percentile in the distribution, Figure AXII).[44]

[43] This result holds and the difference becomes more pronounced using schools in the top and bottom 1 percent of the distribution of the share of male students. Thirty-nine percent of schools with more than 54 percent male students are high schools.

[44] Panel A of Figure AXII shows an event study of the gender wage gap for schools where the share of male teachers was above and below 30 percent pre-Act 10. These estimates indicate that the gap is large at 1.1 percent five years after a CBA expiration in schools where more than 30 percent of teachers are men (solid line), and it is indistinguishable from zero for teachers in schools with less than 30 percent male teachers (dashed line). Panel B shows the same event study for districts with a share of male teachers above and below 30 percent. These estimates indicate that the gap is unrelated to the share of men in the district, and it is similar across schools with fewer and more men.

These results provide suggestive evidence that the demand for male teachers is unlikely to be driving the pay gap. It is however possible that this demand is not evenly distributed across schools and it is higher among those with an already larger share of male teachers before Act 10. A larger salary gap in schools with more men could also indicate that men are more successful than women at bargaining and able to secure a larger share of school resources, or that being in an environment with more men affects women's ability to bargain.

7 Conclusion

Bargaining has been discussed as one of the reasons for the gender wage gap. This paper uses data from a large public-sector employer, the Wisconsin public school system, to shed light on this debate. Wisconsin's Act 10 replaced the traditional bargaining system in which teacher unions bargain with the school district and instead allowed for individual bargaining between teachers and school districts. The staggered timing of the introduction of the bill's provisions allows us to quantify the impact of flexible pay on the gender wage gap as teachers became "forced" to bargain over their salaries.

In line with previous experimental work, we find that women lose relative to men when they are required to bargain. When school districts adopted flexible pay a pay gap emerged in the salaries of men and women. The gap is largest among new, inexperienced teachers, and among teachers working in schools or districts run by men. These results suggest that bargaining might play an important role in shaping the gender wage gap.

Responses to a survey administered to all Wisconsin teachers confirm this hypothesis. Women are less likely to have negotiated their salary or to expect to do so in the future, especially if they work in a district with a male superintendent. Survey responses further suggests that women chose not to negotiate because they feel uncomfortable doing so, not because they underestimate the returns to it or are worse at bargaining. We also explore possible alternative explanations to the gap, unrelated to bargaining. The gap is not explained by gender differences in teacher ability or job mobility, and is unlikely to be driven by a higher demand for men in certain schools.

Taken together, our results support the hypothesis that forcing women to bargain could perpetuate the wage gap. Our results also brings causal evidence to questions on unionization and wage inequality, corroborating earlier work showing that unionization is negatively correlated with the gender wage gap (Blau and Kahn, 1996). Policies that train women to negotiate or that have women negotiate with other women could prove successful and represent important

topics for further research.

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Tables

Table I: Male and female teachers: Mean observable characteristics

	2007-2011			2012-2016		
	Males	Females	Diff.	Males	Females	Diff.
experience (years)	14.9	14.3	0.6***	14.2	13.9	0.3***
			(0.04)			(0.04)
age	43.0	43.3	-0.3***	42.4	42.5	-0.06
			(0.04)			(0.05)
highest ed = BA	0.5	0.5	-0.003	0.5	0.5	0.003
			(0.002)			(0.002)
highest ed = Master	0.5	0.5	0.0006	0.5	0.5	-0.005**
			(0.002)			(0.002)
highest ed = PhD	0.003	0.001	0.002***	0.004	0.001	0.002***
			(0.0002)			(0.0002)
salary ($)	51213.2	51019.6	193.5***	53971.9	53611.5	360.5***
			(48.2)			(59.1)
value-added	-0.002	-0.00005	-0.002***	-0.001	-0.00003	-0.001*
			(0.0007)			(0.0005)
ever moves	0.1	0.09	0.01***	0.1	0.1	0.01***
			(0.001)			(0.002)
leaves sample	0.07	0.06	0.003***	0.08	0.08	-0.0005
			(0.001)			(0.001)
elementary T	0.2	0.5	-0.3***	0.2	0.5	-0.3***
			(0.002)			(0.002)
middle school T	0.2	0.2	0.05***	0.2	0.2	0.05***
			(0.002)			(0.002)
high school T	0.6	0.2	0.3***	0.5	0.2	0.3***
			(0.002)			(0.002)
math T	0.1	0.06	0.06***	0.1	0.06	0.06***
			(0.001)			(0.001)

Note: The table shows the mean characteristics of males and female teachers, and the differences in means (standard errors in parentheses) for the years 2007–2011 (columns 1-3) and 2012–2016 (columns 4–6). $^{*} \leq 0.1$, $^{**} \leq 0.05$, $^{***} \leq 0.01$.

Table II: District characteristics, CBA expiration dates, and extensions: Differences

	Expiration post 2011 vs in 2011			W/ extension vs w/out		
	(1)	(2)	(3)	(4)	(5)	(6)
District chars.	Difference	SE	P-value	Difference	SE	P-value
Enrollment	13116.29	8153.50	0.11	2618.90	791.06	0.00
N teachers	957.31	569.04	0.09	177.26	54.38	0.00
Per pupil expenditure	0.08	0.88	0.92	-1.42	0.38	0.00
Share black students	0.14	0.06	0.03	0.01	0.01	0.07
Share disadvantaged students	0.06	0.06	0.36	-0.03	0.02	0.05
In urban area	0.23	0.17	0.19	0.09	0.05	0.05
In suburban area	0.34	0.17	0.05	0.07	0.03	0.02

Note: The table shows the estimates ("Differences"), robust standard errors, and p-values from OLS regressions in which we separately regress each district characteristic listed in the first column on a dummy variable indicating that a CBA expiration occurred after 2011 (columns 1-3) and a dummy variable indicating that a district received an extension (columns 4-6). Each observation is a school district.

