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From Incentive to Impact: The Texas Teacher Incentive Allotment's Path to Improved Retention and Achievement

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Abstract

This study is the first statewide analysis of the effectiveness of the Texas Teacher Incentive Allotment (TIA) program. Introduced in 2019, TIA is the most significant and unprecedented teacher merit-pay system in the U.S. Leveraging the Synthetic Control Method (SCM), we construct a counterfactual scenario to assess the causal impact of TIA on the initial 26 participating districts, focusing on teacher turnover rates and standardized assessment scores in math and reading. Using statewide data from 2014-15 to the 2022-23 school years, we show TIA had a large, positive impact on teacher retention and student achievement. Our findings contribute insights into the debate on merit-based compensation and underscore how large-scale teacher compensation strategies may combat long-standing shortages and improve student outcomes.

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From Incentive to Impact: The Texas Teacher Incentive Allotment's Path to Improved Retention and Achievement

In 2019, the 86th Texas Legislature enacted the largest pay-for-performance teacher compensation system in history. The Texas Teacher Incentive Allotment (TIA) represents a significant departure from traditional teacher compensation programs. TIA aims to transform the state's education landscape by rewarding and incentivizing high-performing teachers by directly linking teacher pay to performance metrics related to student achievement and growth. Teachers are eligible for substantial financial bonuses, including nearly $30,000 in additional compensation each year for the most effective educators teaching in the most high-need schools in the state.

As part of TIA, Local Education Agencies (LEAs) designate high-performing teachers as Recognized, Exemplary, or Master based on a series of guidelines established locally, which must include a teacher observation and an indicator quantifying the academic performance of that teacher's students in addition to other locally determined merits. LEAs receive incremental funding from the state each year, which is determined by the number and type of designated teachers, while rural and/or high-needs campuses receive greater amounts per designated teacher. A portion of this funding is then transferred to the designated teacher. Though the Texas Education Agency (TEA) is the executor of TIA, control over designation requirements remains at the local level, creating formula differences between districts. Despite the impact of TIA on the Texas teacher labor market, there exists limited evidence on whether TIA is effective in retaining teachers.

This paper presents the first statewide analysis of TIA, assessing its impact on both teacher retention and student performance. Using the Synthetic Control Method (SCM) and rich administrative data from the University of Houston's Education Research Center, we explore the early effects of this unprecedented policy in Texas, providing critical insights into the efficacy of

large-scale, merit-based teacher compensation as a strategy to address longstanding challenges in education. Specifically for the first cohort of 26 participating districts, we ask:

1. Does the implementation of TIA link to improved student achievement, specifically in standardized assessments in math and reading?
2. Does the implementation of TIA lead to improved teacher retention rates?

Texas Education Policy Context

TIA is a novel addition to the state's efforts to develop an education finance policy that distributes resources equitably across districts. In its early development, Texas' education financial system relied on land allocations from policymakers to fund local education efforts (TEA, 2019). The Texas Constitution of 1876 further localized education by authorizing districts to levy property taxes to supplement funds received through prior land grants. These efforts resulted in school districts that were "property-rich" and "property-poor", which created resource inequities across local education agencies (TEA, 2020). These inequities were highlighted in the case *Edgewood Independent School District v. Kirby (1989),* in which the Texas Supreme Court ruled the state's education funding system unconstitutional (Yarab, 1989). The Texas Legislature responded to the court's decision by implementing the "Robin Hood" school finance plan in the 1990s, which aimed to redistribute property tax revenue from wealthier school districts to those with fewer local resources (Moore, 2005).

Legislative attempts to provide equitable funding across districts have been coupled with efforts to staff all schools with effective teachers (Herbert & Ramsay, 2004). As teacher attrition rates reach historic levels in Texas (Landa, 2023)– with poor and rural schools typically being affected disproportionately (Ingersoll & Tran, 2023)-- the Teacher Incentive Allotment creates tiered financial incentives that aim to recruit and retain teachers in the classrooms where they are most needed.

In examining the impacts of TIA, we contextualize this study within the broader literature that addresses the role of teachers and pay-for-performance initiatives on student achievement and teacher retention. A recent study of Texas teacher turnover beginning in 2011 suggested that turnover rates held steady at an average of 10.41% through the 2019-2020 school year. The number dropped in 2020-2021 to 9.34%, rose to 11.57% in 2021-2022, and then grew to a high of 13.44% in the 2022-2023 school year (Landa, 2023). Similar to national statistics, Texas schools that have higher minority and poverty rates experience the greatest rates of teacher turnover (Holme et al., 2018; Lopez, 2022). Yet while multiple studies have examined teacher turnover post-pandemic, no study has considered the potential role of TIA in Texas as a protective means of retaining effective educators.

