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The Effect of Four-Day School Week Adoption on Teacher Retention and Sorting

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As teacher shortages worsen across the U.S., many school districts have implemented a unique solution to attract and retain effective teachers: switching from the traditional five-day school week to a four-day school week (4DSW). I use 17 years of teacher-level employment data from Texas in a difference-in-differences analysis to examine whether the 4DSW truly affects teacher retention and sorting across districts. I also introduce Google's PageRank algorithm as a revealed preference measure of school district attractiveness, ranking districts based on how teachers change workplaces over time in a network analysis. I find that the 4DSW decreases turnover by 2.7 percentage points (p.p.). This effect drives a 5.2 percentile increase in the statewide attractiveness rank of adopting districts, from the 39th to the 44th percentile. Districts with a four-day week also see a 5.1 p.p. increase in the share of entering teachers coming from other districts, suggesting substitution away from first-time teachers and those from outside the Texas public school system during hiring. However, the 4DSW causes no change in measures of PageRank that capture attractiveness to teachers in othe

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The Effect of Four-Day School Week Adoption on Teacher Retention and Sorting

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December 19, 2025

Abstract

As teacher shortages worsen across the U.S., many school districts have implemented a unique solution to attract and retain effective teachers: switching from the traditional five-day school week to a four-day school week (4DSW). I use 17 years of teacher-level employment data from Texas in a difference-in-differences analysis to examine whether the 4DSW truly affects teacher retention and sorting across districts. I also introduce Google's PageRank algorithm as a revealed preference measure of school district attractiveness, ranking districts based on how teachers change workplaces over time in a network analysis. I find that the 4DSW decreases turnover by 2.7 percentage points (p.p.). This effect drives a 5.2 percentile increase in the statewide attractiveness rank of adopting districts, from the 39th to the 44th percentile. Districts with a four-day week also see a 5.1 p.p. increase in the share of entering teachers coming from other districts, suggesting substitution away from first-time teachers and those from outside the Texas public school system during hiring. However, the 4DSW causes no change in measures of PageRank that capture attractiveness to teachers in other districts, and has no effect on the experience or education levels of incoming cohorts of teachers.

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1 Introduction

Teacher shortages have been a leading issue in U.S. education policy over the past decade, with the falling supply and rising demand for educators frequently emerging as a concern in both academic studies and the popular press (Sutcher et al., 2016). Despite these warnings, teacher shortages have accelerated rapidly in the years since the COVID-19 pandemic (Schmitt and DeCourcy, 2022). In 2024 alone, there were over 360,000 teachers working without full certification and at least 41,000 teaching positions left completely unfilled across the U.S. (Tan et al., 2024). The problem has become pervasive in both urban and rural communities (Ingersoll and Tran, 2023; Herman, 2023), posing a serious threat to the quality of education for K-12 students.

In response to worsening staffing challenges, school districts across the U.S. have turned to the four-day school week (4DSW) in an attempt to recruit and retain teachers. In a traditional 4DSW, students attend school four days per week and have the fifth day off. To compensate for the lost day, which is often Monday or Friday, the remaining four days are generally lengthened to hold total instructional time constant. While the first 4DSW dates back to at least the 1930s (Donis-Keller and Silvernail, 2009), adoption has grown substantially since the start of the 2000s: over 1,600 schools in 24 states had made the transition as of 2021, mainly in rural settings (Thompson et al., 2021). Survey evidence suggests that the 4DSW is usually received positively by parents and students (Kilburn et al., 2021).

While many districts explicitly cite staffing challenges as a reason for adopting the 4DSW (Barnes and McKenzie, 2025), others turn to the policy as a potential cost-cutting mechanism or to improve in-school outcomes like attendance (Thompson et al., 2021). Recent evidence suggests that the 4DSW has negative effects on student achievement (Thompson, 2021b; Thompson and Schuna Jr, 2022; Thompson and Ward, 2022; Morton et al., 2024) and generates only modest cost savings (Thompson, 2021a), but the literature on how the four-day calendar affects teacher mobility has been slower to develop. Understanding whether district leaders are realizing the recruitment benefits they hope for or trading off student achievement for no measurable gain is an important policy issue.

In this paper, I use 17 years of teacher-level employment data from Texas in a difference-in-differences analysis to show how the 4DSW affects teacher retention and sorting across school districts. I also apply Google's PageRank algorithm to quantify school district attractiveness, ranking districts based on how teachers change workplaces over time in a network analysis. I find that the 4DSW reduces teacher turnover by 2.7 percentage points (p.p.), a modest retention effect from a pretreatment mean turnover rate of 23%. This retention effect drives a 5.2 percentile increase in the statewide attractiveness rank of adopting districts, a rise from the 39th to the 44th percentile. I also show that 4DSW districts see a 5 p.p. increase in the share of incoming teachers coming from other districts, resulting in substitution away from first-time teachers and those from outside the Texas public school system. Otherwise, I find no evidence that the 4DSW affects whether or how outside teachers sort into a district. The 4DSW causes no change in measures of PageRank that attempt to isolate attractiveness to teachers in other districts (i.e. moving teachers), and has no effect on the experience or education levels of incoming cohorts of teachers.

This paper contributes to the literature on 4DSW effects and also to the broader literature on evaluating teacher recruitment policies. It does so in three ways. First, I provide early evidence on how the 4DSW affects teacher mobility. A small but growing literature (discussed in the following section) addresses the teacher retention and recruitment effects of the 4DSW, but results have been mixed. I study a set of both existing and newly-defined measures of teacher mobility to identify mobility effects as thoroughly as possible.

Second, I provide the first causal evidence on the effects of four-day school week adoption from Texas. Over 180 districts (15%) enrolling 165,000 students had adopted a 4DSW as of SY 2024-25, with at least 15 more announcing a switch in time for SY 2025-26 (Adams, 2025). Prior studies on the 4DSW have focused on early-adopting states like Colorado and Oregon, which have had four-day school weeks for well over a decade. In contrast, over 95% of 4DSW districts in Texas adopted the policy after the COVID-19 pandemic. Because the teacher labor market has changed so much since the pandemic (Camp et al., 2024), estimates of 4DSW effects on teacher mobility from before school year (SY) 2020-21 may be less applicable in today's education landscape than those from later-adopting settings like Texas. As such, results from this work should be of value to school district leaders deciding whether to implement the policy in the coming years.

Finally, I provide what I believe is the first application of the PageRank algorithm, invented to order search results on Google, for quantifying school district attractiveness. There are very few time-varying measures of how attractive schools and districts are to teachers, despite a long-standing literature discussing the relationships between factors like working conditions or student body composition and teacher mobility (Hanushek et al., 2004; Horng, 2009). I demonstrate that measures leveraging teachers' revealed preferences for workplaces correlate with these structural determinants of attractiveness, but are flexible enough to respond to policy changes. I emphasize that these measures, which have already been validated as useful proxies for private firm attractiveness (Sorkin, 2018), can be used to study mobility in the public sector using data kept by many states. I introduce the PageRank algorithm in depth in the Methods section, with a focus on explaining the mechanics intuitively so that future researchers can apply the method in their own research.

The paper proceeds as follows. In Section 2, I provide additional background on the four-day school week both nationally and in Texas. In Section 3, I introduce the data used in my analysis. In Section 4, I introduce and motivate the PageRank algorithm. In Section 5, I describe my quasi-experimental approach for studying the effect of 4DSW adoption. In Section 6, I present and discuss my results. I conclude and discuss policy implications in Section 7.

2 Background

In this section, I discuss the existing literature relevant to this study and introduce the details of the four-day school week in Texas. I begin with a broad look at the literature on teacher recruitment and retention policies. I then introduce the literature on how the 4DSW affects first mobility and then non-mobility outcomes before discussing how and where the policy has been adopted in Texas.

2.1 Teacher Recruitment and Retention Policies

The negative effects of failing to recruit and retain effective teachers, including lower academic achievement, have been well-documented (Hanushek et al., 2016; Carver-Thomas and Darling-Hammond, 2017; Sorensen and Ladd, 2020). These costs, coupled with long-standing evidence that teacher turnover is often driven by conditions inside schools rather than the overall supply of teachers (Ingersoll, 2001), has led districts to pilot a host of recruitment and retention policies over the years. These include a set of both financial and non-financial incentives, of which the 4DSW is one.

Research finds that well-designed financial incentives can have large effects on turnover and recruitment outcomes. Retention bonuses have been shown to reduce turnover by up to 17% (Clotfelter et al., 2008), with some evidence suggesting that benefits concentrate among teachers in tested subjects (Springer et al., 2016) and that schools offering bonuses see improved academic performance for students (Swain et al., 2019). Prior work also finds that loan forgiveness can reduce attrition by around 10% in hard-to-staff *subjects* (Feng and Sass, 2018), but that similar incentives are less effective in high-need *schools* (Jacob et al., 2024). In terms of recruitment, even modest increases in wages have been shown to raise the average education level of recruited teachers and generate additional downstream benefits for students (Gjefsen, 2020).

Non-financial approaches to teacher retention, of which the 4DSW is one, have shown overall positive results. So-called "induction" policies, which provide additional mentorship and support for new teachers, generally find positive effects on teacher retention (Ingersoll and Strong, 2011; Ronfeldt and McQueen, 2017). There is also evidence that professional development programs can boost retention among teachers (Luesse et al., 2022). However, there is relatively little work documenting how non-financial policies like the 4DSW which implicitly aim to improve the working conditions of teachers change retention and recruitment, despite evidence that working conditions are predictive of attrition (Geiger and Pivovarova, 2018).

2.2 Effects of the Four-Day School Week on Teacher Mobility

The desire to improve staffing outcomes is a commonly-cited reason for adopting the 4DSW (Barnes and McKenzie, 2025; Camp et al., 2025). In general, the literature breaks staffing effects down into two categories: retention and recruitment. I discuss related findings in that order.