Table III: Gender salary gap after CBA expiration and extension (OLS and 2SLS)

Dep Var: Log Salary	Expirations		Extensions		2SLS, Extensions	
	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.0024**	-0.0024**	-0.0024**	-0.0024**	-0.0024**	-0.0024**
	(0.0012)	(0.0012)	(0.0011)	(0.0011)	(0.0011)	(0.0011)
Female × Post Extension	-0.0033***				-0.0031***	
	(0.0009)				(0.0010)	
Female × 1 Year(s) Post		-0.0006		0.0005		0.0006
		(0.0011)		(0.0010)		(0.0019)
Female × 2 Year(s) Post		-0.0030*		-0.0018		-0.0038*
		(0.0015)		(0.0013)		(0.0020)
Female × 3 Year(s) Post		-0.0012		-0.0016		-0.0012
		(0.0012)		(0.0014)		(0.0019)
Female × 4 Year(s) Post		-0.0062***		-0.0036**		-0.0050
		(0.0017)		(0.0015)		(0.0031)
Female × 5 Year(s) Post		-0.0091***		-0.0078***		-0.0105***
		(0.0020)		(0.0017)		(0.0033)
Female × Post Expiration			-0.0027***			
			(0.0009)			
Distr × Post exp	Yes	Yes	Yes	Yes	Yes	Yes
Educ, Exper, Teaching Assign × Post exp	Yes	Yes	Yes	Yes	Yes	Yes
Yr × Exp yr	Yes	Yes	Yes	Yes	Yes	Yes
N	579596	579596	579596	579596	579596	579596
# districts	428	428	428	428	428	428

Note: The dependent variable is the natural logarithm of salary per year, in full-time equivalency units. The variable *Female* equals one for female workers, the variable *Post Expiration* equals one for years following the expiration of a CBA, and the variable *Post Extension* equals one for years following the expiration of a CBA or its extension. The variables *X Year(s) Post* equal one for observations X years after an extension (in columns 1, 2, 5, and 6) or after an expiration (columns 3 and 4). Columns 1-4 estimate OLS; columns 5 and 6 estimates 2SLS, with *Post expiration* as an instrument for *Post extension*. All specifications include fixed effects for the district, number of years of experience, highest education degree, grade level (elementary, middle, high), and subject (math, reading, and others), alone and interacted with an indicator for years after the extension of a CBA. All specifications also include year fixed effects interacted with extension year effects. Standard errors in parentheses are clustered at the district level. $^{*} \leq 0.1$, $^{**} \leq 0.05$, $^{***} \leq 0.01$.

Table IV: Gender salary gap after CBA extension by district type

	Baseline			W/ gender-specific schedule, 3-4 yrs seniority, master's		
	(1)	(2)	(3)	(4)	(5)	(6)
	FP	SP	Difference	FP	SP	Difference
=1 if Female	-0.0031**	-0.0015	-0.0019	0.0064	0.0006	0.0005
	(0.0015)	(0.0018)	(0.0019)	(0.0047)	(0.0033)	(0.0035)
Female × Post Extension	-0.0028*	-0.0048***	-0.0046***	-0.0088*	0.0018	0.0044
	(0.0014)	(0.0013)	(0.0013)	(0.0045)	(0.0058)	(0.0063)
Female × FP			-0.0014			-0.0011
			(0.0024)			(0.0023)
Female × FP × Post Extension			0.0020			-0.0084
			(0.0019)			(0.0104)
Distr × Post exp	Yes	Yes	Yes	Yes	Yes	Yes
Educ, Exper, Teaching Assign × Post exp	Yes	Yes	Yes	Yes	Yes	Yes
Exper * Female * Post Ext	No	No	No	Yes	Yes	Yes
N	203157	259956	463255	203157	259816	462973
# districts	102	122	224	102	122	224

Note: The dependent variable is the natural logarithm of salary per year, in full-time equivalency units. The variable *female* equals one for female workers, the variable *Post Extension* equals one for years following the expiration of a CBA or its extension. Columns 1 and 3 are estimated on teachers in flexible-pay districts, and columns 2 and 4 are estimated on teachers working in seniority-pay districts. All specifications include fixed effects for the district, number of years of seniority, highest education degree, grade level (elementary, middle, high), and subject (math, reading, and others), alone and interacted with an indicator for years after the extension of a CBA. Columsn 4-6 also include years of experience fixed effects, interacted with *Female* and for *Post Extension*. All columns present OLS estimates. All specifications also include year fixed effects interacted with extension year effects. Standard errors in parentheses are clustered at the district level. $^{*} \leq 0.1$, $^{**} \leq 0.05$, $^{***} \leq 0.01$.