Impact of Merit Pay Policies

The concept of merit pay in education is deeply rooted in the ideology of enhancing educational outcomes by rewarding individual teacher performance. Historical implementations date back over four decades, beginning with initiatives like the Tennessee STAR project in the 1980s, which explored financial incentives alongside class size reduction (Mosteller, 1995). Subsequent innovations such as the Teacher Advancement Program (TAP) introduced in the 1990s, emphasized teacher evaluations tied to classroom effectiveness and offered financial bonuses as incentives for high-performing educators (Hudgens et al., 2022). This evolution of merit pay has continued as states and districts explore diverse approaches to motivate and retain talented educators while navigating the complexities of evaluations, impacts on collaboration, and fairness.

Historically, efforts to implement merit-based compensation have encountered challenges related to the fairness and accuracy of teacher evaluations, the potential for incentivizing undesirable teaching practices, and the implications for teacher collaboration (Lavy, 2009). For instance, policies emphasizing test scores can lead to "teaching to the test" behaviors that may neglect broader

educational goals such as fostering critical thinking and creativity (Hanushek & Woessmann, 2012). Despite these challenges, the growing adoption of sophisticated evaluation systems that offer a more comprehensive assessment of teacher performance may help mitigate some of these concerns.

The introduction of TIA also coincides with a broader policy landscape concerned with educational equity, especially following landmark legal challenges such as Edgewood Independent School District v. Kirby (1989), which reshaped Texas's approach to school funding. Merit pay systems have increasingly been recognized as pivotal interventions aimed at enhancing teacher effectiveness. These systems, including recent initiatives like Selective Retention Bonuses (SRB) and comprehensive teacher evaluation frameworks, focus on rewarding teachers who significantly influence student growth, particularly in high-need areas such as STEM education (Swain et al., 2019). TIA represents a significant evolution in this landscape by offering unprecedented financial incentives and granting districts the flexibility to design their evaluation criteria, thereby marking a unique approach in linking compensation directly to teacher performance and broader educational outcomes (TIA, 2022).

Impact on Student Achievement

Research affirms the profound influence that teacher quality has on student performance across various metrics, including standardized test scores, college attendance rates, and long-term earnings (Chetty et al., 2011, 2014; Hanushek, 2011; Rockoff, 2004; Sorensen & Ladd, 2020a). Yet, establishing robust strategies to elevate teacher effectiveness within schools has been a contentious and complex policy priority.

Teacher pay-for-performance has faced considerable scrutiny in education research due to mixed outcomes of student achievement (Dee & Wyckoff, 2015). Historically, the evidence on the effectiveness of financial incentives in education has been mixed, with some research indicating improvements in student outcomes (Dee & Wyckoff, 2015; Springer et al., 2010), while other studies

show minimal or adverse effects (Hill & Jones, 2021). As evidenced in a recent study, merit pay may increase achievement gaps between the races (Hill & Jones, 2021). Additionally, the competitive nature of merit pay can foster a sense of rivalry rather than promoting a collaborative professional environment, which is crucial for student success (Lavy, 2009).

One significant problem in implementing new merit-pay systems is the prevalence of "teaching to the test," where educators may neglect the broader aspects of education, creativity, and problem-solving skills (Hanushek & Woessmann, 2012). Furthermore, measuring the effectiveness of merit pay systems may be compromised by other factors that can influence student achievement that are beyond the control of the classroom teacher. Often, teacher pay incentives are bundled with other policy initiatives , such as class size caps or added educational resources that can make it difficult to discern the actual impact of any one of those policies in isolation (Swain et al., 2019).

These discrepancies underscore the challenges of applying financial incentives in an educational sector where some contexts are heavily regulated by teachers' unions, while others operate under right-to-work laws. TIA introduces a new approach by offering substantial financial rewards—not just tied to student performance but also other district-determined metrics—allowing a highly customizable and multifaceted incentive structure. This substantial investment and flexibility provide a unique opportunity to assess the impacts of a robust merit pay system on a variety of educational outcomes.