Evidence on whether the 4DSW affects teacher retention is mixed. A recent statewide study from Colorado finds small negative or statistically insignificant effects of 4DSW adoption on teacher retention (Morton and Dewil, 2024). Similarly, in the context of Oregon, Ainsworth et al. (2024) find that 4DSW adoption increases turnover for teachers but has no discernible effect among nonteaching staff. Evidence from Arkansas suggests that 4DSW adoption reduces turnover modestly (Camp, 2024), while a study from Missouri finds null effects on retention (Camp et al., 2025). While the direction of these effects varies by study, estimates are consistently very small in magnitude. An important caveat is that most 4DSW districts studied so far are in rural settings; the only evidence from a larger metropolitan district finds more substantial negative effects on retention (Nowak et al., 2023). As such, the existing literature provides little support for the idea that 4DSWs help districts retain teachers.

Studies examining the 4DSW's effect on teacher recruitment paint a similar picture: effects of differing directions but small magnitudes. Morton and Dewil (2024) use reliance on teachers with a shortage credential as a proxy for recruitment, finding that the 4DSW increases the share of teachers with a shortage credential by 0.11 percentage points. However, Manion and Varkey (2021) find that rural 4DSW-adopting districts have greater success filling teaching vacancies with qualified candidates. A third study, Camp et al. (2025), finds no effect on adopting districts' ability to hire new teachers.

2.3 Other Four-Day School Week Effects

The 4DSW has been shown to have important effects that extend far beyond teacher recruitment and retention. These outcomes, which are often unintended "side-effects" of the policy, should be considered alongside teacher-centered effects when making the decision to adopt the 4DSW. Much of this literature relates to student achievement, where evidence is mixed but trending negative in recent years. Earlier work finds modest positive gains in reading and math scores for students in 4DSW districts (Anderson and Walker, 2015) while more recent studies find larger declines in performance, especially in non-rural schools and for female students (Thompson, 2021b; Thompson and Schuna Jr, 2022; Morton et al., 2024) that are often most pronounced in districts that reduce total instructional hours when transitioning to the four-day model (Thompson and Ward, 2022).

In addition to recruitment, cost saving is frequently cited as a reason for adopting the 4DSW. There have been a handful of studies addressing this question, with the 4DSW shown to cause modest reductions in overall school expenditure driven by reductions to support services such as personnel expenses, supplies, and materials (Thompson, 2021a). 4DSW districts have also been found to receive less in federal revenue while spending less overall, with results again driven by cuts to support services and noninstructional support (Morton, 2021). The 4DSW is often associated with a variety of secondary non-academic effects such as increased crime among youth (Fischer and Argyle, 2018), decreased parental labor supply (Ward, 2019), increased likelihood of 4DSW adoption by neighboring districts (Anglum and Park, 2021), and lower rates of bullying (Morton, 2023).

2.4 The Four-Day School Week in Texas

Adoption of the 4DSW has been most common in rural districts, where teacher shortages are generally thought to be the most severe (Ingersoll and Tran, 2023), and Texas is no exception. In the state of Texas, just over 97% of 4DSW districts are in rural communities or remote towns as designated by the National Center for Education Statistics. The remaining 3% is comprised of districts in medium or large suburban areas. In most cases, districts adopt the 4DSW by giving all students and teachers a third day of the weekend on either Monday and Friday. Some districts instead adopt a "hybrid" version of the 4DSW, where students generally attend school for some four-day weeks and some five-day weeks based on the month of year. The growth of the 4DSW has been exponential in Texas since the COVID-19 pandemic: the majority of districts which have adopted the policy did so in during the 2023 and 2024 school years. I plot the growth of the 4DSW across Texas districts in Figure 1.

By the start of SY 2019-20, only 8 districts had adopted the 4DSW. By the time SY 2024-25 began, that number had risen to just over 180 – nearly 15% of all districts in the state, serving over 165,000 students. At least 15 more districts adopted some version of a 4DSW for SY 2025-26 (Adams, 2025), with deliberations likely to begin soon for SY 2026-27 adopters. As of SY 2023-24, the average 4DSW district was majority-white (55%) and 63% comprised of economically disadvantaged students (Priyanti et al., 2025).

3 Data

I use teacher-level data obtained via a Freedom of Information Act (FOIA) request from the Texas Education Agency (TEA) in this analysis. The TEA maintains a longitudinal database containing every teacher in the state of Texas dating back to the 2006-07 school year, allowing me to follow teachers across schools and districts over time. There are approximately 400,000 teachers in the state when considering both full-time and substitute teachers. The data contains a rich set of information on each teacher, including place of employment, salary, supplemental pay, years of tenure, years of experience, age, sex, full-time equivalent status, and subjects taught. The granularity of this data allows me to calculate flows of teachers between districts year-over-year so that I can estimate whether the 4DSW affects both retention and the composition of incoming teacher cohorts in adopting districts. Data on each teacher's experience level allows me to identify first-time teachers who are new to the profession.[1]

While the TEA provides annual teacher-level data, it does not track which districts have adopted a 4DSW or the year in which each district adopted the policy. To identify 4DSW-adopting districts in Texas, I leverage data collected by Priyanti et al. (2025) which lists the year of adoption for each 4DSW district in the state.[2] I supplement this data with a hand-collected dataset of my own, which I use to validate the starting year of the 4DSW in each district. I collected this data by combining information from a series of teacher union websites, news articles (including Adams (2025)), and district press releases discussing the adoption of the four-day school week. Whenever a source did not mention the year of adoption, I visited the district's website or the WayBack Machine and viewed past year calendars to determine the appropriate start date.

I compare the characteristics of teachers in four- vs. five-day school weeks in Texas in Table 1, with an emphasis on the teachers who change places of work. A "mover" is any teacher who changes districts from one year to the next. By comparing movers who enter 4DSW districts (Column IV) to the full population of movers (Column II) and to movers entering rural districts (Column III), one can see whether there systematic differences in the types of teachers who choose to join 4DSW districts.

I focus on comparisons between teachers who move to any rural district (Column III) and those who move to a 4DSW district (Column IV) because 4DSW adoption has predominantly

[1] My primary analysis uses data from SY 2012 and onward due to availability of campus-level student enrollment data and to ensure that events from much earlier in the panel, such as the Great Financial Crisis and general changes in the teaching profession, are not picked up by district fixed effects. I also omit any districts which are not present for the full sample period from my analysis, as such districts are expected to create noisy spikes in sorting and retention outcomes after opening or closing.

[2] Some districts adopt variants of the four-day week which have a combination of four- and five-day weeks or other hybrid approaches. I combine pure four-day calendars and hybrid four-day calendars in my analysis, demonstrating in a later robustness check that my results are not sensitive to the inclusion of hybrid districts.

occurred in rural Texas districts, making it a more natural and informative comparison than one between 4DSW movers and the full population of movers. Compared to the sample of teachers who move to any rural district, teachers who move to a 4DSW district are 2 percentage points (p.p) more likely to hold an advanced degree (23% vs. 21%) and earn over $3,000 more during their first year in the new district. Much of the earnings difference is driven by teacher experience, which is higher among 4DSW movers than other rural movers (8.2 years vs. 6.7 years). I observe just over 7,000 teachers entering 4DSW districts between SYs 2017-18 and 2024-25.

3.1 Measuring Teacher Mobility

Districts which adopt the 4DSW speculate that it can improve both retention and recruitment of teachers. While there are intuitive ways to measure retention using administrative data, it is not possible to cleanly define a true measure of recruitment without observing either vacancies or the pool of applicants. However, I can identify changes in the composition of incoming cohorts of teachers and other related outcomes. I refer to these as "sorting" measures, which can provide evidence on how district teacher composition changes after adopting the 4DSW. I describe my measures of retention and sorting in this section.

1. **Measures of Retention**

My primary measure of teacher retention is a district's turnover rate, defined as the percent of teachers from year t who left the district before the next year $t + 1$. I am not able to observe retention in the last year of my panel, SY 2025, because doing so requires data from the following school year. This prevents me from studying retention outcomes in districts that adopt the 4DSW for the first time during SY 2025.

2. **Measures of Teacher Sorting**

To study whether the 4DSW changes the composition of teachers entering adopting districts, I define a set of annual cohort-level measures for each district. I define a "cohort" as the set of teachers who are new to the district in year t, and calculate the average characteristics of each cohort year-over-year. My first set of cohort measures capture the average education level of incoming teachers. These include the share of the cohort with an advanced degree[3] and the share with no college degree.

I then define measures of where each new teacher comes from. Because I observe the work location of every teacher along with their cumulative years of experience, I can identify three types of incoming teachers: 1) teachers from other Texas public school districts, 2) first-time

[3] Advanced degrees include master's degrees and doctorate degrees.

teachers, and 3) teachers from alternate places (out-of-state, private schools, other sectors, etc.). This allows me to define cohort-level shares of teachers who are new to the teaching profession,[4] the share who come from other districts in Texas,[5] and the share who come from any other place. This allows me to test whether 4DSW districts substitute between types of teachers the policy is adopted. I also test whether there are changes in the average experience level of incoming cohorts, regardless of where the teachers are from.

Finally, I use year-over-year teacher flows to rank each district's attractiveness to teachers. I do so using the PageRank algorithm, which I introduce in depth in the following section. I use each district's rank as a proxy for that district's own quality, which changes over time depending on how many teachers move there and which districts they move from. I construct this measure by identifying each teacher's current and future district between any two years, summing the total incoming and outgoing teachers moving between all pairs of districts in Texas, and applying the PageRank algorithm to the resulting matrix of district-to-district flows. This results in an annual measure of a school district's attractiveness to teachers based on preferences revealed by their movements over time.