Table V: Gender salary gap after CBA extension, By principal and superintendent gender and by share of men in the district or school

	Principal	Super.	Share Men	
	(1)	(2)	(3)	(4)
			In school	In district
Female	-0.0026	-0.0036	-0.0015	-0.0026*
	(0.0019)	(0.0026)	(0.0015)	(0.0014)
Female × Post	-0.0002	0.0028	0.0010	-0.0017
	(0.0015)	(0.0028)	(0.0015)	(0.0012)
Female × Male princ	-0.0002			
	(0.0017)			
Female × Male princ × Post	-0.0035**			
	(0.0015)			
Female × Male super		0.0011		
		(0.0029)		
Female × Male super × Post		-0.0063**		
		(0.0031)		
Female × High share men			-0.0007	-0.0006
			(0.0016)	(0.0024)
Female × High share men × Post			-0.0081***	-0.0043*
			(0.0019)	(0.0025)
Distr, Educ, Exper, Teaching Assign × Post exp	Yes	Yes	Yes	Yes
Yr × Exp yr	Yes	Yes	Yes	Yes
N	538434	540533	579493	579496
# districts	428	428	428	428

Note: The dependent variable is the natural logarithm of salary per year, in full-time equivalency units. The variable *female* equals one for female workers, the variable *Post Expiration* equals one for years following the expiration of a CBA or its extension. The variables *Male princ* and *Male super* equal one for teachers in schools with at least one male principal and districts with at least one male superintendent in the years prior to the CBA expiration or extension, respectively. The variable *High share men* equals one for teachers with an average share of male colleagues in their school/district and year higher than 30 percent in the years prior to the CBA expiration or extension. All specifications include fixed effects for the district, number of years of seniority, highest education degree, grade level (elementary, middle, high), and subject (math, reading, and others), alone and interacted with an indicator for years after the extension of a CBA. Specifications also include year fixed effects interacted with extension year effects. All columns present OLS estimates. Standard errors in parentheses are clustered at the district level. $^{*} \leq 0.1$, $^{**} \leq 0.05$, $^{***} \leq 0.01$.

Table VI: Survey Answers: Means, Women vs Men, and Differences in Means

	Women	Men	Difference	Std. Error
Have you ever negotiatied...				
w/prev employer	0.295	0.379	-0.084***	(0.019)
w/current employer, at start	0.223	0.306	-0.083***	(0.018)
w/current employer, after start	0.205	0.245	-0.040**	(0.017)
If yes, negotiation was successful				
w/prev employer	0.819	0.904	-0.085***	(0.025)
w/current employer, at start	0.709	0.814	-0.105***	(0.034)
w/current employer, after start	0.455	0.572	-0.117***	(0.042)
Why did you not negotiate? (current employer, at start)				
it was not possible	0.419	0.451	-0.032	(0.020)
I was not comfortable doing so	0.233	0.128	0.105***	(0.016)
It was useless	0.084	0.063	0.022**	(0.011)
I feared backlash	0.065	0.055	0.011	(0.010)
I was satisfied w/pay	0.186	0.149	0.036**	(0.015)
I didn't know it was possible	0.000	0.000	0.000	(0.000)
Average likelihood that you will negotiate...				
salary	3.365	3.889	-0.524***	(0.121)
classroom assignment	4.752	4.539	0.213	(0.130)
non-teaching duties	4.347	4.579	-0.232*	(0.124)
Average likelihood that you will negotiate, male superintendent				
salary	3.233	3.996	-0.764***	(0.143)
classroom assignment	4.652	4.449	0.202	(0.157)
non-teaching duties	4.215	4.509	-0.293**	(0.148)
Average likelihood that you will negotiate, female superintendent				
salary	3.556	3.667	-0.110	(0.229)
classroom assignment	4.922	4.714	0.209	(0.237)
non-teaching duties	4.581	4.724	-0.143	(0.231)
Share agreeing w/statements				
I worked in other industries	0.476	0.503	-0.027	(0.020)
I know someone who negotiated their pay	0.505	0.590	-0.085***	(0.020)
I know my colleagues' pay	0.275	0.387	-0.111***	(0.019)
I am confident talking to people I don't know	0.728	0.839	-0.110***	(0.017)
I can read subtle signals	0.890	0.884	0.006	(0.013)
I can read people's feelings	0.871	0.861	0.010	(0.014)
I have good people's skills	0.888	0.883	0.006	(0.013)
My performance is above the mean	0.321	0.364	-0.044**	(0.019)
N (teachers)	2190	843		

Note: This table presents the average shares of female and male teachers answering "yes" to a given survey question, as well as the differences in means and standard deviations (in parentheses). $^{*} \leq 0.1$, $^{**} \leq 0.05$, $^{***} \leq 0.01$.

Table VII: Survey Answers: Likelihood of Negotiating, OLS Estimates

Panel A) Ever negotiated with:

	Previous employer	Current empl., at start	Current empl, after start
Female	-0.068***	-0.071***	-0.028
	(0.020)	(0.022)	(0.018)
Controls	Yes	Yes	Yes
N	2836	2836	2836
Y mean, males	0.379	0.306	0.245

Panel B) Negotiated successfully conditional on negotiating, with:

	Previous employer	Current empl., at start	Current empl., after start
Female	-0.080***	-0.132**	-0.107*
	(0.029)	(0.052)	(0.062)
Controls	Yes	Yes	Yes
N	902	700	614
Y mean, males	0.904	0.814	0.572

Panel C) Reasons for not negotiating (current employer, at start)