Impact on Teacher Turnover

Teacher turnover remains a long-standing problem with few solutions (Goldhaber & Gratz, 2022; Nguyen & Springer, 2023). Though not a novel policy issue (Doan & Steiner, 2022), the COVID-19 pandemic and subsequent stressors further exacerbated an already dire situation (Goldhaber & Gratz, 2022). This further increases the need for greater teacher retention, especially for those teachers who consistently contribute to student growth. While researchers are limited in

ways to track teacher turnover nationally, it is hypothesized that around 500,000 teachers leave their positions each year, a number that continues to grow (Goldhaber et al., 2022).

The literature on teacher turnover does not cite one singular catalyst as the reason teachers are leaving the profession; more so, it is a conglomerate of school and district factors that appear to impact teacher retention in addition to external factors beyond systemic control. Subpar teacher salaries are often cited by stakeholders as a major factor contributing to teacher turnover. Yet research indicates that salary may be a barrier to attracting new teachers into the workforce rather than being the primary cause of turnover (Doan & Steiner, 2022; Sorensen & Ladd, 2020b). Furthermore, literature examining the impact of increased teacher salaries on retention yields inconsistent findings, with some studies suggesting no correlation (Hill & Jones, 2021; Hough & Loeb, 2013) and others suggesting that a salary increase has not only a positive correlation with retention but also an increase in hiring rates (Sun et al., 2022).

"Pay-for-performance" structures have become increasingly popular interventions to improve teacher effectiveness by offering financial incentives to individual teachers who improve student achievement (Fitzpatrick et al., 2022) with a growing number of LEAs instating local programs designed to incentivize teacher performance. Prior to the Teacher Incentive Allotment, Dallas Independent School District implemented a comprehensive teacher evaluation system that linked teacher salaries with classroom effectiveness to better staff underperforming schools with more highly proficient teachers. This systemic shift not only increased student achievement but incidentally also raised teacher retention rates, surpassing the average retention rate across the state (Hanushek, 2020).

Current Study

Against this backdrop, TIA could play an important role not only in elevating student achievement but also in addressing longstanding disparities in educational access and quality as well

as challenges to retaining high-quality educators. By examining the outcomes associated with TIA, this study seeks to contribute to the ongoing debate on the efficacy of pay-for-performance in education and its potential to foster a more equitable and effective educational system. TIA is not the first policy effort to tie teacher compensation to student performance. Rather, TIA is unprecedented in that it offers the largest monetary incentives of any pay-for-performance program and grants school districts the autonomy to tailor the criteria for teacher evaluations and designations. Such flexibility in design, coupled with the magnitude of potential earnings, distinguishes TIA as a unique policy experiment aimed at motivating teachers and, by extension, potentially elevating student achievement across the state.

Method

Data

The study draws upon student-level data from the University of Houston Education Research Center, which compiles statewide, longitudinal data from students attending Texas public schools. This dataset includes information on student demographics, school-provided student services, transcript data, student achievement tests, attendance, and disciplinary records. Additionally, teacher data allows us to connect individual teachers to students at the classroom level. We use data from 2013-14 to the 2022-23 school years. Specifically, we focus on students and teachers in the first cohort of districts participating in TIA—26 districts serving 414,644 students. These districts were approved to participate in TIA by TEA based on their robust data systems evaluated and validated as part of the enactment of Texas House Bill 3. These systems are used to develop and evaluate educators, making it possible to analyze the effectiveness of the TIA program in enhancing teacher performance and, consequently, student academic outcomes.

Key Variables

The variables of interest are students' standardized testing outcomes and teacher turnover rates. First, we assessed student performance on the State of Texas Assessments of Academic Readiness (STAAR), which reports scores using Item Response Theory Scale Scores for students annually in grades 3-8 for math and reading. We specifically analyzed math achievement for grades 4-7 and reading for grades 4-8, excluding data from 2019-20 due to COVID-19 school closures. This constrained our achievement sample to the school years from 2013-14 to 2018-19 and 2020-21 to 2022-23. Note we do not evaluate math achievement for 8th-grade students, as students enrolled in Algebra I in 8th grade complete the Algebra I end-of-course exam, dramatically changing the composition of the student sample. Secondly, we assessed teacher turnover, defined as a teacher leaving Texas public schools entirely. Our focus was on 3rd-8th grade STAAR teachers, including data from the 2019-20 and 2020-21 school years, as the initial TIA adopters could only include teachers of STAAR subjects as eligible for TIA designation.