3.2 Descriptive Statistics

I present descriptive statistics for each outcome of interest in Table 2. Columns I and II compare mean outcomes in 5DSW districts to those in 4DSW districts over the period ranging from SY 2018, when the first district adopted a 4DSW, to SY 2025. Columns III and IV report the average outcomes in 4DSW the year before vs. the year after adopting the policy. The largest differences between four- and five-day districts are in the reported percentile of attractiveness: 5DSW districts rank at the 51st percentile in a given year while 4DSW districts rank at the 43rd percentile (i.e. are less attractive on average). First stage evidence from Columns III and IV reveal few immediate pre-to-post differences in outcomes after adopting the 4DSW, including no change in the student-teacher ratio and very moderate changes in the composition of incoming teachers.

[4] I identify first-time teachers using their listed years of teaching experience. Texas Administrative Code 153.1021 mandates that districts track years of service for all teachers, whether they come from other Texas public school systems or from "out-of-state private schools, foreign public and private institutions, the military, and colleges and universities" (Texas Office of the Secretary of State, 2024). As such, teachers listed with zero years of experience in TEA data should correspond to new teachers entering the profession.

[5] I designate all moving teachers for whom I cannot observe an origin or destination as "alternate pathway" teachers. These are teachers who enter a district with greater than 0 years of experience but who were not teaching anywhere in the Texas school system during the prior year, indicating that the teacher must have come out of retirement, from a different state, from the private school system, or from another industry where their work was counted as teaching experience.

4 Ranking Districts Using Revealed Preference

In this section, I introduce the PageRank algorithm and explain why it is applicable for ranking school districts by their attractiveness to teachers. I introduce two separate measures of PageRank: one which combines attractiveness to current teachers (i.e. consider direct retention) and prospective teachers, and one which more cleanly isolates the district's attractiveness to prospective teachers (i.e. omits direct retention). I then provide a simple example of how the algorithm works and validate it using external data.

4.1 Measuring District Appeal Using PageRank

There are few, if any, time-varying measures of how attractive a school district is to teachers (analogs to "firm quality" in the labor economics literature). Furthermore, common approaches used to study the amenities in private firms do not translate well to the context of teacher labor markets. For example, fixed pay schemes within school districts complicate hedonic approaches (Goldhaber et al., 2010) while decentralized application processes for teaching jobs both within and across states make application and vacancy-based measures difficult to construct.[6] This limits the ability of researchers to study how policies like the 4DSW affect a district's attractiveness relative to other districts.

However, the teacher labor market is unique because data on where teachers work each year, like the data used in this study, is often accessible to researchers. This makes it possible to construct revealed preference measures of district attractiveness by following which districts are able to attract the most teachers from other districts year-over-year. I accomplish this by ranking each district using the PageRank algorithm, which (in simplest terms) ranks a district as being "more attractive" if it (1) attracts more teachers from other school districts in Texas, and (2) attracts teachers from districts that are themselves considered more attractive by the algorithm (recursively).

The algorithm, which was developed to rank web pages returned in Google search results (Page et al., 1999), has gained traction as a measure of firm quality since seminal work by Sorkin (2018). Other studies using mobility flows to study quality include Bell et al. (2025), who use migration flows and a stylized version of PageRank to quantify the attractiveness of housing, and Bagger and Lentz (2019), who construct a "poaching index" based on the share of employees a firm hires from other firms. Under the assumption that workers (teachers) move from lower- to higher-quality firms (school districts), the algorithm leverages discrete revealed preferences to

[6] For example, Texas divides the state into 20 regions which each maintain separate job listing pages. For more information, see: https://tea.texas.gov/about-tea/other-services/education-service-centers/texas-educator-job-sites.

rank each district.[7] One can think of PageRank as a joint measure of recruitment and retention: the best districts recruit teachers from other top districts and also lose fewer of their own teachers. However, as I demonstrate later, one can make small changes to weight the results less towards retention and more towards attractiveness to prospective teachers.

Estimating PageRank requires constructing a matrix that documents the flow of teachers between each possible pair of districts, the transition matrix T. T is therefore an $n \times n$ matrix where entry (i, j) is the number of teachers leaving district j for district i and entry (i, i) (the diagonal) gives the number of teachers from i who stay in i (retention). Let v be the $n \times 1$ column vector containing the rank of n school districts. v is can be obtained from the following equation:

$$(S^{-1}T)\,v = v \tag{1}$$

In Equation (1), S is an $n \times n$ diagonal matrix where entry S_{nn} is the total number of teachers leaving district n.[8] $S^{-1}M$ is therefore a normalized transition matrix, where entry (i, j) is simply the share of teachers leaving j who move to i.[9]

I construct two measures of PageRank for each district. The first, which I call PR_{Total}, is a composite measure of a district's ability to (1) retain its current teachers and (2) attract teachers from other districts. The second, which I call $PR_{Transfer}$, purges the direct effect of district retention and instead ranks districts based on their attractiveness to teachers who move (i.e. "transfer"). Because I separately study retention rates as an outcome, I present $PR_{Transfer}$ as my preferred PageRank outcome and use PR_{Total} as a robustness check on my retention results. $PR_{Transfer}$ more cleanly isolates how the 4DSW changes the attractiveness of a district to teachers from other districts, but I caution that it is not possible to fully remove all retention effects from measures of Transfer PageRank.[10]

[7] This assumption may be especially reasonable in the teacher labor market, where dismissals and layoffs are less common than in the private sector (U.S. Bureau of Labor Statistics, 2025).

[8] In accordance with Equation (1), PageRank can be calculated using a number of methods. For example, it can obtained by normalizing the principal eigenvector of $S^{-1}T$. It can also be obtained using power iteration by initializing v as an $n \times 1$ vector where each entry equals $1/n$ and iteratively updating v to the value $v' = (S^{-1}T)\,v$ until $||\,v' - v\,|| < \epsilon$ for some pre-determined threshold ϵ that indicates sufficient convergence. I implement PageRank using the R package `igraph`.

[9] PageRank has one parameter, called a damping factor. I set the damping factor to 0.85 in my analyses, which is the standard value across the PageRank literature. In cases with "dangling nodes" (when a district has no teachers outgoing to other districts in a year), I follow the convention of initializing all outflows for that district-year to $1/N$ where N is the total number of districts.

[10] While the $PR_{Transfer}$ approach removes the *direct* effect of retention from the final ranking, it is not guaranteed to purge *indirect* retention effects. Because changes in the retention rate can implicitly affect the off-diagonal entries in the transition matrix T, $PR_{Transfer}$ cannot be interpreted as a pure "recruitment" effect. For example, imagine the 4DSW causes retention to increase to 100% in district i at a time when all teaching positions are filled. This mechanically forces all entries in both row i (teachers incoming to i) and column i (teachers outgoing from i) to

4.2 A Simple Example

In this section, I provide a simple example of how the PageRank algorithm ranks three hypothetical districts: District H (for "High Quality"), District M (for "Medium Quality"), and District L (for "Low Quality"). To build intuition, I demonstrate how to calculate PR_{Total} (the composite measure of retention and attractiveness). Estimating $PR_{Transfer}$ follows the same procedure, but requires zeroing out the diagonal of T before calculating S.
Between two school years, teachers in the three districts make the following decisions:

- **District H**: 12 stay, 2 move to *District M*, 1 moves to *District L*.
- **District M**: 10 stay, 4 move to *District H*, 2 move to *District L*.
- **District L**: 10 stay, 4 move to *District M*, 1 move to *District H*.

Using this information we can construct the transition matrix T, whose rows represent destination districts and columns represent origin districts. T takes the following form:

$$T = \begin{pmatrix} \text{stay in } H & M \rightarrow H & L \rightarrow H \\ H \rightarrow M & \text{stay in } M & L \rightarrow M \\ H \rightarrow L & M \rightarrow L & \text{stay in } L \end{pmatrix} = \begin{pmatrix} 12 & 4 & 1 \\ 2 & 10 & 4 \\ 1 & 2 & 10 \end{pmatrix}$$

To construct the matrix S, which normalizes the transition matrix by the number of total teachers originally in the origin district (i.e. calculates the share of teachers moving from the origin district to each possible destination), one simply sums each column of T into a diagonal 3×3 matrix where entry $\{1, 1\}$ corresponds to the total for District H, $\{2, 2\}$ corresponds to District M, and $\{3, 3\}$ corresponds to District L:

$$S = \begin{pmatrix} 15 & 0 & 0 \\ 0 & 16 & 0 \\ 0 & 0 & 15 \end{pmatrix} \implies S^{-1} = \begin{pmatrix} \frac{1}{15} & 0 & 0 \\ 0 & \frac{1}{16} & 0 \\ 0 & 0 & \frac{1}{15} \end{pmatrix}$$

The operation $S^{-1}T$ then gives a matrix whose diagonal represents the retention rate of each district, and whose off-diagonal entry $\{i, j\}$ represents the share of teachers from district j moving to district i. As such, the columns sum to 1: every teacher either stays in the same district or moves to another one.

$$S^{-1}T = \begin{pmatrix} 0.80 & 0.25 & 0.07 \\ 0.13 & 0.63 & 0.27 \\ 0.07 & 0.13 & 0.67 \end{pmatrix}$$

zero, since there are no incoming or outgoing teachers. This pushes the district's $PR_{Transfer}$ rank downward.

Taking Column 1 as an example, we see that the high-quality district H retained 80% of its teachers, lost 13% to district M, and lost 7% to district L. Row 1 tells us where District H's teachers came from: it drew in 25% of District M's teachers and 7% of District L's teachers. Finally, we solve for v in from Equation (1) and obtain the following PageRanks:

District H	District M	District L
0.47	0.32	0.21

The algorithm produces the following ranking: $H > M > L$. Note that the retention rate of the low-quality district L is higher than that of the medium-quality district M (67% vs. 63%). Even though M loses a higher share of its teachers than L, the algorithm picks up that teachers from M move up to H while teachers from L move up to M and replace them, producing an intuitive quality ranking.