	Not possible	Not comfortable	Useless	Fear backlash	Satisfied w/pay
Female	-0.023	0.065**	0.024	0.005	-0.040*
	(0.028)	(0.029)	(0.025)	(0.019)	(0.022)
Controls	Yes	Yes	Yes	Yes	Yes
N	2222	2222	2222	2222	2222
Y mean, males	0.565	0.210	0.215	0.131	0.189

Panel D) Likelihood of negotiating in the future, over:

	Salary	Classroom assignment	Non-teaching duties
Female	-0.475***	0.273*	-0.135
	(0.162)	(0.139)	(0.133)
Controls	Yes	Yes	Yes
N	2836	2836	2836
Y mean, males	3.889	4.539	4.579

Note: Panel A shows whether a teacher negotiated her salary at the start of her contract with her current employer (column 1) or after the start of her contract with her current employer (column 2). Columns 3-5 ask whether a teacher plans to negotiate her salary, classroom assignments, or non-teaching duties in the future. Panel B shows whether female teachers are more likely to state that they were unsuccessful conditional on negotiating relative to men. Panel C presents the reasons respondents gave for not negotiating. *Female* is an indicator for female teachers. All regressions include controls for age class, self-reported job performance (above/below average), a measure of people skills, an indicator for whether the respondent knows someone who negotiated his/her salary, an indicator for whether the respondent knows his/her colleagues' salaries, and district fixed effects. Standard errors in parentheses are clustered at the district level. $^{*} \leq 0.1$, $^{**} \leq 0.05$, $^{***} \leq 0.01$.

Table VIII: Survey Answers, By Superintendent's Gender. OLS Estimates

Panel A) Ever negotiated with:

	Current empl.		In the future		
	At start	After start	Salary	Class assgn	Non-teach. duties
Female	-0.083***	-0.057***	-0.718***	0.272*	-0.186
	(0.025)	(0.020)	(0.151)	(0.161)	(0.151)
Female * F super	0.038	0.086**	0.746**	0.009	0.156
	(0.046)	(0.035)	(0.354)	(0.334)	(0.278)
Controls	Yes	Yes	Yes	Yes	Yes
N	2784	2784	2784	2784	2784
Y mean, males	0.306	0.245	3.889	4.539	4.579

Panel B) Negotiated successfully conditional on negotiating, with:

	Current employer, at start	Current employer, after start
Female	-0.087	-0.082
	(0.057)	(0.069)
Female * F super	-0.134	-0.119
	(0.119)	(0.139)
Controls	Yes	Yes
N	682	601
Y mean, males	0.814	0.572

Panel C) Reasons for not negotiating:

	Not possible	Not comfortable	Useless	Fear backlash	Satisfied w/pay
Female	-0.001	0.074**	0.024	-0.004	-0.059**
	(0.033)	(0.035)	(0.030)	(0.023)	(0.023)
Female * F super	-0.070	-0.024	0.017	0.034	0.061
	(0.057)	(0.058)	(0.054)	(0.042)	(0.048)
Controls	Yes	Yes	Yes	Yes	Yes
N	2183	2183	2183	2183	2183
Y mean, males	0.565	0.210	0.215	0.131	0.189

Note: Panel A shows whether a teacher negotiated her salary at the start of her contract with her current employer (column 1) or after the start of her contract with her current employer (column 2). Columns 3-5 ask whether a teacher plans to negotiate her salary, classroom assignments, or non-teaching duties in the future. Panel B shows whether female teachers are more likely to state that they were unsuccessful conditional on negotiating relative to men. Panel C presents the reasons respondents gave for not negotiating. *Female* is an indicator for female teachers. *F super* is an indicator that takes the value one if a teacher currently works in district with a female superintendent. All regressions include controls for age class, self-reported job performance (above/below average), a measure of people skills, an indicator for whether the respondent knows someone who negotiated his/her salary, an indicator for whether the respondent knows his/her colleagues' salaries, and district fixed effects. Standard errors in parentheses are clustered at the district level. $^{*} \leq 0.1$, $^{**} \leq 0.05$, $^{***} \leq 0.01$.

Table IX: Gender salary gap and teacher value-added

Dep Var: Log Salary	All districts			FP			SP		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female	0.0022	0.0022	0.0022	0.0052*	0.0052*	0.0052*	0.0013	0.0013	0.0013
	(0.0016)	(0.0016)	(0.0016)	(0.0030)	(0.0030)	(0.0030)	(0.0021)	(0.0021)	(0.0021)
Female × Post Extension	-0.0036*	-0.0036*	-0.0036*	-0.0103***	-0.0102***	-0.0102***	-0.0007	-0.0007	-0.0009
	(0.0021)	(0.0021)	(0.0021)	(0.0032)	(0.0032)	(0.0032)	(0.0026)	(0.0026)	(0.0026)
VA		0.0148	0.0148		0.0110	0.0110		0.0080	0.0080
		(0.0093)	(0.0093)		(0.0172)	(0.0172)		(0.0123)	(0.0123)
VA × Post Extension		0.0025	0.0677*		0.0344	0.1093		-0.0107	0.0521
		(0.0175)	(0.0368)		(0.0312)	(0.0689)		(0.0225)	(0.0497)
Female × VA × Post Extension			-0.0780**			-0.0879			-0.0751
			(0.0367)			(0.0717)			(0.0493)
Distr, Educ, Exper, Teaching Assign × Post exp	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yr × Exp yr	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	134620	134620	134620	47288	47288	47288	60007	60007	60007
# districts	425	425	425	102	102	102	121	121	121

Note: The dependent variable is the natural logarithm of salary per year, in full-time equivalency units. The variable *Female* equals one for female workers, the variable *Post-extension* equals one for years following the time limit for an extension to a CBA (for districts without an extension, this variable equals one for years after expiration), and the variable *VA* is equal to teachers' value-added. Columns 1 and 4 are estimated on teachers in all districts, columns 2 and 5 are estimated on teachers in flexible-pay districts, and columns 3 and 6 are estimated on teachers in seniority-pay districts. All columns present OLS estimates. All specifications include fixed effects for the district, number of years of seniority, and highest education degree, alone and interacted with an indicator for years after the extension of a CBA. Specifications also include year fixed effects. Standard errors in parentheses are clustered at the district level. $^{*} \leq 0.1$, $^{**} \leq 0.05$, $^{***} \leq 0.01$.

