Flexible Wages, Bargaining, and the Gender Gap*

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Abstract

Does flexible pay increase the gender wage gap? To answer this question we analyze the wages of public-school teachers in Wisconsin, where a 2011 reform allowed school districts to set teachers' pay more flexibly and engage in individual negotiations. Using quasi-exogenous variation in the timing of the 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 principal or superintendent. Survey evidence suggests that the gap is partly 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
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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, however, has been difficult to study because 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 flexible pay disadvantages 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 before Act 10 was strictly based on seniority and academic credentials, using rigid schedules that school 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 without union consent. Following the reform, 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).

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 fe-

[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.

male teachers. While no gender pay gap existed before Act 10, the introduction of flexible pay led to a 0.1 standard deviations decline in women's salaries relative to their male counterparts. Although small (one percent) in absolute terms, this gap corresponds to 1.5 times the pre-Act 10 increase in pay associated with one additional year of seniority and 10 percent of the increase associated with obtaining 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 the early retirement documented by 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; 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.

We also find that 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 seniority in the top quartile of the distribution, it is larger at 1.5 percent and more persistent over time for teachers with seniority in the bottom quartile. Similarly, the gap is smaller for older teachers and larger for younger ones. These estimates imply that, if the gap persisted over time, women would lose an entire year's pay over the course of a 35-year career relative to men.

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, whereas it is zero in schools with a female principal. Similarly, the gap is 0.6 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 emergence of a gender wage gap following the introduction of flexible pay and its association with the gender of the leadership suggests that gender differences in either teachers' willingness to bargain or in their bargaining ability could be driving part of the observed pay 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 teachers who opted out of bargaining why they chose to do so; to those who did bargain, we asked whether the negotiation was successful. We also collected information on teachers' knowledge about their colleagues' salaries (to measure beliefs on the returns to bargaining) 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.

Survey responses indicate that women are between 12 and 23 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 the estimates 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 men being more likely to bargain under a male superintendents, whereas men and women who work under a female superintendent are equally likely to negotiate their salaries. Furthermore, women are 31 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 the perceived returns to bargaining or a lower bargaining ability do not explain our findings.

One limitation of our setting is the inability to link survey answers to administrative records. This 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. 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 rewarded for their teaching ability at the same rate as men are.

A second explanation relates to differences in job mobility and the returns to moving.[5] 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 moving to a different school or district. They might also garner fewer outside offers, which would lower their bargaining power in wage negotiations. We find that, after the introduction of flexible pay, women are slightly less likely to move than men across (but not within) commuting zones. 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 when restricting the sample to 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. Again, we believe that this finding points to bargaining as a primary channel driving the observed gender wage gap.

Finally, the 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: (i) schools where men are scarcer and (ii) schools enrolling a higher share of male students (where men could serve as role models for boys). In fact, the gap is smaller in schools where men are scarcer. The gap is larger among schools with a very high fraction of male students, but 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.[6]

Taken together, our results indicate 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 workforce. Workplace environmental factors (rather than gender differences in bargaining abil-

[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] 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.

[6] 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 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 observed gap across schools and districts.

ity) 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 (Babcock and Laschever, 2003; Leibbrandt and List, 2014; Dittrich et al., 2014). Similarly, evidence from the tech industry, where workers are required to post an "ask" salary at the beginning of the employment relationship, indicates that women systematically ask for lower pay than men (Roussille, 2020). These findings have given credence to the idea that women should bargain more. One notable exception is Exley et al. (2019), who 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.[7] 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.[8] Following teachers over several years allows us to account for sorting and differences in 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 our main findings on the gender wage gap in section 4. Section 5 describes our survey and its results. We explore alternative mechanisms for the gender wage gap in section 6. 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 the pay of each employee based on their seniority and academic credentials. A schedule is designed as a matrix: Increases in pay arise from movements along its rows or "steps," which correspond to increases in seniority, and columns or "lanes," which correspond to obtaining credentials such as Master's degree 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. CBAs 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 not directly related to teacher effectiveness (Podgursky, 2006).

[7] 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.

[8] Controlling for variables like sorting is especially important given the recent work by Farber et al. (2018) that shows that sorting into unionized jobs 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.

2.1 Wisconsin's Act 10

Until 2011, salaries of all Wisconsin teachers were determined using a schedule, which districts negotiated with the union.[9] These schedules were a key part of the CBAs and were 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. In an attempt to close a projected $3.6 billion budget deficit, the state legislature passed the Wisconsin Budget Repair Bill, which became known as Act 10. The bill 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. Third, it limits the validity of newly stipulated CBAs to one year. 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 teachers' 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. Districts used this flexibility in a variety of ways 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 (Biasi, 2020).[12] Even within these two groups the specific pay schemes adopted by the districts varied,

[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 state aid and local property taxes.

[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).

with some districts linking pay to principal or peer evaluations and others seeking to attract or retain employees by negotiating raises and bonuses with each individual teacher. Regardless of how districts set up pay after Act 10, teachers in all districts could negotiate their salaries to some degree; even in seniority-pay districts, some teachers were able to increase their pay by negotiating for a higher place on the salary schedule (Kimball et al., 2016). In sum, 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. Since pre-Act 10 CBAs fully regulated teacher pay with a salary schedule, however, districts could begin to use their freedom to flexibly set teacher pay only after the expiration of these CBAs. In addition, after Act 10 some districts decided to unilaterally extend the validity of their CBAs by one or two additional years (we discuss these instances in more detail in Section 3).