4.3 Validating the PageRank Measure

Because PageRank is indirectly a function of total teacher inflows, a relevant concern is that it may be too heavily biased in favor of larger districts and therefore not a useful measure in smaller districts like those that adopt the 4DSW. I plot the PageRank percentile of each 4DSW district in Figure 2. This exercise reveals that 4DSW districts are highly dispersed in their estimated PageRanks, despite being nearly 100% rural: their ranks range from the 3rd to the 90th percentile. Even small districts have a chance to appear high in the rankings, depending on the quality of districts they draw teachers from.

Another concern is that estimating PageRank *annually* will result in estimates that are too noisy to be useful for inference, since smaller districts may have only a few teachers entering and leaving per year. To test the relevance of PageRank estimated using just one year of teacher mobility data, I estimate two versions of PageRank for each district: a single-year version, calculated by following teacher moves between SY 2023-24 and SY 2024-25, and a cumulative version which sums teacher inflows and outflows across all years before estimating PageRank. The former version mirrors the method used in my main analysis, which calculates PageRank annually tracks changes year-over-year. The latter is designed to produce a more "stable" and less noisy estimate, since it aggregates inflows and outflows over a full 13 years. I then regress each version of PageRank on a set of proxies for district attractiveness such as average salary, total enrollment, student demographics, and the district's state accountability score. I plot the resulting elasticities and semi-elasticities in Figure 3.

The results are intuitive: both 2025 PageRank and cumulative SY 2012 - SY 2025 PageRank correlate negatively with the share of English Language Learners and economically disadvantaged students, consistent with findings that teachers sort out of lower-income schools and into higher-income ones (Hanushek et al., 2004; Bonesrønning et al., 2005; Simon and Johnson, 2015). The negative coefficient on log(Average Salary) is consistent with the compensating differentials paid for poorer working conditions, while the coefficient on log(Enrollment) is strong and positive. This likely reflects that larger districts are more "central" to the network, in the sense that they hire from a larger set of districts during a given year to fill a larger number of vacancies. Interestingly, the coefficient on the $log(AccountabilityScore)$ is small and negative: a district's rank decreases modestly as its 0-100 state accountability score (in 2025) increases.

Importantly, the coefficients are similar in magnitude whether they are estimated based off of the 1-year PageRank measure (shown in black) or the 13-year measure (shown in red). This suggests that PageRank can provide a reliable signal of district attractiveness even when it is estimated using a single year's worth of mobility data.

5 Methods

5.1 Identification Strategy

My identifying variation comes from the staggered adoption of 4DSW policies across time and districts in Texas. As of SY 2024-25, 181 school districts in Texas (15%) had adopted the 4DSW since the first adoptee in SY 2017-18. The staggered nature of the rollout (see Figure 1) requires the use of a generalized difference-in-differences estimator of the Callaway and Sant'Anna (2021) ("C&S") or De Chaisemartin and d'Haultfoeuille (2020) ("D&H") variety. My primary specification uses the C&S approach.

My primary analyses are conducted at the district level. In my preferred specification, I use all rural school districts that are either never-treated and not-yet-treated as a control group for rural 4DSW districts. In addition to being a more natural comparison group for 4DSW districts, of which 97% are rural themselves, this approach generally results in better evidence for the standard parallel trends assumption. However, I present results using the full set of rural and non-rural districts as a control group as a robustness check.[11] I restrict my analysis to school districts which existed for all 18 years of my panel, which excludes any district that merged with another district or was dissolved, leaving 1,137 districts. Only one 4DSW district is dropped for this reason, having merged with a nearby district before SY 2024-25.

For my estimates to be considered causal, this approach assumes that outcomes for treated units (districts) would have trended the same way as outcomes for untreated units had they never

[11] I code any district listed as "rural" or "town" by the National Center for Education Statistics (NCES) as a rural district. The five non-rural 4DSW districts in Texas are identified as suburban by the NCES.

received treatment. I evaluate the plausibility of this assumption using event studies to provide evidence that pre-trends were parallel between treated and control units. I do so for each outcome I study.

The C&S estimator also requires the "no anticipation" assumption that teachers were not able to select into or out of districts in expectation of future 4DSW adoption – in other words, that districts in baseline period $t-1$ from date of 4DSW adoption are truly untreated. The plausibility of this assumption is different across my retention and sorting analyses. Because districts announce the transition to a 4DSW well before the academic year begins, teachers currently employed in the district during year $t-1$ will have the opportunity to react. They are "partially treated" by the news of the policy, which affects their retention in $t-1$ before they even experience the 4DSW in period t. To account for this, I allow for one pre-treatment anticipation period in retention analyses using the approach in Callaway and Sant'Anna (2021).

My sorting analyses are less susceptible to this issue. These analyses measure the composition of incoming cohorts of teachers, who are employed elsewhere in $t-1$. Their behavior is therefore unable to contaminate the $t-1$ outcome in the district they will relocate to in period t, even if they hear about the policy. Anticipation in this setting would require the district announced the 4DSW over a year ahead of time, giving teachers in other districts time to adjust their employment before the policy takes effect. In simpler terms, retention is measured at the end of the school year while sorting (such as the average experience level of an incoming cohort of teachers) is measured at the beginning of the school year. This makes anticipation plausible for retention-related outcomes, but less plausible for sorting-related ones.

I outline the formal structure of the C&S estimator in Equation (2). Treated units are districts which have adopted the 4DSW in year t; control units are rural districts which never adopt or are yet to adopt as of year t. The C&S procedure estimates group-time average treatments on the treated (ATTs), where "group" (g) refer to the year of first adoption of the 4DSW in a district. Estimation of these group-time ATTs, which are then aggregated to a single population-level ATT, is implicitly conducted by running the regression given in Equation (2), adapted from Callaway and Sant'Anna (2021), using only district observations from years t and $g-1$ for districts which are either not treated (control) or first treated in g:

$$Y_1 = \gamma_1^{g,t} + \gamma_2^{g,t} G_g + \gamma_3^{g,t} T + \beta^{g,t}(G_g \times T) + \epsilon^{g,t} \tag{2}$$

In the above, G_g is an indicator for whether an observation corresponds to a 4DSW district which first adopts in period g and T is an indicator variable equal to 1 only in time t. The parameter $\beta^{g,t}$ gives the group-time ATT for districts first treated in period g during time t, henceforth referred to as $ATT^{g,t}$. Y_1 is the outcome of interest. Each $ATT^{g,t}$ is then summed with accompanying weight $w^{g,t}$ which corresponds to the size of group g, effectively granting years with more first-time adopting school districts more influence over the population-level ATT (which I call DID_{CS}). I cluster standard errors at the district level. Because nearly all 4DSW districts adopt the policy late in the panel (from SY 2021-22 onward, with the modal year of adoption being SY 2023-24), I bin the endpoints in all event study figures after 2 years post-treatment.

6 Results

6.1 District PageRank

I first discuss the effect of 4DSW adoption on a school district's place in the PageRank distribution. I estimate effects of adoption on both Total PageRank (PR_{Total}, which includes both direct retention effects and effects on attractiveness to prospective teachers) and Transfer PageRank ($PR_{Transfer}$, which removes direct retention effects and more cleanly isolates the attractiveness of the district to prospective teachers). Because PageRank is unitless, I focus my discussion on how the 4DSW changes each district's PageRank *percentile* among all Texas districts rather than its raw PageRank value.[12] I present the estimated effects in Table 3.

I find that the 4DSW has a modest effect on a district's Total PageRank but no detectable effect on its Transfer PageRank. Compared to other rural districts, those that adopt a 4DSW see increases of just over 5 percentile points in the statewide Total PageRank distribution – from the 39th percentile pre-4DSW to the 44th percentile post-4DSW, on average. However, districts only improve by an imprecisely-estimated 1.9 percentiles in the Transfer PageRank distribution after adopting the policy. The estimated effect on raw Transfer PageRank is similarly modest, with an increase of 0.001 in Transfer PageRank corresponding a roughly 2% increase from the pretreatment mean. However, the 95% confidence interval for Transfer PageRank effects is not able to rule out modest increases of up to 4.9 percentiles.

I present event study estimates of the effect of 4DSW adoption on a district's PageRank percentile in Figure 4. While it does appear that the largest effect on Total PageRank comes in the third year of the policy, there is little evidence that treatment effects evolve much over the first few years. However, the recency of 4DSW adoption for most Texas districts prevents me from studying effects over longer time horizons.

[12] While analyzing PageRank percentile is useful for interpretability, it may also throw out valuable information contained in raw PageRank because PageRank percentile is ordinal while raw PageRank is both ordinal and cardinal. As such, it could be the case that the policy materially improves the raw PageRank of adopting districts but not enough to increase their percentile by much (since the gaps in underlying PageRank between any two percentiles could be quite large). For readability of coefficients, I scale raw PageRank by 100 in all models.

Taken together, these results suggest that districts adopting the 4DSW see increases in attractiveness that are largely driven by improved retention of their own teachers rather than heightened ability to draw in transfer teachers from other high-quality districts. I return to this distinction in subsequent analyses of teacher retention and sorting across districts.

6.2 Teacher Retention

I now analyze the effect of the 4DSW on teacher turnover in adopting districts. As discussed previously, my retention results allow for anticipation effects during period $t-1$ since current teachers get to make employment decisions during $t-1$ before the policy is fully enacted. I present the results of this analysis in Table 4, which displays the estimated effect of 4DSW adoption on districts' annual turnover rates.

Row (I) contains the results of my preferred specification, which compares turnover in rural 4DSW districts to never- and not-yet-treated rural districts. I find that the 4DSW reduces teacher turnover by 2.7 percentage points (p.p.), a decrease of 11.7% from the pretreatment mean of 23%. While this effect is detectable, it is relatively modest in magnitude. A small retention boost follows intuitively from my earlier finding that adopting districts see increases in their Total PageRank, which captures direct retention effects.