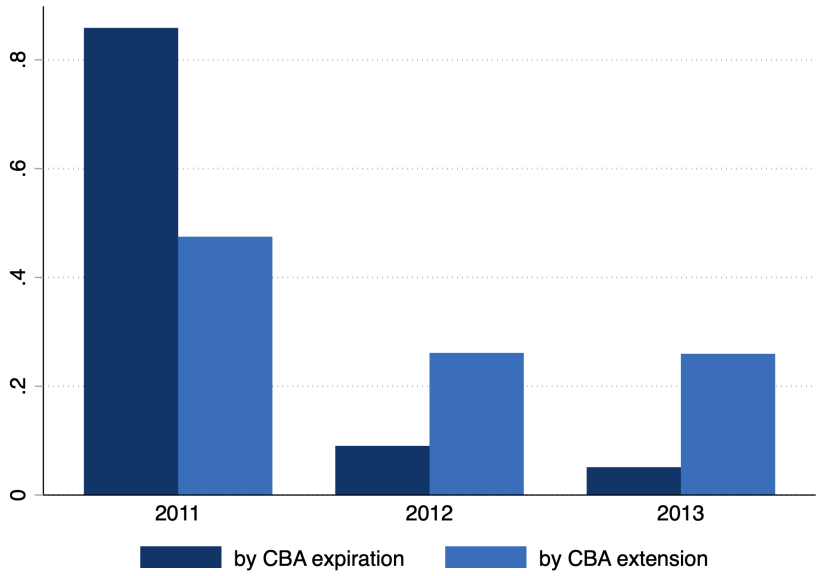
Table X: Gender Differences in Mobility

	All moves			Within CZ	Across CZ
	(1)	(2)	(3)	(4)	(5)
Female	-0.0011**	-0.0006	-0.0004	0.0007**	-0.0002
	(0.0005)	(0.0005)	(0.0006)	(0.0003)	(0.0004)
Post Extension	0.0180***	0.0008	-0.0048**	0.0001	
	(0.0011)	(0.0020)	(0.0019)	(0.0010)	
Female × Post Extension	-0.0022**	-0.0022**	-0.0024**	-0.0008	-0.0033***
	(0.0010)	(0.0011)	(0.0010)	(0.0007)	(0.0006)
District FE	No	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes
Experience, education FE	No	No	Yes	Yes	Yes
N	540074	540074	539906	546376	539012
# districts	428	428	428	428	428
Mean of dep. var.	0.0237	0.0237	0.0237	0.0101	0.0117

Note: The dependent variable is an indicator for a teacher changing district (columns 1-3), changing district but not CZ (column 4), and changing district *and* CZ in a given year (column 5). The variable *Female* equals one for female teachers and the variable *Post Extension* equals one for years following the expiration of a CBA or its extension. Columns 2-5 include district and year fixed effects; columns 3-5 also include fixed effects for years of experience and for the highest education degree. Standard errors in parentheses are clustered at the district level. $^{*} \leq 0.1$, $^{**} \leq 0.05$, $^{***} \leq 0.01$.

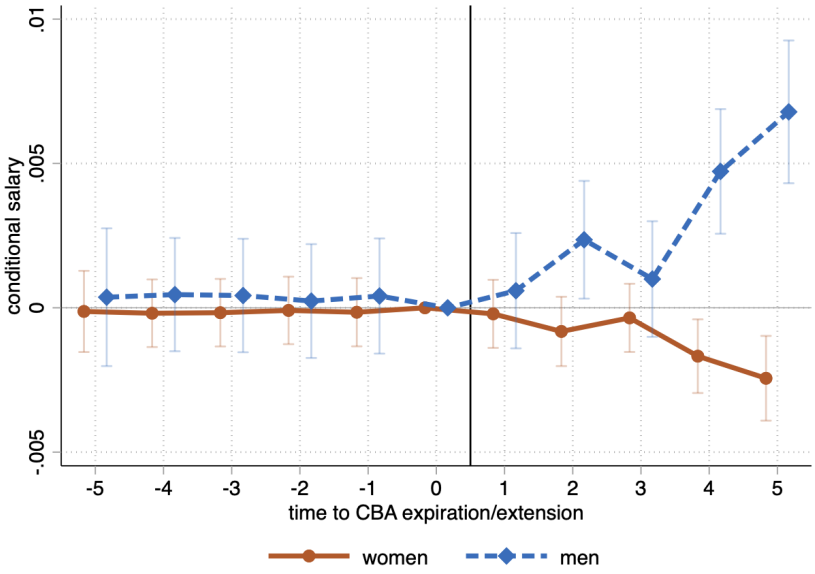
Figures

Figure I: Share of Teacher-Year Observations, by Expiration and Extension Dates of CBAs