Covariates

We incorporate an extensive array of observable attributes for both teachers and students in our analysis. For teachers, this includes demographic variables such as race/ethnicity and gender, educational qualifications such as possession of advanced degrees, total years in the teaching profession, and a quadratic term for years of teaching experience to capture potential nonlinear effects. Additionally, we consider whether teachers are instructing outside their certified subject areas or grade levels. For students, the variables encompass prior academic performance in reading and math, demographic details, status in special education programs, English learner status (whether current or formerly classified), and indicators of economic disadvantage. The full set of descriptive statistics for student and teacher characteristics, as well as the urbanicity of the school districts, are outlined in Table 1.

Table 1. Mean statistics of TIA and non-TIA school districts

	Non-TIA	TIA
Student characteristics		
Male	0.51	0.52
Asian	0.01	0.01
Black	0.09	0.15
White, Latinx	0.40	0.56
White, non-Latinx	0.46	0.22
Other race	0.04	0.06
English learner, current	0.12	0.06
English learner, reclassified	0.06	0.01
Economically disadvantaged	0.61	0.74
Individualized education program	0.13	0.13
Teacher characteristics		
Male	0.18	0.14
Asian	0.02	0.01
Black	0.07	0.02
White, Latinx	0.15	0.26
White, non-Latinx	0.74	0.69
Other race	0.02	0.02
Master's degree or more	0.13	0.10
Teaching out of certification area	0.30	0.21

Certification pathway		
University, traditional	0.42	0.60
University, alternative	0.06	0.07
Online, alternative	0.27	0.17
LEA or ESC, alternative	0.08	0.07
Out-of-state	0.10	0.06
Other postbaccalaureate, alternative	0.03	0.01
Uncertified	0.09	0.03
Class size	16.68	19.18
District Urbanicity		
Major Urban	0.16	0.42
Major Suburban	0.12	0.10
Other Central City Urban	0.38	0.11
Other Central City Suburban	0.14	<0.01
Independent Town	0.01	<0.01
Non-Metropolitan, Fast-Growing	0.05	0.01
Non-Metropolitan, Stable	0.05	0.01
Rural	0.03	<0.01
Charter	0.05	0.34
Number of Districts	1,080	26

LEA=Local Education Agency, ESC=Education Service Center

TIA districts differ in the composition of their students and teachers on a few key characteristics. As shown in Table 1, TIA districts have a greater proportion of Black and Latinx students while having notably fewer White, non-Latinx students. TIA districts are comprised of a greater proportion of economically disadvantaged students. Regarding teacher characteristics, TIA districts have fewer Black teachers and a greater proportion of Latinx teachers. TIA districts employ fewer teachers prepared via alternative pathways and fewer teachers without teaching certification. Lastly, considering the urbanicity of districts, TIA districts are in more major urban compared to rural areas of the state. Many TIA districts are charter school districts compared to non-TIA districts. These key differences in observable student, teacher, and geographic characteristics of TIA and non-TIA districts draw attention to the need for an analytic strategy that creates an appropriate counterfactual for examining the effect of TIA on student and teacher outcomes.

Analytic Approach

We employed the Synthetic Control Method (SCM) to examine aggregated district-level data from our student-level sample. That is, the outcome variables, as well as covariates associated with both teachers and students, are aggregated across all schools within districts to create a district-level dataset. This consolidation allows us to construct a synthetic control group that mirrors the pre-treatment characteristics of TIA districts as closely as possible, enhancing the comparability necessary for our identification strategy. For TIA districts, data are aggregated into one unit-level average each year (Abadie et al., 2010).

To understand how STAAR achievement outcomes and teacher turnover rates may shift due to the implementation of TIA, we need to construct a comparable counterfactual explanation of what we would have observed for students and teachers if they were in districts that did not adopt TIA. We employed SCM to create a synthetic control group that best resembles the observed characteristics in these districts (Abadie et al., 2010). SCM uses observed characteristics from

students in multiple districts over time in the dataset. Districts are assigned positive weighted averages that sum to one that represents the similarity to the districts with respect to the outcomes and covariates included in each model. The SCM approach accounts for unobserved confounders changing over time by reweighting the control group so that it has similar characteristics pre-treatment when compared to the treatment group (Kreif et al., 2016).