I present corresponding event study estimates in Figure 6.[13] Stronger retention effects seem to develop during the second school year after the policy is implemented. This evolution over time could be consistent with teachers who prefer a 5DSW sorting out before or during the first year, muting the retention effect in that year.

My retention results are robust to a number of additional checks. In Row (II), I estimate the effect of 4DSW adoption on adopting districts using all never- and not-yet-treated districts as a control group (rather than just rural 4DSW and non-4DSW districts). The point estimate does not change but becomes slightly more precise with the additional sample included.

A possible concern for a difference-in-differences strategy with a treatment affecting smaller rural districts and an outcome reliant on teachers moving between districts is the possibility of spatial spillovers between treatment and control units. If there is a regional component to teacher labor markets, it is possible that 4DSW adoption in one district may affect the turnover rate of both that district and its neighbors. For example, imagine a 4DSW is attractive enough that it both reduces turnover in the adopting district and increases it in neighboring districts as teachers move into the adopting district. This spillover from treated to untreated units would constitute a stable unit treatment value assumption (SUTVA) violation and bias the estimated 4DSW effect.

[13] Because the majority of 4DSW districts adopted the policy over the past 2 years, I display event study coefficients for up to 3 years post treatment to avoid noisy distant effects estimated off of very few early-adopting districts.

To address this possibility, I conduct a supplementary analysis that uses only rural districts that are never adjacent to a 4DSW district (i.e. always at least 1 district away from a 4DSW district) as a control group. I present these results in Row (III) of Table 4 and find that the coefficient increases slightly, from 2.7 p.p. to 3.1 p.p. This provides suggestive evidence that spatial spillover effects are not driving my results.

Finally, I test whether results differ based on the type of 4DSW calendar implemented. While most districts institute a "full" 4DSW where every instructional week has only 4 school days, some districts implement "hybrid" versions of the 4DSW with various changes made to the calendar. For example, a district may have a four-day week every other week or only for the middle portion of the school year. In Row (IV) of Table 4, I test this by dropping all districts with a hybrid calendar from the treatment group. The estimated effect is nearly the same as in the pooled model, suggesting that there are few differences for districts with a pure vs. hybrid 4DSW calendar.

I note that not allowing for a one-year anticipation period attenuates the estimated retention effect to a 1.4 p.p. decrease in turnover (not statistically significant), with a 95% confidence interval ranging from a 3.4 p.p. decrease to a 0.7 p.p. increase. However, this approach confounds the announcement of the policy with the policy's true effect and results in bias with an unknown sign.[14] Assuming the policy truly decreases retention, attenuation of the estimate suggests that turnover could also be decreasing modestly during the announcement period $t-1$. However, I am not able to test this theory rigorously.

As a final robustness check, I also conduct my retention analysis at the teacher level and find effects of similar magnitude to my main district-level specification. I discuss this approach and associated results in Appendix A1.

6.3 Teacher Sorting

Finally, I discuss my results on outcomes related to teacher sorting and the average characteristics of incoming teachers. I find limited evidence that the 4DSW materially changes the characteristics of recruited cohorts of teachers. In Table 5, I report the point estimates and corresponding 95% confidence intervals for each of my sorting-related outcomes: those that track the average composition of recruited cohorts, and those that track other district-level metrics.[15].

[14]For example, if the announcement causes more teachers to leave than to stay (i.e. turnover increases), the effect will be biased because $t-1$ will have an artificially high turnover rate to compare subsequent periods against. If true 4DSW effects reduce turnover, this would bias the estimate upward; if the 4DSW increases turnover, it would bias the effect downward.

[15]Results reported in Table 5 use the full set of never- and not-yet-treated rural districts as control units. As a robustness check, I demonstrate that my results are quantitatively similar when using the full set of rural and

My results reveal a small degree of substitution between types of incoming teachers after adopting the 4DSW. Adopting districts recruit cohorts that are 5.1 p.p. more heavily comprised of teachers from other public school districts in Texas, substituting away from first-time teachers and teachers from alternate pathways. This effect is intuitive given the prior finding that 4DSW districts experience only small (statistically insignificant) increases in Transfer PageRank, which approximately measures the attractiveness of the district among teachers who move. The policy induces more hiring from other school districts, but not enough to move the needle on Transfer PageRank substantially. This could be because the 5.1 p.p. increase in cohort composition alone is not enough to mvoe a district up in the rankings, or because the teachers included in that increase are not coming from notably more attractive districts.

Incoming cohorts in 4DSW districts are no more experienced on average than recruited cohorts in other rural non-4DSW districts. Together with the result that 4DSW districts recruit more heavily from other districts, this may imply a modest recruitment boost for 4DSW districts: Giersch and Dong (2018) find that principals prefer to hire teachers with some prior experience (extensive margin), but that their preferences over levels of experience are less strong (intensive margin).

However, Giersch and Dong (2018) also find that principals prefer more educated candidates. I find relatively precise null effects on the share of incoming cohorts holding an advanced degree (a 1 p.p decrease, with a 95% confidence interval ranging from effects of -4 p.p. to 2 p.p.) and the share of incoming cohorts with no college degree at all (a 0.4 p.p. decrease). This implies that 4DSW districts recruit cohorts with similar education levels to those of rural 5DSW districts, though I do not observe other important proxies for teacher effectiveness such as the quality of a teacher's undergraduate institution or their value-added that may be more informative.

Lastly, I find no significant change in the student-teacher ratio of districts that adopt a 4DSW. The point estimate suggests that student-teacher ratios fall by 0.06 after adopting the policy, a decrease of just 0.5% from the pretreatment mean of 10.9 students per teacher. The 95% confidence interval once again rules out economically meaningful effects: possible effects range from a 4.2% decrease to a 3.1% increase in a district's student-teacher ratio. While I do not observe data on vacancies in a district, meaningful changes in the student-teacher ratio could suggest that districts are able to fill previously unstaffed positions or create new ones. I find no evidence of movement along this dimension.

In summary, I find limited evidence that the 4DSW meaningfully changes how teachers sort across districts. While adopting districts do see a modest increase in the share of incoming cohorts coming from other districts, the change is not substantial enough to show up in the estimated

non-rural never- and not-yet-treated units in Appendix Table A1 attractiveness rank of the district. I find precise null results on all other measures of teacher sorting, including the shares of cohorts by education level and the cohorts' average experience level. I present the event study estimates for each sorting outcome in Figure 6. These provide evidence for parallel trends between treatment and control units in each analysis, but reveal little evidence of notable treatment effect evolution over time. I also conduct the same two robustness checks for these outcomes as I did in my retention analysis: (1) omitting all hybrid 4DSW districts and (2) omitting any control districts that are ever adjacent to a 4DSW district. I present the results of these analyses in Appendix Table 2. The mainline results do not change at all: 4DSW districts recruit cohorts of teachers more heavily comprised of teachers from other districts, but see no change in any other sorting outcome.

6.4 Differences by Year of Adoption

In this section, I discuss patterns in 4DSW effects by year of first adoption. There are two main reasons that cohort-level heterogeneity is of interest in this setting. First, there are substantial differences in the size of adoption cohorts. For example, the SY 2018 cohort of adopters includes just 2 districts while the SY 2024 cohort includes 94 districts. Second, some cohorts adopted the policy during the COVID-19 pandemic, while others adopted it either before or after. There could be differences in either the overall effect of the policy or the evolution of effects over time across these cohorts. I present cohort-level treatment effects in Figure 7.

Panels (h) and (i) of Figure 7 show effects of 4DSW adoption on Transfer PageRank and Total PageRank, respectively. There are virtually no differences across cohorts in a district's Transfer PageRank, but the strongest effects on Total PageRank appear for the SY 2020 - SY 2023 cohorts. The very small effects for SY 2024 and SY 2025 adopters is intuitive, given that Total PageRank is driven by retention effects that take a couple of years post-adoption to develop. This pattern also appears in Panel (j), which displays 4DSW effects on district turnover rates. Estimated effects for each cohort are negative, with the exception of the SY 2018 cohort (comprised of just 2 districts) and the SY 2024 cohort (for which retention effects can only be estimated for the year of adoption). Districts that adopted the policy earlier have larger turnover reduction, driven by downward pressure on turnover rates in years 2+ after the 4DSW is implemented.

Cohort-level effects are generally consistent across other outcomes, with the occasional exception of the small early-adopting SY 2018 and SY 2020 cohorts. Point estimates for the share of teachers coming from other districts are consistently positive across all post-2021 cohorts, and cohort-level effects on the education level of recruited teachers are very similar. Overall, the cohort-level analyses do not suggest that my results are systematically driven by potentially non-representative groups such as the first adopters or the districts that adopted the 4DSW during the

COVID-19 pandemic (SY 2021 cohort).

7 Discussion & Conclusions

With educator shortages worsening across the U.S., many school districts – especially those in rural areas – have employed creative approaches to attract and keep qualified teachers. I evaluate the effects of one such policy, the four-day school week, on outcomes related to teacher retention and sorting. I find that the 4DSW decreases turnover in adopting districts by 2.7 percentage points, a modest fall from 23% turnover annually pre-4DSW to around 20% annually after implementing the policy. While the effect is statistically significant, the magnitude is quite small. That said, my estimated retention effects are larger than those found in prior studies such as (Camp, 2024) and (Camp et al., 2025). This emphasizes the importance of studying the policy in diverse contexts, as effects increasingly appear to vary both by state and over time.

Districts adopting a 4SDW also see their attractiveness rank, as measured by the PageRank algorithm, increase by just over 5 percentiles after adopting the policy. However, this is driven almost entirely by the direct retention effect discussed previously: measures of rank that account for the district's attractiveness to teachers *outside* the district show no detectable change after the policy is enacted. However, 4DSW districts recruit cohorts of teachers that are over 5 percentage points more heavily-comprised of teachers from other districts. This suggests that 4DSW districts substitute away from first-time teachers and teachers from sources outside the public school system after adopting the policy, though the effect is subtle.