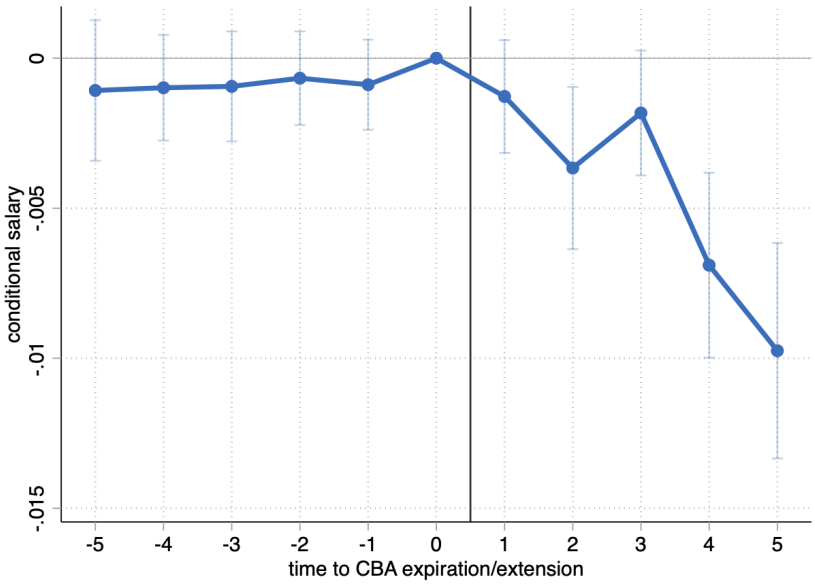
Note: This figure shows the share of teachers covered by collective bargaining agreements (CBAs) with different expiration dates. The darker bars show the share of teachers covered by a CBA that expired in 2011, 2012, and 2013. The lighter bars show the share of teachers covered by a CBA that expired or had its expiration date extended to 2011, 2012, and 2013.

Figure II: Salaries of Men and Women, by Time to Expiration/Extension of CBA



Note: The figure shows how the conditional salaries of male and female teachers evolve after Act 10. We plot the OLS point estimates and 90% confidence intervals of the coefficients δ_s in equation (2), for g =female (solid line) and g =male (dashed line). All coefficients are plotted relative to the average salary of male and female teachers in the year a CBA expires ($t = 0$), using the expiration date of the extended contract as the expiration year. Standard errors are clustered at the district level.

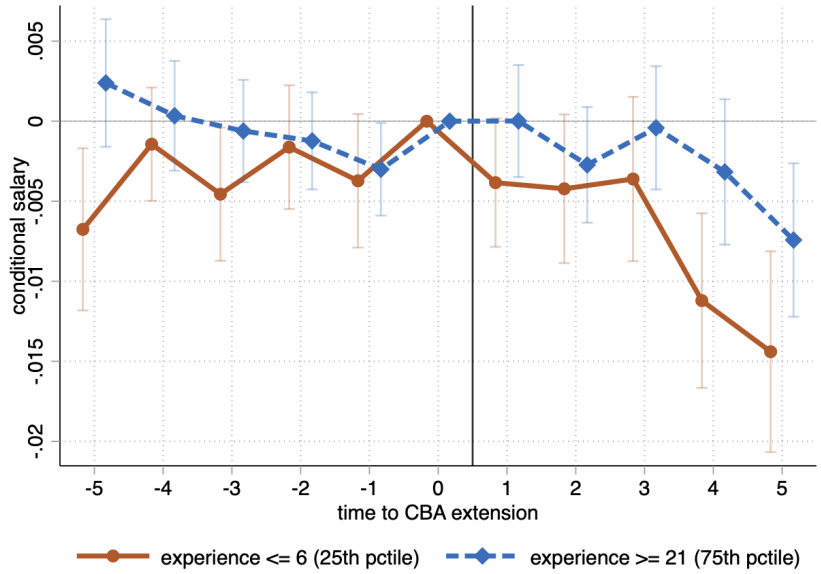
Figure III: Gender Gap in Salaries, by Time to Expiration/Extension of CBA



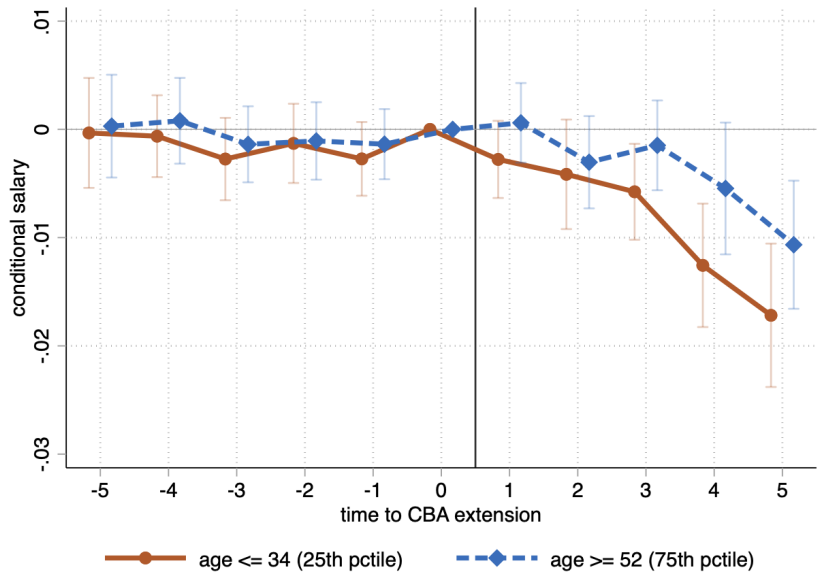
Note: The figure shows OLS point estimates and 90% confidence intervals of the coefficients δ_s in equation (3). All coefficients are plotted relative to the year a CBA or its extension expired ($t = 0$).Standard errors are clustered at the district level.