Due to differences in electoral cycles, the expiration dates of pre-existing CBAs and 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 Wisconsin public-school employees. 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).

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). The data set also includes total salaries for each worker.[13] 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 minutes of school board meetings. 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 (VA), an estimate of a teacher's contribution to the growth in achievement. We follow the canonical VA model of Kane and Staiger (2008):

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

and where 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, $i(kt)$ denotes student k's teacher in t, and $\theta_{c(kt)}$ is a classroom shock.[17] Teacher VA is the estimate of $\mu_{i(kt)}$, the teacher-specific component of test score residuals.

VA is usually estimated using datasets that contain classroom identifiers, in which teachers can be linked to the students they taught. Until 2017, the WDPI did not record classroom identifiers. 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 VA in the presence of this data limitation we use the same measure as Biasi (2020), a modified version of the empirical Bayes estimator of Kane

[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 handbook 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. For this reason, for 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.

and Staiger (2008) adapted to reflect the structure of the data. This measure exploits teacher turnover across grades and schools (rather than classrooms) over time.[18] With multiple years of data, turnover permits the identification of a single teacher's effect by comparing test score residuals $\bar{\nu}_{gst}$ of a grade g in school s and year t before and after her arrival in that 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.[19]

We allow a teacher's VA to differ before and after Act 10, to account for changes in effort in response to the reform, and we standardize it to have mean zero and variance equal to one. VA estimates are available for 23,581 teachers of Math and Reading in grades 4 to 8.

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. On average, these districts are more likely to be located in suburban areas and serve a larger share of Black students (Table II, columns 1-3); the latter difference, however, is largely driven by the Milwaukee Public Schools district.

After the CBAs expired, 100 school districts (23 percent) decided to extend the validity of

[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] The Online Appendix of Biasi (2020) presents this estimator in details and shows that, although noisier than the canonical estimator, the measure of teacher effectiveness it generates explains a substantial portion of the variance in test scores and is a forecast-unbiased estimator of standard VA estimates and future student achievement.

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

their agreements by one or two years, primarily to gain more time to design the new pay schemes. While the timing of expiration of the 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 the CBAs and their extensions. Although only the former can be considered random, our strategy still allows us to estimate the effects of flexible pay on the gender wage gap if the reasons that induced school districts to opt for an extension are not directly related to the differences in salaries between men and women. 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, teacher salaries were determined by attributes such as experience, academic credentials, and teaching assignment (i.e., grade 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:

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

where $\ln(w_{it})$ is the natural logarithm of the salary of teacher i working in district $j(it)$ in year t. The vector X_{it} contains indicators for teacher i's highest education degree and for years of experience. Alone and 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

[21] On average, women earned 0.9 percent less than men prior to Act 10 (Appendix Table AI, column 1). Accounting for experience, credentials, and teaching assignment 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).

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 people 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 (Appendix Figure AII). While small in an absolute sense, these changes are 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 pre-Act 10 salary increase associated with 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:

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

where all variables are defined as before and the variable F_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 overall increase in the standard deviation of salaries that followed Act 10 (equal to $670).

These results are summarized in Table III, where we re-estimate equation (3) pooling together the years before and after a CBA expiration. These estimates indicate that, prior to the introduction of flexible pay, women and men earned similar salaries conditional on observables. In the five years following the expiration of a CBA or 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 post-expiration gap 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 the variation from CBA expirations, to 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 to set pay using 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 these seniority-pay districts. We test this hypothesis in Appendix Figure AIII, 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 gap five years after a CBA extension (significant at 1 percent), while the latter experience a 1.2 percent increase (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, after the reform 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 Appendix Figure AIII, 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 AIV shows that while in the years prior to an expiration men and women with the same experience earned 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, which boils down to estimating experience- and education-specific gender gaps.[24] The results of this test are shown in the bottom panel of Appendix Figure AIII; for exposition, we plot the gender gap for teachers with 3 or 4 years of experience and a Master's degree. 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). 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

[23] In columns 1-3 of Table IV we re-estimate equation (3) pooling together years before and after a CBA extension, 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.

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

school hours. Thus, 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.[26]

We investigate this possibility in Figure IV, which shows estimates of δ_s in equation (3) obtained separately for teachers with six or fewer years and more than 21 years of seniority (the bottom and top quartiles of the seniority distribution, Panel A), and for those aged 32 and younger and 51 and older (the bottom and top quartiles of the age distribution, 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, the gap is smaller at 0.7 percent (significant at 1 percent). These estimates correspond to 12 and 8 percent of the pre-Act 10 standard deviation in salaries, respectively. 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 that can be used in the negotiations. A possible explanation for the 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 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 compo-

[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 later, however, that our results remain even when we restrict our sample to teachers who never quit in our study period.

[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.

sition 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 they ultimately decide on employees' pay. Principals manage individual schools, have closer interactions with the teachers relative to superintendents, and are responsible for assessing teachers through a combination of objective and subjective evaluations (Kimball et al., 2016; Biasi, 2020).

Principals We first test whether the existence of a salary gap after Act 10 is correlated with a school principal's gender. Panel A of Figure V shows results from estimating equation (3) 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 columns 1-3 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.