SCM constructs a separate synthetic control group for each model employed. In addition to the covariates, we included lagged measures of each outcome in the school years 2014-15, 2016-2017, and 2018-19. We chose three lagged outcome measures based on recommendations from Abadie et al. (2011) and alternated years selected to test for the sensitivity of our results. Our results were not sensitive to the chosen years of lagged outcome measures.

Empirical Specifications

In more detail, we outline the SCM approach in accordance with the framework outlined by Abadie et al. (2010). Within this framework there are J + 1 entities, which we consider districts. The treatment unit is the combination of districts that adopted TIA in the 2019-20 school year based on achievement data from 2018-19. The remaining units, which are districts that have not adopted TIA as of the 2022-23 academic year, form the 'donor pool' to the synthetic control unit, the counterfactual to TIA districts. These outcomes are tracked over T years, with the policy coming into effect just after the T0 year. The outcome vector for each district is denoted by Y_i, which is a sequence of observed outcomes from period 1 to period T, presented in a columnar vector.

The actual observed outcome, Y_{jt} represents the combination of the potential outcome that would occur in the absence of the treatment, denoted by Y_{jt}^{N}, and the impact of the treatment itself, denoted by a_{jt}. This relationship is indicated by the specification where D_{jt} represents the binary status of treatment exposure. In turn, the potential outcome without treatment, Y_{jt}^{N}, is represented as a function of time-specific effects δ_t , the interaction of time-specific coefficients λt with

unobserved district-specific factors μ_j, the influence of observed covariates Z_j with coefficients θ_t, and an error term ε_{jt} as specified below:

$$Y_{jt} = Y_{jt}^N + a_{jt}D_{jt.}$$

$$Y_{jt}^N = \delta_t + \lambda_t\mu_j + \theta_t Z_j + \varepsilon_{jt}$$

In the first equation above, δ_t represents effects associated with time, while Z_j is an array of predictors that do not change over time but have a coefficient vector θ_t that varies with time. The term μ_j refers to a set of predictors that remain hidden and consistent, paired with a coefficient vector λ_t that fluctuates over time. The variable D_{jt} serves as an indicator, assigned a value of 1 for the unit receiving treatment after the treatment period, and 0 for all other times. The term ε_{jt} refers to unpredictable, temporary disturbances that average out to zero. Presuming a linear correlation between the outcomes and the predictors, the SCM allows the influence of the unseen predictors μ_j, signified by λ_t, to vary over time (Abadie et al., 2015).

Prior to the implementation of the intervention, the potential outcome that would be expected without treatment, Y_{jt}^N, matches the actual observed outcome for both the district that will receive the treatment and those that will not. However, for time periods succeeding treatment, the potential outcome in the absence of treatment for the treated district, $Y1_{jt}^N$, cannot be directly observed. To approximate the treatment effect for these subsequent years, the SCM predicts the unobservable Y_{jt}^N by constructing a synthetic control unit. This is done by combining control districts with calculated weights that best replicate the pre-intervention traits of the TIA districts (Abadie & Cattaneo, 2021). Those weights are represented by the vector $W = (w_2 \ldots w_{J+1})$, where each W_J signifies the proportion each control district contributes to the synthetic control, with the condition that all W_J are non-negative and their sum equals 1. The counterfactual outcome is then synthesized as a linear combination of the actual outcomes of the control districts: $Y\hat{}N_{1t} = \sum^{j+1} J_{+2}$

j+1=2$w_j Y_{jt}$. To estimate the treatment effect on the treated region for each year post-treatment, one would calculate as $\alpha\hat{}1t=Y1t-Y\hat{}N1t$.

Results

Figures 1 and 2 illustrate the impact of TIA on student achievement in math and reading within TIA districts, compared to a synthetic control unit. Achievement is presented in the form of standard deviation units, which allows for interpreting shifts in achievement as effect sizes. Beginning with math achievement in Figure 1, the TIA districts (solid line) and the synthetic control (dashed line) exhibit closely aligned trajectories before the implementation of TIA, indicating a robust match between the treated and control groups. In the first achievement outcome observed after the implementation of TIA- notably the year following COVID-19 initial school closures-the TIA districts show a decline in math achievement by approximately 0.025 standard deviation units, marked by the vertical line in 2021. Relative to the synthetic control, which experiences a more pronounced decline of about 0.150 standard deviation units, this differential suggests that while both groups faced declines, the TIA districts were buffered significantly against larger drops in math achievement compared to their synthetic counterparts in the year following the pandemic. Further, as the lines stretch to the 2021-22 and 2022-23 academic years, the TIA districts consistently outperform the synthetic control group with an overall 0.100 standard deviation larger relative to their counterparts.