Figure IV: Gender Gap in Salaries, by Seniority and Age

Panel A: Pay Gap by Seniority



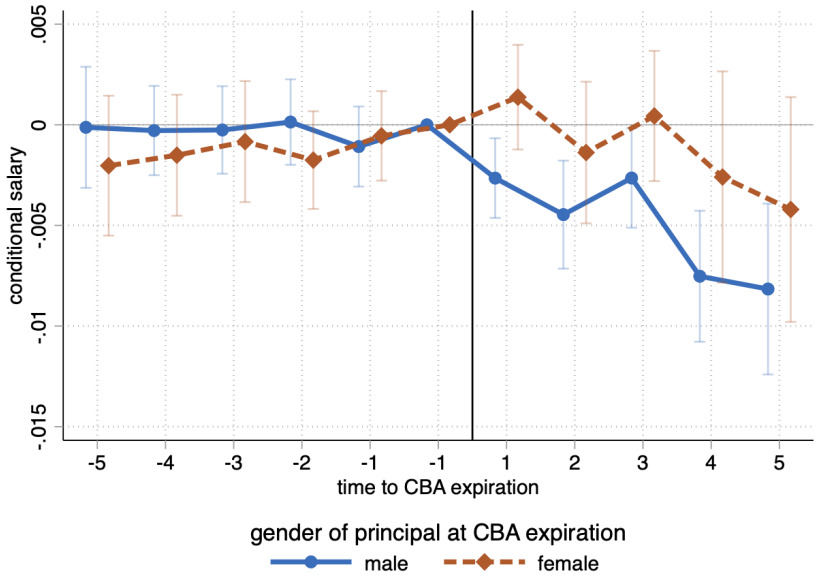
Panel B: Pay Gap by Age



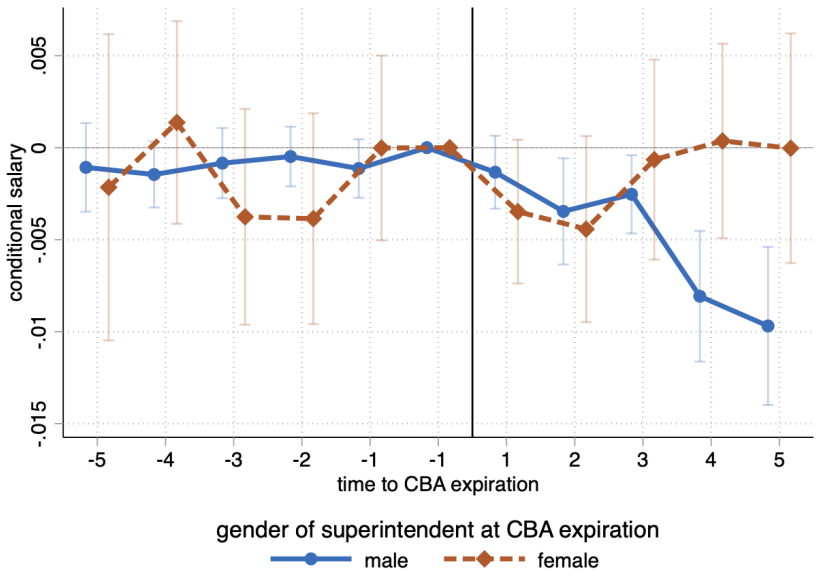
Note: Panel A shows OLS point estimates and 90% confidence intervals of the coefficients δ_s in equation (3), estimated separately for teachers with less than five (solid line) and more than 15 years of experience (dashed line). Panel B shows OLS point estimates and 90% confidence intervals of the coefficients δ_s in equation (3), estimated separately for teachers who are younger than 30 (solid line) and older than 45 (dashed line). All coefficients are plotted relative to the year a CBA or its extension expired ($t = 0$).Standard errors are clustered at the district level.

Figure V: School Environment and the Gender Gap in Salaries

Panel A: Gender of School Principals



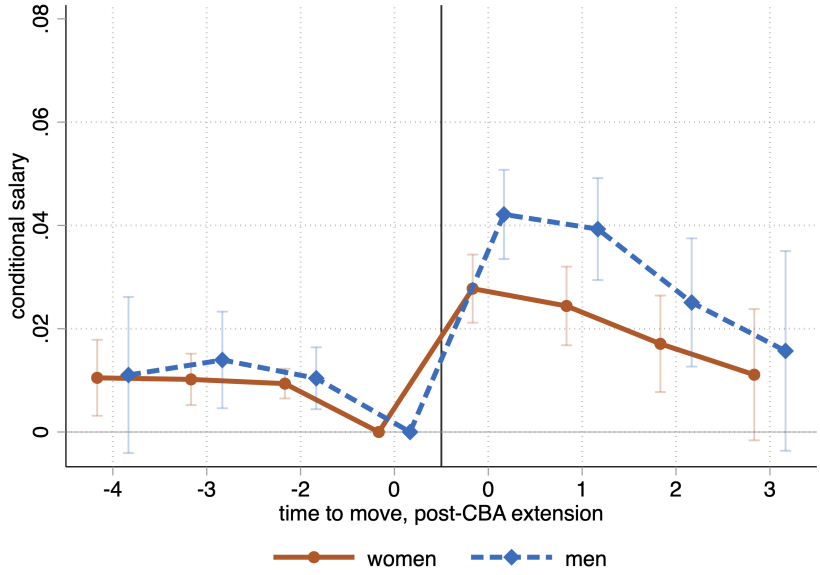
Panel B: Gender of District Superintedents