Superintendents Next, we re-estimate equation (3) 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

[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.

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 AIII 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 (Appendix Table AII, column 1, significant at 1 percent). Second, we re-estimate equation (3) controlling for teacher fixed effects. The corresponding estimate is robust at 0.4 percent (Appendix 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,

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

regardless of whether they have moved from that district.[30] ITT estimates, shown in column 3 of Appendix 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 Appendix 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 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 AVII). 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 gap is concentrated among young and less experienced teachers and in districts and schools with male principals and superintendents. This suggests

[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 rates to workers based on workers' location in January 2007.

[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.

that gender differences in bargaining might play an important 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. 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 information on these returns could close part or all of the gender pay gap.[32] 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 discern 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 about their intention to bargain over pay and other aspects of their job in the future. We asked the teachers who reported negotiating their salaries whether the negotiation was successful. We asked the teachers who did not report negotiating their salaries why they did not do so. To measure beliefs on the returns to bargaining, we also asked respondents 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 and we measure teachers' confidence by asking them to rate their own performance. Answers to these questions allow us to study the mechanisms underlying the salary gap.

Survey Details and Sample Description The survey questionnaire is in Appendix B. We sent an invitation to fill in the survey (shown in Appendix Figure BI) via email to 39,081 teachers employed in the 276 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 AVIII and AIX).[34]

[32] Roussille (2020) shows that while women in tech ask for a much lower initial salary compared with men, they raise their bid when informed about the median salary for their position.

[33] These include 212 districts with CBA or extension expiration dates in 2011, 43 in 2012, 20 in 2013, and one in 2014, as well as 62 flexible-pay and 78 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.

[34] Differences in the district characteristics for districts that had a respondent and those that did not are reported in Appendix Table AIV.

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, 37.9 percent of men and 29.5 percent of women report having negotiated with past employers (a 21 percent difference). Women are also 8.3 percentage points less likely to have negotiated at the start of their current job (a 27 percent difference, with 30.6 percent of men and 22.3 percent of women) and 4.0 percentage points less likely to have negotiated after the start of their current job (16 percent).

If a teacher reported having negotiated, we asked whether the negotiation was successful. Conditional on having negotiated, women are 10.5 percentage points less likely than men to state that the negotiation with the current employer at the start of the relationship was successful (or 13 percent). 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 salaries. 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 plan on negotiating non-teaching duties and slightly more likely to plan on negotiating their classroom assignment.

We also collected information on other individual-level determinants of the likelihood to 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.[35] No gender differences exist in measures of socio-emotional skills, such as the ability to assess how people feel and to read subtle signals in other people's behavior, which we use as proxy for bargaining ability (Sharma et al., 2013).[36] Women are, however, 13

[35] 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).

[36] These skills are drawn from the literature on individual differences in negotiating and negotiating outcomes. For

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.[37]

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, confidence, or their expected returns to negotiating.[38]

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, 18 percent) and 7.1 percentage points less likely to have negotiated at the start of their tenure with their current employer (column 2, 23 percent). 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 (9 percent, Table VII, panel B, column 3).

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.[39] 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

an overview, see Sharma et al. (2013).

[37] 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.

[38] Estimates obtained controlling for district fixed effects, but not for teacher attributes, are shown in Appendix Table AV.

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

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) and 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.[40] 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 confirms that women who work under a female superintendent are 8.3 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 (35 percent, 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 women are more likely to report that their negotiations were successful when negotiating with a female superintendent (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 *Female* $\times$ *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 AVI we also investigate whether individual attributes (such as knowing the salaries of colleagues, 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 like-

[40] 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.

lihood of negotiating, we do not find strong evidence that this relationship varies by gender: Estimates for the interaction coefficients in Appendix Table AVI (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 (measured as the likelihood of claiming 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 beliefs on the returns to bargaining, confidence, and bargaining ability have a large impact on the gender gap in the propensity to negotiate. One caveat to this conclusion, however, is that these attributes could 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 remains even when controlling for socio-emotional skills as a proxy for bargaining ability. Similarly, the gap in the likelihood to negotiate does not appear to be driven by whether teachers know their colleagues' salaries or other people who have negotiated their pay.

Our results suggest that the bargaining environment might have an important role 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 for 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 VA between men and women does not support this hypothesis: Women's average VA is equal to zero both before and after Act 10, whereas men's VA is equal to -0.002 before Act 10 and -0.001 afterwards. The gender difference in VA 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 VA across teachers. We do so by augmenting equation (3) to flexibly control for VA, and we estimate:

$$\begin{aligned} \ln(w_{it}) \quad = \quad & \beta_1' X_{it} + \beta_2' X_{it} \times postext_{j(it)t} + \beta_3' VA_{it} + \beta_4' VA_{it} \times postext_{j(it)t} + \gamma_1' T_{it} \\ & + \gamma_2' T_{it} \times postext_{j(it)t} + \theta_{j(it)} + \theta_{j(it)} \times postext_{j(it)t} + \tau_t + \tau_t \times Y^{exp}_{j(it)} + \tau_t \times Y^{ext}_{j(it)} \\ & + \delta_0 Female_i + \delta Female_i \times postext_{j(it)t} + \varepsilon_{it} \end{aligned} \tag{4}$$

where VA_{it} is the VA of teacher i in year t.