While I describe my estimated effects as small, it is worth noting that it can be costly to generate even modest retention effects using financial incentives. For example, (Clotfelter et al., 2008) find that $1,800 retention bonuses – equal to around 4% of a teacher's salary – resulted in a 5 p.p. decrease in turnover, implying a cost of nearly $36,000 per retained teacher. Such policies may be difficult to implement in settings like the 4DSW districts of rural Texas, which are often financially-constrained. In contrast, the 4DSW is free to implement and has also been found to generate modest cost savings in implementing districts (Thompson, 2021a).

However, the low monetary cost of the 4DSW is offset at least partially by high opportunity costs incurred by students. The most recent evidence suggests that students in 4DSW districts perform worse, with estimated losses ranging from to 5% to 9% of a standard deviation (Morton et al., 2024; Thompson and Schuna Jr, 2022). To contextualize these declines, 5 - 9% of a standard deviation is roughly the difference in effectiveness between a rookie teacher and one with 5 years of experience (Papay and Kraft, 2015). A tradeoff between improving retention rates by just under 3 p.p. and achievement losses of this magnitude should be evaluated carefully by policymakers considering the 4DSW. This is especially true if the overall goal of reducing turnover is to protect students from the negative effects of teacher attrition.

Future work should continue to explore the dynamics of 4DSW adoption in both Texas, which provides a unique setting for understanding the effects of the policy in a post-COVID education landscape, and in other recently-adopting states. This includes through research on how the 4DSW affects students and families in Texas, where these outcomes have not yet been studied, and elsewhere. As more districts turn to the four-day week, it is important that decision-makers are equipped with information that is both timely – accurately reflecting how the 4DSW interacts with teacher labor markets that have evolved since the COVID-19 pandemic (Camp et al., 2024) – and relevant to their own local contexts.

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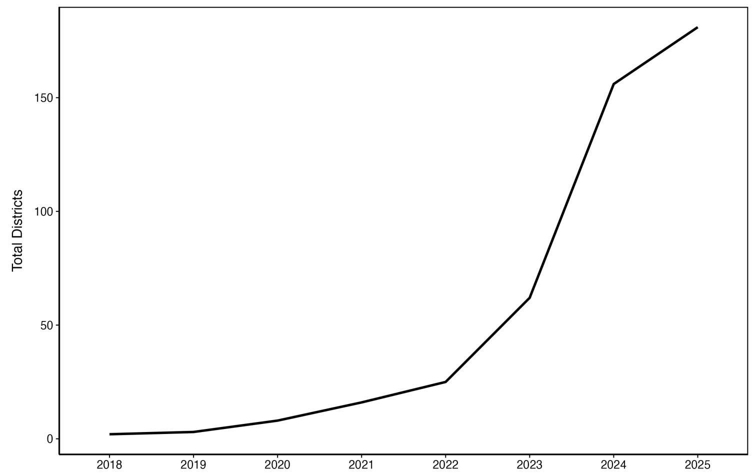
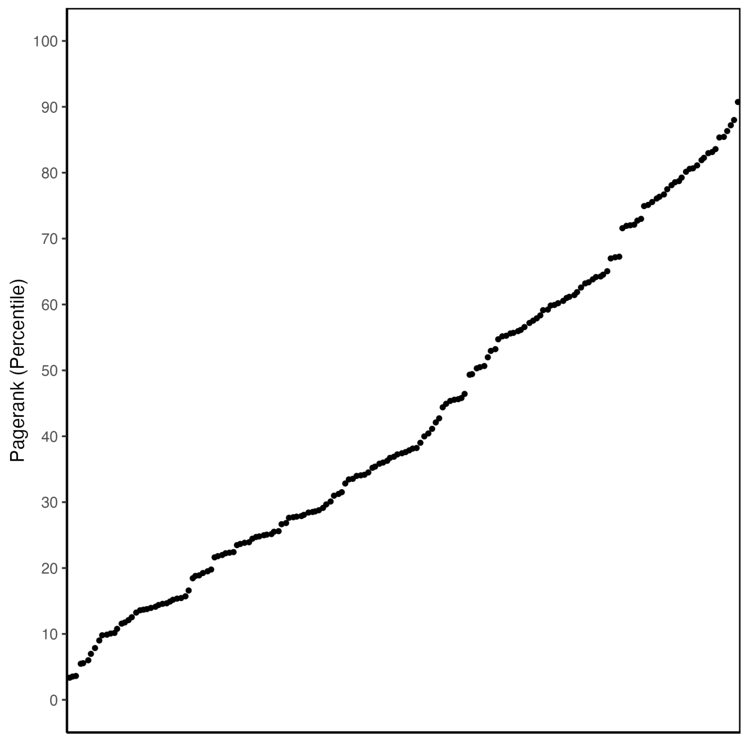
Figure 1: Cumulative districts adopting 4DSW in Texas, by school year.



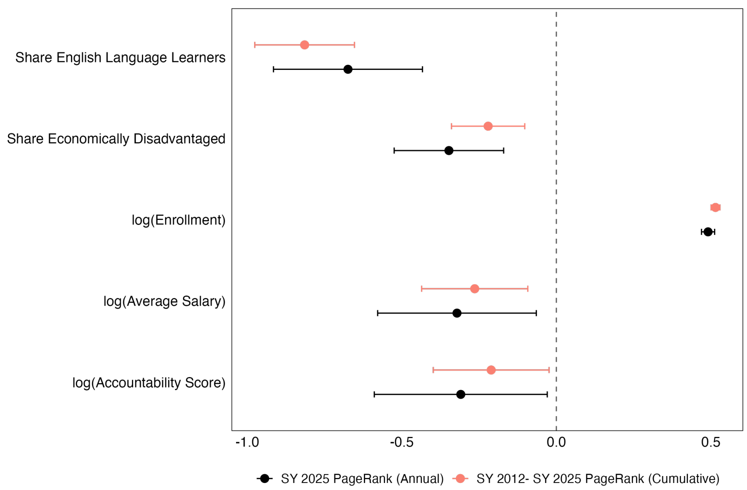
Notes: The figure above shows the cumulative number of districts in Texas that had adopted a 4DSW calendar prior to the start of each school year.

Figure 2: Percentile of PageRank for each 4DSW district in Texas.



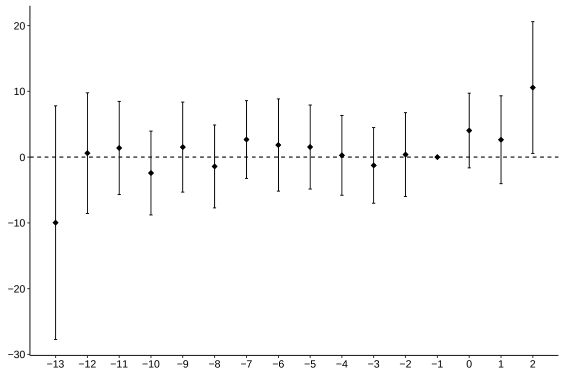
Notes: The figure above plots the percentile corresponding to each 4DSW district's Transfer PageRank value. The figure uses a cumulative PageRank estimated from SY 2012 to SY 2025. This measure sums the total number of teachers entering and leaving each district to and and from every other district in Texas over the 13-year period and estimates a rank based on the aggregate flows.

Figure 3: Estimated elasticities and semi-elasticities of Transfer PageRank with respect to other measures of district attractiveness.

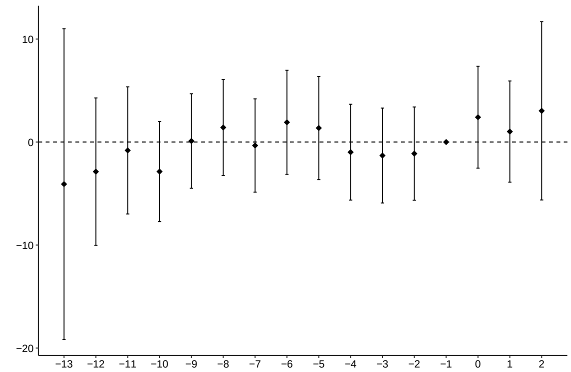


Notes: The figure above displays coefficients and 95% confidence intervals from a regression of log(PageRank) on other district factors. Accountability scores, average salaries, enrollment, and shares of economically disadvantaged students and English language learners are calculated as of SY 2025.

Figure 4: Event study estimates of the effect of 4DSW adoption on district PageRank percentile.



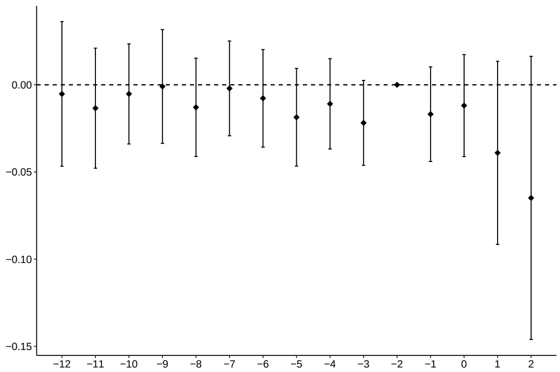
(a) Total PageRank



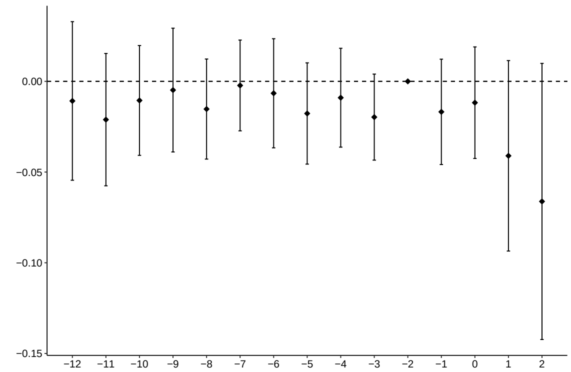
(b) Transfer PageRank

Notes: The figures above displays coefficients and 95% confidence intervals for effects of of 4DSW adoption on the percentile of a district's PageRank, comparing Total PageRank and Transfer PageRank. Estimates compare rural 4DSW adopters to a control group of rural non-adopters.