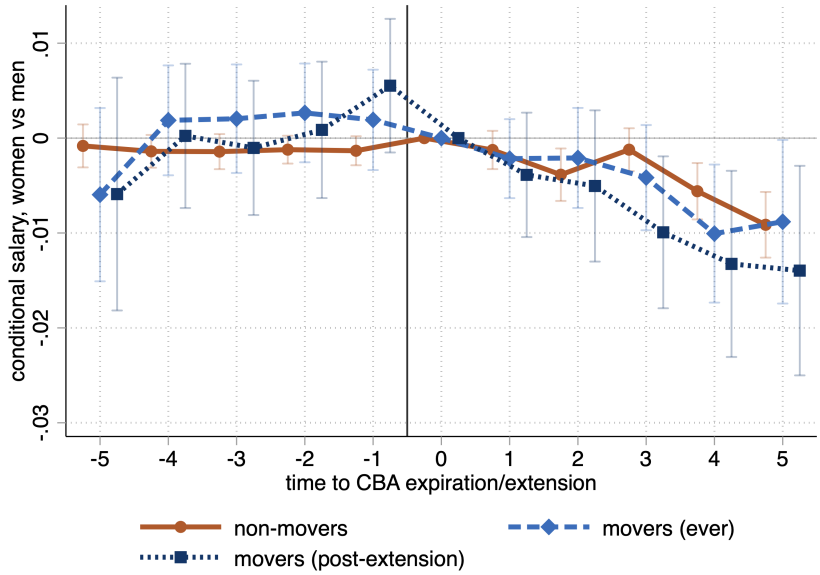
Note: The figure shows OLS point estimates and 90% confidence intervals of the coefficients δ_s in equation (3), estimated and shown separately for teachers in schools with at least one female principal and teachers in schools with all male principals in the years before a CBA expiration (Panel A), and for teachers in districts with at least one female superintendent and teachers in districts with all male superintendents in the years before a CBA expiration (Panel B). All coefficients are plotted relative to the year a CBA or its extension expired ($t = 0$). Standard errors are clustered at the district level.

Figure VI: Salaries and Mobility

Panel A: Conditional Salaries Around a District Move

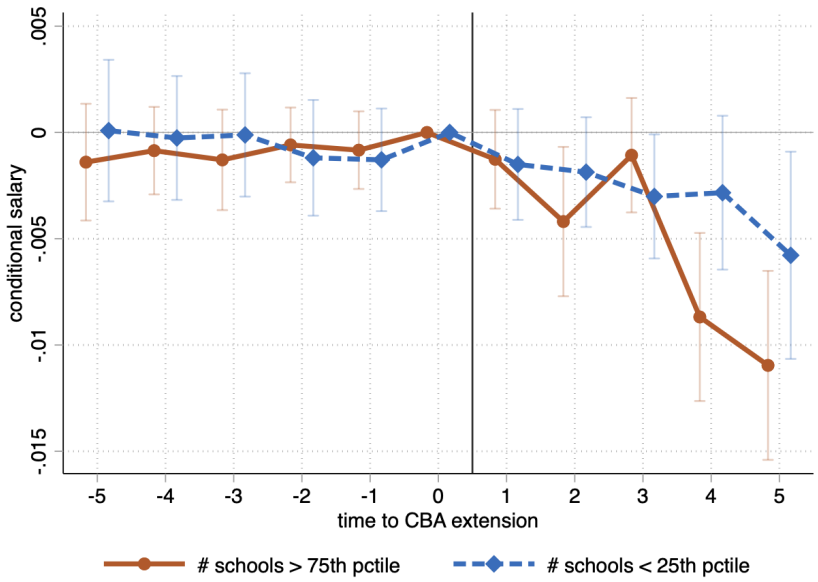


Panel B: Gender Gap in Salaries for Movers vs Non-Movers



Note: Panel A shows OLS point estimates and 90% confidence intervals of the coefficients δ_s in equation (7), estimated separately for male and female teachers. Panel B shows OLS point estimates and 90% confidence intervals of the coefficients δ_s in equation (7), estimated separately for teachers who never move between 2007 and 2016 ("non-movers"), those who move at least once ("movers (ever)"), and those who move at least once after a CBA expiration ("movers (post-extension)"). All coefficients are plotted relative to the year a CBA or its extension expired ($t = 0$). Standard errors are clustered at the district level.

Figure VII: Gender Gap in Salaries and Outside Options



Note: OLS point estimates and 90% confidence intervals of the coefficients δ_s in equation (2), estimated separately for teachers in commuting zones with a small number of schools (below the 25th percentile of the distribution) and a large number of schools (above the 75th percentile). All coefficients are plotted relative to the year a CBA or its extension expired ($t = 0$). Standard errors are clustered at the district level.