Estimates of this equation are shown in Table IX. Because VA measures are available only for teachers who teach Math and Reading in grades 4-8, we first re-estimate(3) on this subsample. The results, shown in column 1, show that the post-extension gender wage gap remains robust at 0.4 percent, although we lose power due to the smaller sample size. Column 2 shows estimates of equation (4). The gender wage gap remains stable at 0.4 percent controlling for VA. A positive estimate on *VA * Post Expiration* (albeit imprecisely estimated) also confirms that districts pay

teachers with higher VA 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 VA are different among men and women by interacting *VA * Post Expiration* with a female teacher dummy. The coefficient on this triple interaction captures the differential returns to VA 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; the sum of *VA * Post Expiration* and *VA * Female * Post Expiration* is indistinguishable from zero). Together, these estimates indicate that while men are compensated for having a high VA, women are not. Importantly, however, in these equations the estimates for *Female * Post Expiration* are unchanged; this implies that even women with average VA experience a wage penalty compared to men with the same VA.

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 VA are driven by changes in the composition of teachers in "tested" positions (for whom VA 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 AXII). This indicates that compositional changes are unlikely to explain our VA 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 VA 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. In this case, they would not be able to take advantage of higher salaries offered in other districts.[41] Second, if employers know that

[41]Research has shown that 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

women are unlikely to move, women may receive fewer outside offers which would decrease their bargaining power in negotiations with their current district or with any prospective employer (Caldwell and Danieli, 2018).

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 (Appendix Figure AX). To more rigorously test for differences in mobility, we estimate

$$Moves_{it} = \beta_1 Female_i + \beta_2 postext_{j(it)t} + \beta_3 Female_i \times postext_{j(it)} + \alpha X_{it} + \theta_{j(it)} + \tau_t + \varepsilon_{it} \quad (5)$$

where $Moves_{it}$ is a dummy indicating that teacher i moved to a different school district in year t. In column 1 of Table X we estimate this equation without teacher controls (X_{it}) and fixed effects ($\theta_{j(it)}$, 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).[42] In column 4 we redefine our dependent variable to only capture movements across districts located in the same commuting zone (CZ), which are less likely to require a relocation. A small and insignificant estimate of *Female* $\times$ *post-CBA extension* does not show 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 VA (Appendix Table AVII). 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.

To test whether these small differences in mobility rates contribute to the gender wage gap, we estimate 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. The results are shown in

applied when thinking about moving. Using survey data from a set of European countries, Hospido (2009) finds no gender differences in moving rates. 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.

[42] The district fixed effect is the district the teacher is currently working in.

Panel A of Figure VI. The gap is largest for teachers who move post-expiration (1.4 percent five years after an expiration), which is not what we would expect if women who move are those who are able to take advantage of higher salaries elsewhere. The gap is also still significant at 0.9 percent for teachers who never move. These results suggest that *observed* mobility plays at most a small role in explaining the gender gap.[43]

It is still possible, however, that *unobserved* mobility plays a role and that men receive more outside offers than women because they can more credibly threaten to move. Our data does not allow us to observe outside offers that teachers do not accept. To make progress, we 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 and bottom quartile of the distribution of the number of schools. These results, shown in Panel B of Figure VI, indicate that the salary gap is larger for teachers living in CZs with a large number of schools, suggesting that outside options may play a role in determining men and women's bargaining power. We interpret these results as being in support of our main hypothesis that differences in bargaining influence the gender wage gap once flexible pay is adopted. Differences in mobility could be an additional driver of differences in bargaining outcomes.

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. Since we are unable to observe the demand for male and female teachers, 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, Appendix Figure AXV).[44] Because the

[43] In Appendix Figure AXI we also test whether the returns to moving differ for men and women who actually move. Specifically, we estimate 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. The estimates 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.

[44] This result holds and the difference becomes more pronounced using schools in the top and bottom 1 percent of

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 (Appendix Figure AXVI).

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, Appendix Figure AXIII). The gap is also smaller in districts with a share of men in the top quartile of the distribution, relative to the bottom three quartiles (Appendix Figure AXIV).[45]

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 willingness or 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 with a system that involves 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 gap emerged in the salaries of men and women. The gap is largest among new, inexperienced teachers, and among

the distribution of the share of male students. Thirty-nine percent of schools with more than 54 percent male students are high schools.

[45] Appendix Figure AXIV 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).

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 felt uncomfortable doing so, rather than 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. We also bring 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).

Our results call for further exploration into policies that might prove successful in reducing the gender wage gap when flexible pay is adopted. The evaluation of policies that train women to negotiate, that have women negotiate with other women, or that improve salary transparency (Baker et al., 2019) or transparency regarding salary gaps 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	42.4	-0.0010
			(0.04)			(0.04)
Highest ed = BA	0.5	0.5	-0.003	0.5	0.5	0.001
			(0.002)			(0.002)
Highest ed = Master	0.5	0.5	0.0006	0.5	0.5	-0.004*
			(0.002)			(0.002)
Highest ed = PhD	0.003	0.001	0.002***	0.004	0.001	0.003***
			(0.0002)			(0.0002)
Salary ($)	51213.2	51019.6	193.5***	54201.7	53765.4	436.3***
			(48.2)			(53.0)
Value-added	-0.002	-0.00005	-0.002***	-0.001	-0.00008	-0.001**
			(0.0007)			(0.0005)
Ever moves	0.1	0.1	0.01***	0.2	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 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 of each district characteristic listed in the first column (measured in 2011) 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 expirations and extensions (OLS and 2SLS)