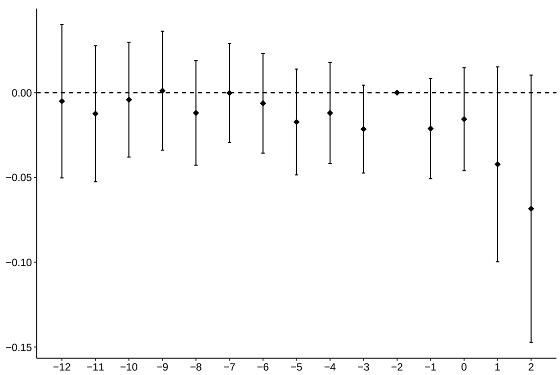
Figure 5: Event study estimates of the effect of 4DSW adoption on school district turnover.



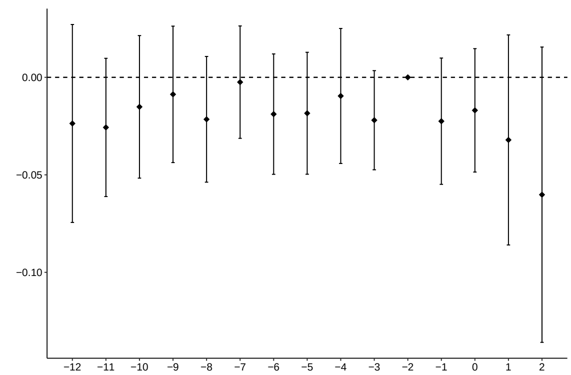
(a) Rural Control Group



(b) All District Control Group



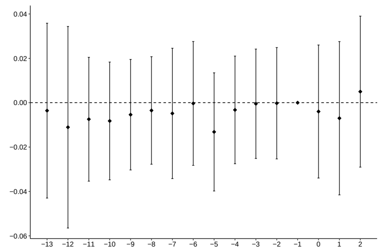
(c) Never-Adjacent Control Group



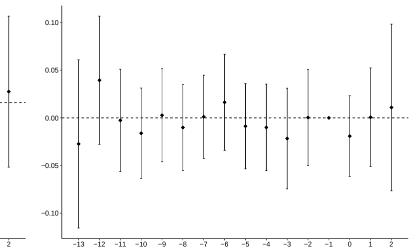
(d) Full 4DSW Only (No Hybrid)

Notes: The figures above displays coefficients and 95% confidence intervals for effects of 4DSW adoption on school district turnover. Panels (a) through (c) vary the control group as specified in the caption, while Panel (d) removes all districts with a hybrid 4DSW schedule from the control group.

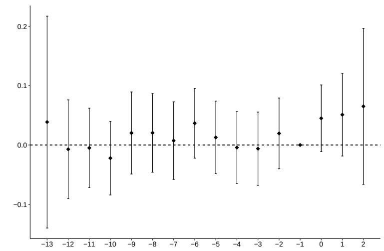
Figure 6: Event study estimates for teacher sorting outcomes.



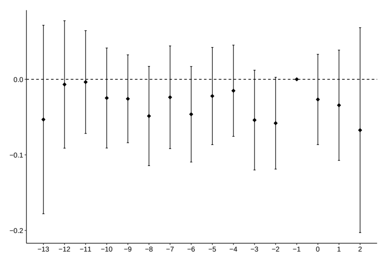
(a) Cohort Share with No Degree



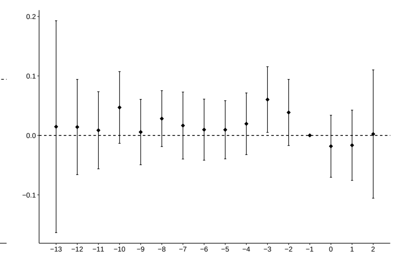
(b) Cohort Share with Advanced Degree



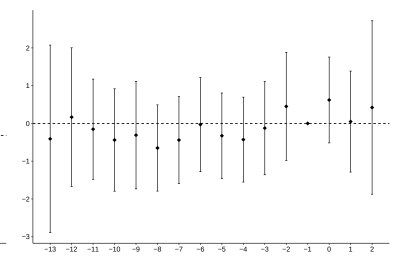
(c) Share of Cohort from Other Districts



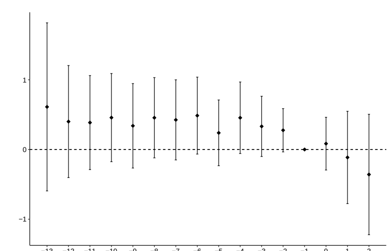
(d) Share of Cohort from Alternate Pathways



(e) First-Time Teacher Share of Cohort



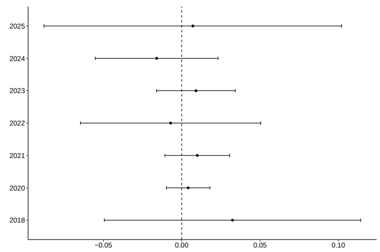
(f) Cohort Average Years of Experience



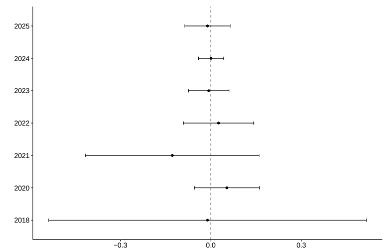
(g) Student-Teacher Ratio

Notes: The figures above displays coefficients and 95% confidence intervals for the effect of 4DSW adoption on each of my 7 sorting outcomes. Estimates compare rural 4DSW adopters to a control group of rural non-adopters.

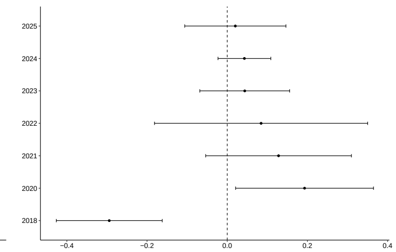
Figure 7: Effect of the 4DSW by adoption cohort.



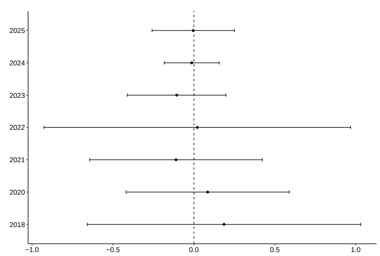
(a) Cohort Share with No Degree



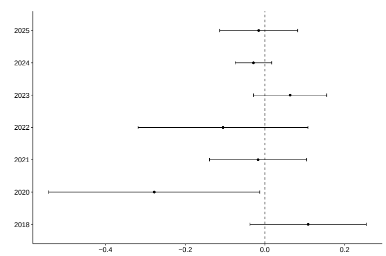
(b) Cohort Share with Advanced Degree



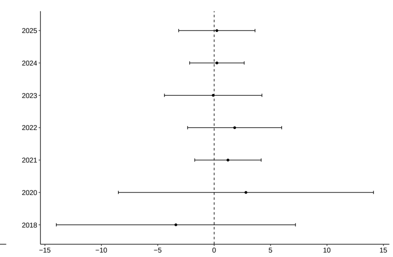
(c) Share of Cohort from Other Districts



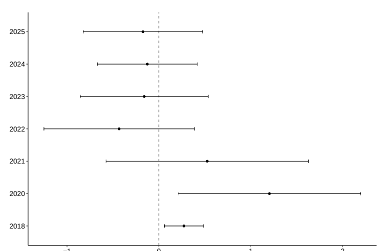
(d) Share of Cohort from Alternate Pathways



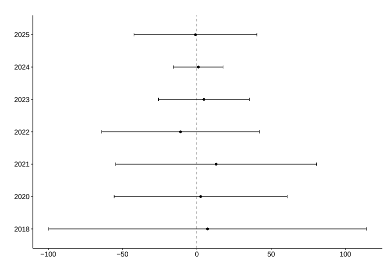
(e) First-Time Teacher Share of Cohort



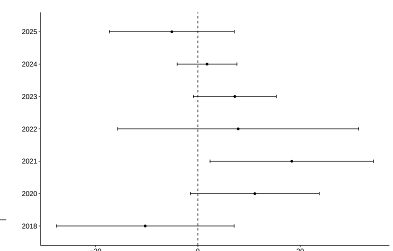
(f) Cohort Average Years of Experience



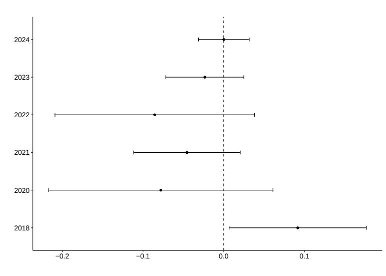
(g) Student-Teacher Ratio



(h) Percentile Transfer PageRank



(i) Percentile Total PageRank



(j) District Turnover Rate

Notes: The figures above displays coefficients and 95% confidence intervals of 4DSW adoption on each outcome aggregated over time, for each treatment cohort. Estimates compare rural 4DSW adopters to a control group of rural non-adopters.

Table 1: Texas teacher characteristics, SY 2017-18 to SY 2024-25.

	All Teachers	Movers		
		Entering Any District	Entering Rural District	Entering 4DSW District
Share with Advanced Degree	0.26	0.24	0.21	0.23
Total Pay	59,835	55,352	52,175	55,319
Years of Experience	11.06	5.53	6.68	8.15
Age	41.35	36.71	37.85	39.57
N	2,953,476	544,808	159,465	7,112

Notes: In the table above, a "mover" is defined as any teacher who changes school districts between any two years. The unit of analysis in the table is the teacher-year. As such, values are averages of teacher characteristics by category from SY 2017–18 (the year of first 4DSW adoption) to SY 2024–25. Any teacher who moves districts multiple times is included once for each move. The results in Column (1) report the teacher-year average across all public school teachers in Texas and therefore include a given teacher once for each year observed teaching.