	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 CBA expiration and 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 expirations and extensions, 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
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 4 are estimated on teachers in flexible-pay districts, and columns 2 and 5 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. Columns 4-6 include years of experience fixed effects, interacted with *Female* and for *Post Extension*. All specifications also include year fixed effects interacted with CBA expiration and 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 V: Gender salary gap after CBA extension, by principal and superintendent gender and by share of men in the district or school

	Principal			Superintendent		
	(1)	(2)	(3)	(4)	(5)	(6)
	Male	Female		Male	Female	
Female	-0.0022**	-0.0021	-0.0026	-0.0025*	-0.0014	-0.0036
	(0.0011)	(0.0018)	(0.0019)	(0.0013)	(0.0023)	(0.0026)
Female × Post Extension	-0.0042***	0.0003	-0.0002	-0.0033***	-0.0008	0.0028
	(0.0011)	(0.0017)	(0.0015)	(0.0011)	(0.0022)	(0.0028)
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)
Distr, Educ, Exper, Teaching Assign × Post exp	Yes	Yes	Yes	Yes	Yes	Yes
Yr × Exp yr	Yes	Yes	Yes	Yes	Yes	Yes
N	338326	199904	538434	471419	68870	540533
# districts	427	402	428	426	340	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 Extension* 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. 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. Column 1 is estimated on schools with a male principal, column 2 on schools with a female principal, column 4 on districts with a male superintendent, and column 5 on districts with a female superintendent. 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

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	0.295	0.223	0.205

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	0.819	0.709	0.455

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	0.525	0.280	0.233	0.132	0.147

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	3.365	4.752	4.347

Note: In panel A the dependent variable equals one if a teacher negotiated their salary with the previous employer (column 1), with the current employer at the start of the work relationship (column 2) or after the start (column 3). In panel B the dependent variable equals one if a teacher believed the negotiation with either the previous employer (column 1), her current employer at the start of the work relationship (column 2), or the current employer after the start of the work relationship (column 3) was successful, conditional on negotiating. In panel C the dependent variable equals one if a teacher gives the corresponding reason as a motive for not negotiating (conditional on not doing so). In panel D the dependent variable equals one if the teacher plans on negotiating either salaries (column 1), classroom assignment (column 2), or non-teaching duties (column 3) in the future. *Female* is an indicator for female teachers. All specifications include controls for age class, self-reported job performance (above/below average), measures 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

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	0.223	0.205	3.365	4.752	4.347

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	0.709	0.455

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	0.525	0.280	0.233	0.132	0.147

Note: In panel A the dependent variable equals one if a teacher negotiated their salary with the current employer at the start of the work relationship (column 1) or after the start (column 2), and if the teacher plans on negotiating either salaries (column 3), classroom assignment (column 4), or non-teaching duties (column 5) in the future. In panel B the dependent variable equals one if a teacher believed the negotiation with their current employer at the start of the work relationship (column 1) or after the start of the work relationship (column 2) was successful, conditional on negotiating. In panel C the dependent variable equals one if a teacher gives the corresponding reason as a motive for not negotiating (conditional on not doing so). *Female* is an indicator for female teachers. *F super* equals 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), measures 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

	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, Teach Assgn × 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 expiration of a CBA or its extension. The variable *VA* is teacher value-added. Columns 4-6 are estimated on teachers in flexible-pay districts, and columns 7-9 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. All specifications also include year fixed effects interacted with CBA expiration and extension year effects. Standard errors in parentheses are clustered at the district level. $^{*} \leq 0.1$, $^{**} \leq 0.05$, $^{***} \leq 0.01$.

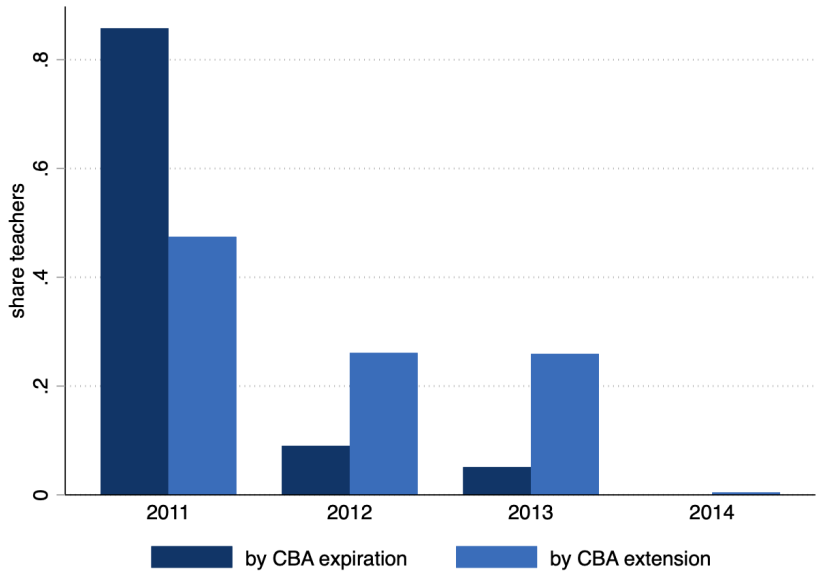
Table X: Gender differences in job mobility

	All moves			Within CZ	Across CZ
	(1)	(2)	(3)	(4)	(5)
Female	-0.0011**	-0.0006	-0.0004	0.0007**	-0.0008*
	(0.0005)	(0.0005)	(0.0006)	(0.0003)	(0.0004)
Post Extension	0.0180***	0.0008	-0.0048**	0.0001	-0.0033**
	(0.0011)	(0.0020)	(0.0019)	(0.0010)	(0.0013)
Female × Post Extension	-0.0022**	-0.0022**	-0.0024**	-0.0008	-0.0019***
	(0.0010)	(0.0011)	(0.0010)	(0.0007)	(0.0007)
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 within the same 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. $^{*} \leq 0.1$, $^{**} \leq 0.05$, $^{***} \leq 0.01$.

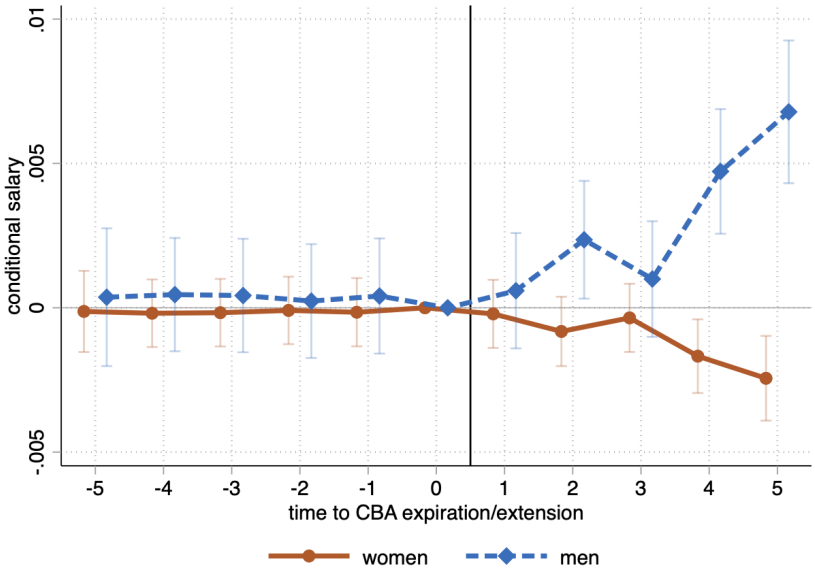
Figures

Figure I: Share of teachers, by expiration and extension dates of CBAs



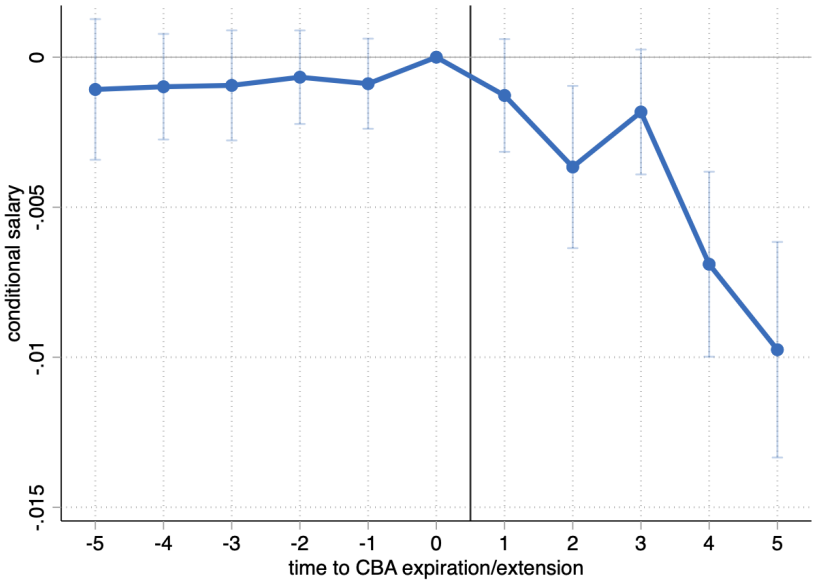
Note: The figure shows the share of teachers covered by collective bargaining agreements (CBAs) with different expiration dates. The darker bars show the share of teachers covered by a CBA that was originally supposed to expire in 2011, 2012, and 2013. The lighter bars show the share of teachers covered by a CBA whose validity was extended until 2011, 2012, 2013, or 2014 (for districts that did not extend the validity of the CBA, we refer to the expiration date).

Figure II: Salaries of men and women, by time-to-expiration/extension of CBAs



Note: The figure shows how the conditional salaries of male and female teachers evolved after Act 10. We plot the OLS point estimates and 90% confidence intervals of the coefficients δ_s^g 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 before a CBA or its extension expired ($t = 0$). Standard errors are clustered at the district level.