Table 2: Mean outcomes for 4DSW and non-4DSW districts.

	(I) Non-4DSW Districts	(II) 4DSW Districts	(III) Year Before 4DSW	(IV) Year After 4DSW
Cohort Characteristics				
Share Advanced Degree	0.22	0.20	0.21	0.20
Share No Degree	0.04	0.03	0.04	0.05
Share First-Time Teachers	0.27	0.24	0.23	0.21
Share From Other Districts	0.40	0.45	0.43	0.47
Share From Alternate Pathways	0.34	0.31	0.34	0.32
Average Years of Experience	6.75	7.87	7.77	8.50
District Characteristics				
Annual District PageRank	51.34	42.81	42.43	45.2
Student-Teacher Ratio	12.51	10.53	10.23	10.29
N	7,632	1,440	178	180

Notes: The table above displays mean outcomes for the variables listed in the leftmost column by the group listed in the column header. Means in Columns I and II average district-year observations between SY 2018 and SY 2025, the period of time over which the 4DSW has been adopted in at least one Texas district. Columns III and IV report means among 4DSW districts during just the year before and the year after they first adopt the 4DSW.

Table 3: The effect of 4DSW adoption on district PageRank.

Outcome	Estimate	Pretreatment Mean	95% CI	N
Total PageRank (Direct Retention + Transfer)				
Raw PageRank (x100)	0.004** (0.002)	0.07	[0.001, 0.008]	11,970
PageRank Percentile	5.17*** (1.93)	39.09	[1.384, 8.955]	11,970
Transfer PageRank (No Direct Retention)				
Raw PageRank (x100)	0.001 (0.002)	0.05	[-0.002, 0.005]	11,970
PageRank Percentile	1.90 (1.54)	42.43	[-1.127, 4.919]	11,970

*Statistically signification at p < *** 1%, ** 5%, * 10%.*
Notes: Results above report treatment effects on outcomes in 4DSW districts, using all never- and not-yet-treated rural districts as a control group. For readability, raw PageRank is scaled by a factor of 100 in all models. Standard errors, reported in parenthesis, are clustered at the district level.

Table 4: The effect of 4DSW adoption on district turnover rates.

Outcome: *District Turnover Rate*	Estimate	Pretreatment Mean	95% CI	N
(I) Rural Control Group	-0.027** (0.013)	0.23	[-0.052, -0.002]	11,115
(II) All District Control Group	-0.027** (0.014)	0.23	[-0.054, -0.000]	14,742
(III) Never-Adjacent Control Group	-0.031** (0.014)	0.23	[-0.057, -0.004]	5,811
(IV) Full 4DSW Only [No Hybrid]	-0.029** (0.014)	0.23	[-0.056, -0.001]	10,686

*Statistically signification at p < *** 1%, ** 5%, * 10%.*
Notes: Standard errors are clustered at the district level. To allow for period t-1 anticipation effects, retention effects are estimated relative to period t-2 before 4DSW adoption. Results in Row (I) compare outcomes of all rural 4DSW-adopting districts to those of non-4DSW rural districts. Row (II) compares all 4DSW districts to all non-adopting districts regardless of urbanicity. Row (III) estimates effects of the 4DSW on rural adopting districts, using only non-adopting districts that are never adjacent to a 4DSW adopter as a control group. Row (IV) estimates treatment effects only for rural 4DSW districts adopting a "full" 4DSW with one day off every week, omitting any districts with hybrid 4DSW schedules.

Table 5: The effect of 4DSW adoption on teacher sorting outcomes.

Outcome	Estimate	Pretreatment Mean	95% CI	N
Cohort Outcomes				
Share with Advanced Degree	-0.010 (0.017)	0.18	[-0.044, 0.023]	11,805
Share with No Degree	-0.004 (0.009)	0.02	[-0.021, 0.014]	11,805
Share from Other Districts	0.051** (0.022)	0.42	[0.009, 0.093]	11,805
Share from Alternate Pathways	-0.030 (0.020)	0.32	[-0.070, 0.011]	11,805
Share of First-Time Teachers	-0.021 (0.020)	0.27	[-0.061, 0.018]	11,805
Average Years of Experience	0.40 (0.417)	7.16	[-0.417, 1.218]	11,805
District Outcomes				
Student-Teacher Ratio	-0.058 (0.215)	10.9	[-0.479, 0.363]	11,970

*Statistically signification at p < *** 1%, ** 5%, * 10%.*
Notes: Results above report treatment effects on outcomes in 4DSW districts, using only never- and not-yet-treated rural districts as a control group (including dropping 5 non-rural 4DSW districts). Standard errors are clustered at the district level. Standard errors reported in parenthesis.

A1 Teacher-Level Retention Analysis

In this section, I discuss my supplementary teacher-level retention analysis. As in my district-level analysis, I allow for one period of anticipation effects to account for the announcement of the 4DSW coming during the preceding school year. My measure of retention is a binary indicator for whether a teacher leaves their current district at the end of school year t. Because teachers who work in 4DSW have different pretrends than teachers who are never exposed to the policy, my teacher-level analysis compares teachers currently working in 4DSW districts to teachers who will work in 4DSW districts in the future (not-yet-treated control group, $N = 127,480$). A teacher is treated beginning during their first year of employment in a 4DSW district and is omitted from the sample once they leave a 4DSW, if ever (i.e. if treatment turns off, which is not permitted in the C&S estimator design).

The approach here includes both unit (teacher) and time (year) fixed effects. I account for time-invariant district characteristics by residualizing my outcome on district fixed effects before estimating treatment effects, since the software used to implement the C&S method does not permit a third level of fixed effects. Standard errors are clustered at the teacher level.

I find that the 4DSW reduces a teacher's probability of exiting the district by 3.5 p.p. (s.e. 0.008) from a pretreatment mean value of 16%. However, the effect follows an interesting trajectory over time. I estimate an event study model for this analysis in, plotting the results in panel (a) of Figure A1. There is what could be an anticipation effect at $t = -1$: teacher turnover spikes by just under 5 p.p. in the period before treatment, then drops substantially after the 4DSW begins. This is consistent with some teachers sorting into 4DSW districts in anticipation of the policy, before staying put for subsequent years. In other words, this may be evidence of a recruitment effect: teachers who are not in a 4DSW district in $t - 1$ hear about the policy and sort into 4DSW districts, mechanically increasing their turnover rate in the pre-period.

Figure A1: The effect of 4DSW adoption on teacher's probability of exiting district.

Notes: The figures above displays coefficients and 95% confidence intervals for the effect of 4DSW adoption on a teacher's probability of exiting their current district. Estimates compare teachers currently working in 4DSW districts to those who work in districts that have not yet adopted the policy.

Table A1: The effect of 4DSW adoption on teacher sorting outcomes, all not-yet-treated district control group.

Outcome	Estimate	Pretreatment Mean	95% CI	N
Cohort Outcomes				
Share with Advanced Degree	-0.01 (0.018)	0.18	[-0.04, 0.02]	15,698
Share with No Degree	-0.002 (0.009)	0.02	[-0.02, 0.02]	15,698
Share from Other Districts	0.044** (0.02)	0.42	[0, 0.08]	15,698
Share from Alternate Pathways	-0.026 (0.022)	0.32	[-0.07, 0.02]	15,698
Share of First-Time Teachers	-0.018 (0.019)	0.27	[-0.06, 0.02]	15,698
Average Years of Experience	0.307 (0.429)	7.12	[-0.53, 1.15]	15,698
Average Prior-District PageRank	0.003 (0.007)	0.13	[-0.01, 0.02]	15,876
District Outcomes				
District PageRank	0.003* (0.002)	0.05	[0, 0.01]	15,876
Student-Teacher Ratio	-0.102 (0.166)	10.98	[-0.43, 0.22]	15,876

*Statistically signification at p < *** 1%, ** 5%, * 10%.*

Notes: Results above report treatment effects on outcomes in 4DSW districts, using all never- and not-yet-treated districts as a control group. For readability, PageRank is scaled by a factor of 100 in all models. Standard errors are clustered at the district level. Standard errors reported in parenthesis.

Table A2: The effect of 4DSW adoption on teacher sorting outcomes, omitting hybrid districts and adjacent districts.

	(I) Only Full 4DSW Districts		(II) Never-Adjacent Control Group	
	Estimate	N	Estimate	N
Cohort Outcomes				
Share with Advanced Degree	-0.015 (0.02)	11,345	-0.012 (0.018)	6,161
Share with No Degree	-0.011 (0.01)	11,345	-0.001 (0.01)	6,161
Share from Other Districts	0.053** (0.025)	11,345	0.056** (0.022)	6,161
Share from Alternate Pathways	-0.026 (0.024)	11,345	-0.033 (0.022)	6,161
Share of First-Time Teachers	-0.027 (0.021)	11,345	-0.023 (0.021)	6,161
Average Years of Experience	0.386 (0.500)	11,345	0.279 (0.431)	6,161
District Outcomes				
Student-Teacher Ratio	0.001 (0.209)	11,508	-0.02 (0.216)	6,258

*Statistically signification at p < *** 1%, ** 5%, * 10%.*
Notes: Results above report treatment effects on outcomes in 4DSW districts, using only never- and not-yet-treated rural districts as a control group (including dropping 5 non-rural 4DSW districts). Standard errors, reported in parenthesis, are clustered at the district level. Column (I) reports results estimated after omitting any districts with a hybrid 4DSW from the treatment group. Column (II) reports results using a control group comprised of districts which are never adjacent to a 4DSW adopter to mitigate spatial spillover effects.