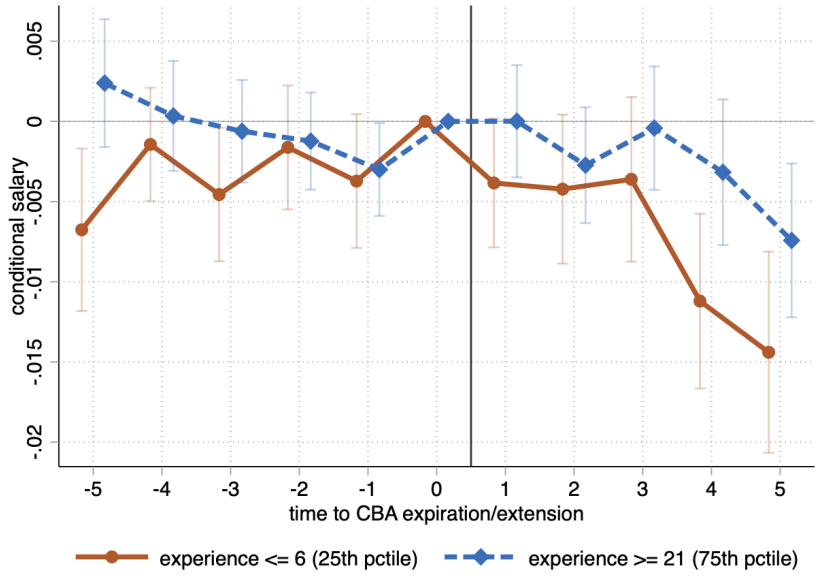
Figure III: Gender gap in salaries, by time-to-expiration/extension of CBAs



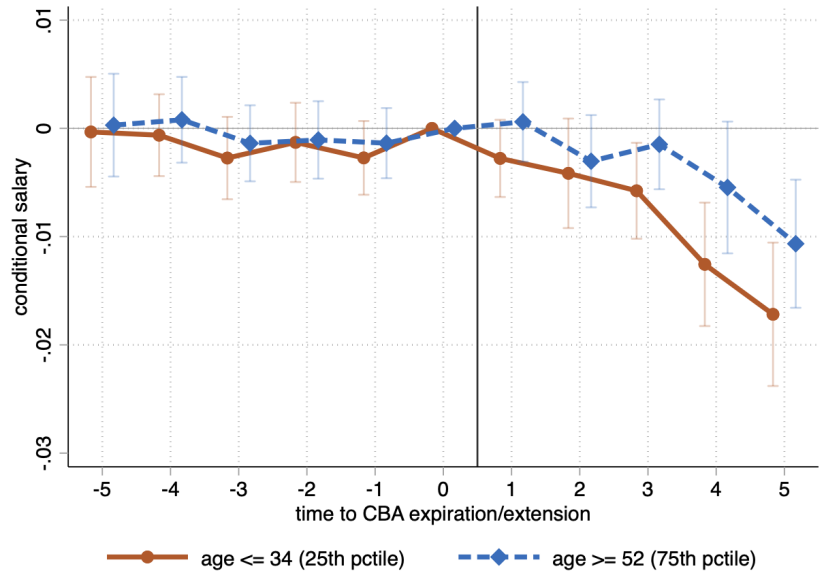
Note: The figure shows OLS point estimates and 90% confidence intervals of the coefficients δ_s in equation (3). All coefficients are plotted relative to the year a CBA or its extension expired ($t = 0$). Standard errors are clustered at the district level.

Figure IV: Gender gap in salaries, by seniority and age

Panel A: Pay Gap by Seniority



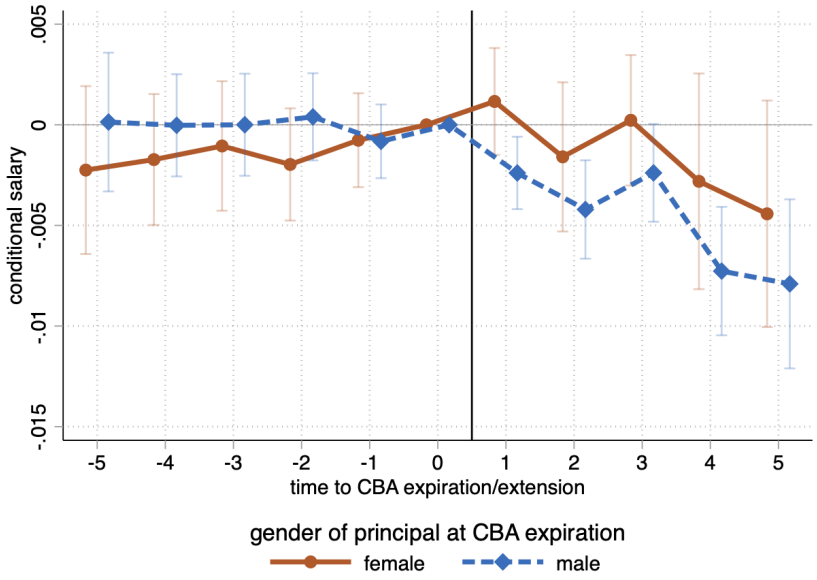
Panel B: Pay Gap by Age



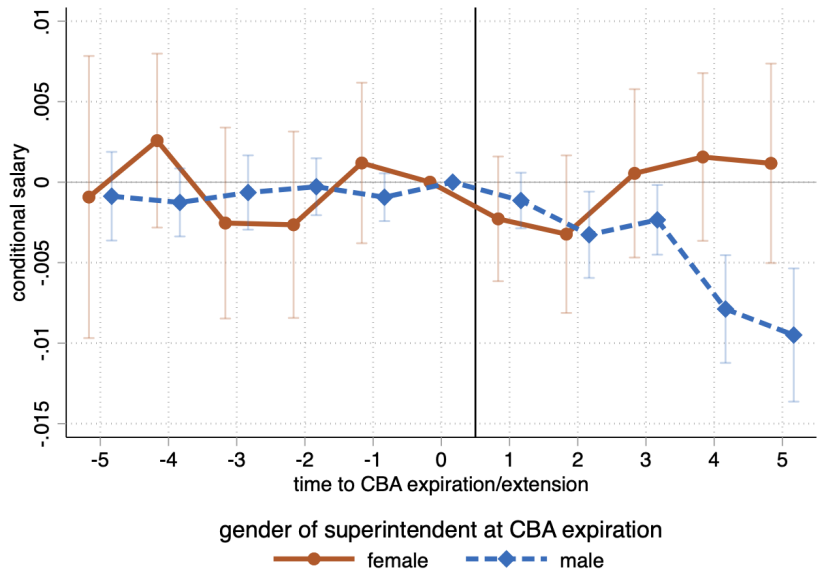
Note: Panel A shows OLS point estimates and 90% confidence intervals of the coefficients δ_s in equation (3), estimated separately for teachers with six or fewer (solid line) and 21 and more years of experience (dashed line). Panel B shows OLS point estimates and 90% confidence intervals of the coefficients δ_s in equation (3), estimated separately for teachers aged 34 and younger (solid line) and 52 and older (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: Gender gap in salaries and the gender of school and district management

Panel A: Gender of school principals



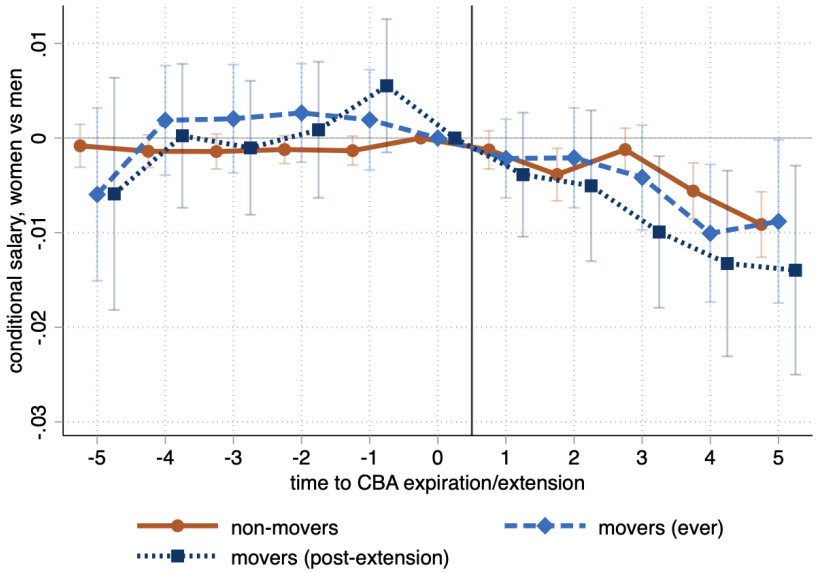
Panel B: Gender of district superintedents



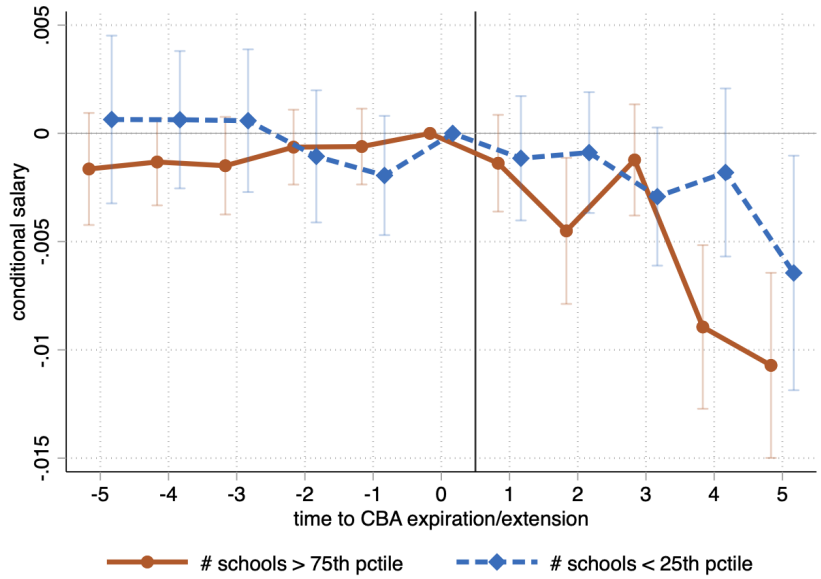
Note: The figure shows OLS point estimates and 90% confidence intervals of the coefficients δ_s in equation (3), estimated separately for teachers who are at least once in a school with a female principal and teachers always in schools with a male principal in the years before a CBA expiration or its extension (Panel A), and for teachers who are at least once in a district with a female superintendent and teachers always in district with a male superintendent in the years before a CBA expiration or its extension (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: The Gender gap and job mobility

Panel A: Gender gap in salaries for movers vs non-movers



Panel B: Gender gap in salaries and outside options



Note: Panel A shows OLS point estimates and 90% confidence intervals of the coefficients δ_s in equation (**??**), 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)"). 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.