Figure 2, depicting reading achievement, reveals a more volatile response post-TIA implementation. Both TIA districts and the synthetic control follow a similar path until 2021, after which TIA districts experience a sharp peak and subsequent trough in reading scores in the years following TIA. The peak represents a 0.180 effect size of the impact of TIA in the 2020-21 school year, where TIA districts significantly outperform the synthetic control unit. The gap persists into

the next two academic years. Similar to the findings for math, the average gap in the years following implementation is 0.100 standard deviation units.

Figure 1. Effect of TIA on Math Achievement

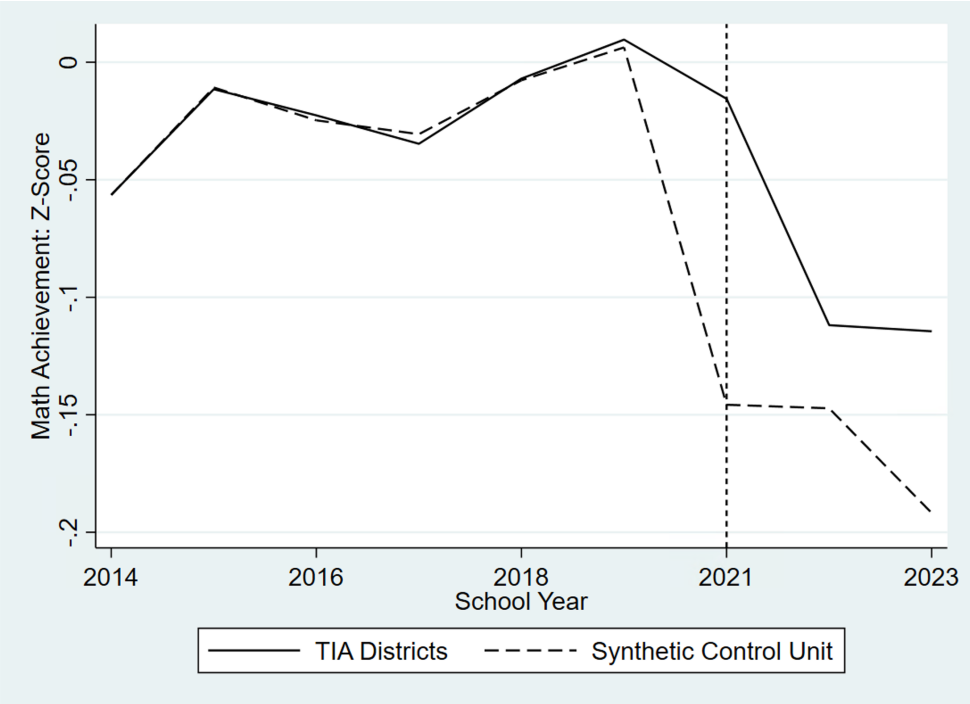


Figure 2. Effect of TIA on Reading Achievement

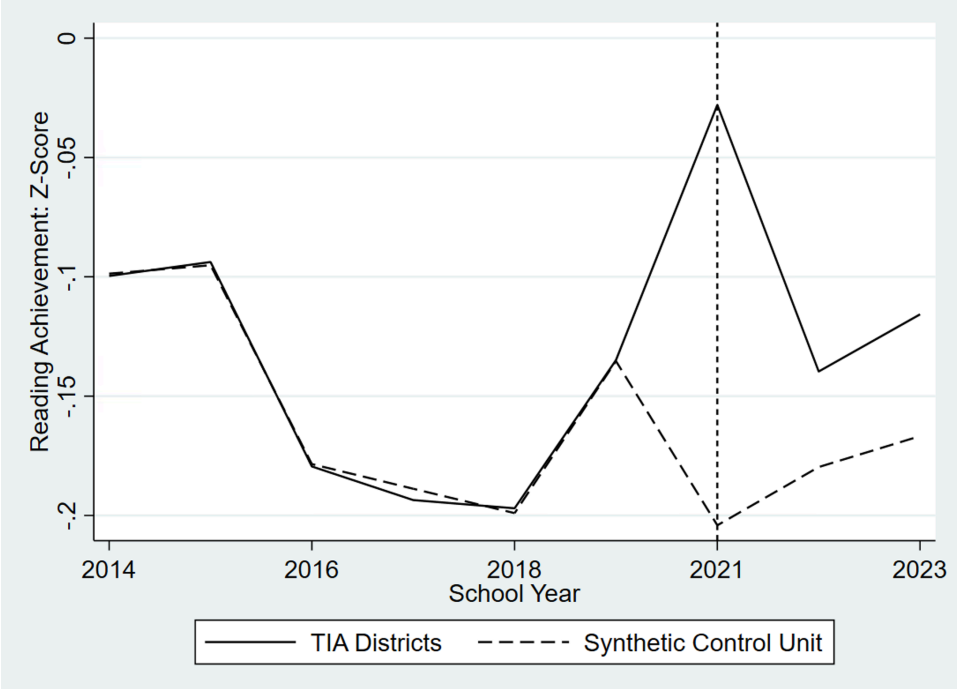
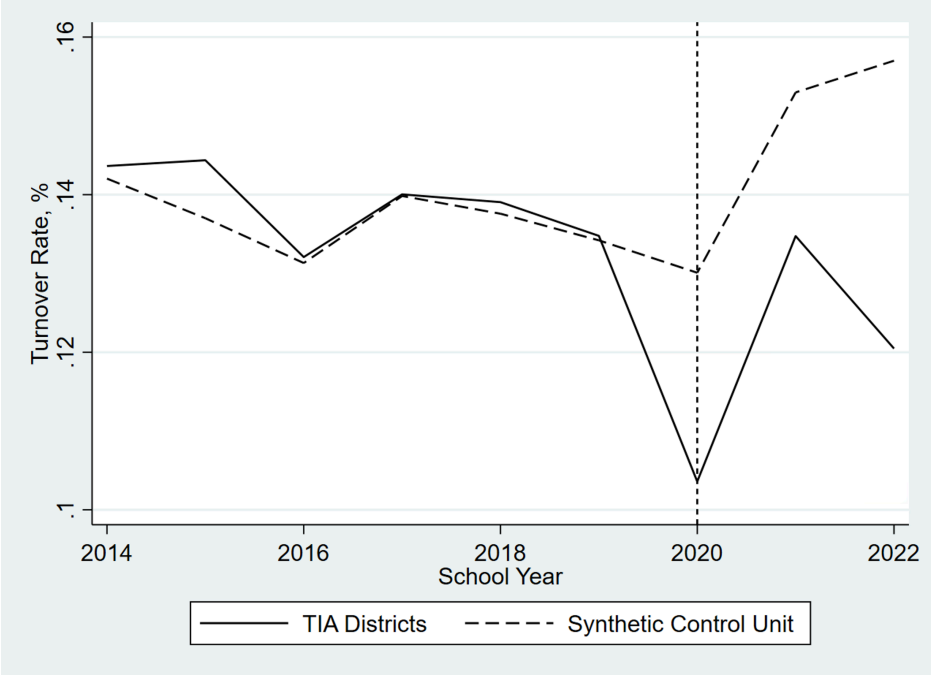


Figure 3 illustrates the impact of TIA on teacher turnover within TIA districts, compared to a synthetic control unit. Turnover rates are presented in percentage terms, directly comparing changes over time between the treated districts and their synthetic counterparts. Prior to the implementation of TIA, the turnover trends for TIA districts (solid line) and the synthetic control (dashed line) show similar patterns, indicating a well-matched comparison in the pre-intervention period. Starting from 2020, marked by the vertical line in the graph, which coincides with the implementation of TIA, there is a notable divergence in turnover rates. In the 2020-21 school year, immediately following TIA's rollout, TIA districts demonstrate d a reduction in teacher turnover by approximately 5 percentage points- or 50% overall- compared to the synthetic control, which remains relatively similar in the 2020-21 year. This suggests that the TIA districts experienced enhanced stability in their teaching workforce relative to their counterparts in a volatile year. Over the subsequent years, TIA districts generally maintain ed lower turnover rates compared to the synthetic control, which exhibits higher variability and increased turnover rates. This result underscores the potential effectiveness of TIA in retaining teachers, particularly in the challenging post-pandemic educational landscape.

Figure 3. Effect of TIA on Teacher Turnover

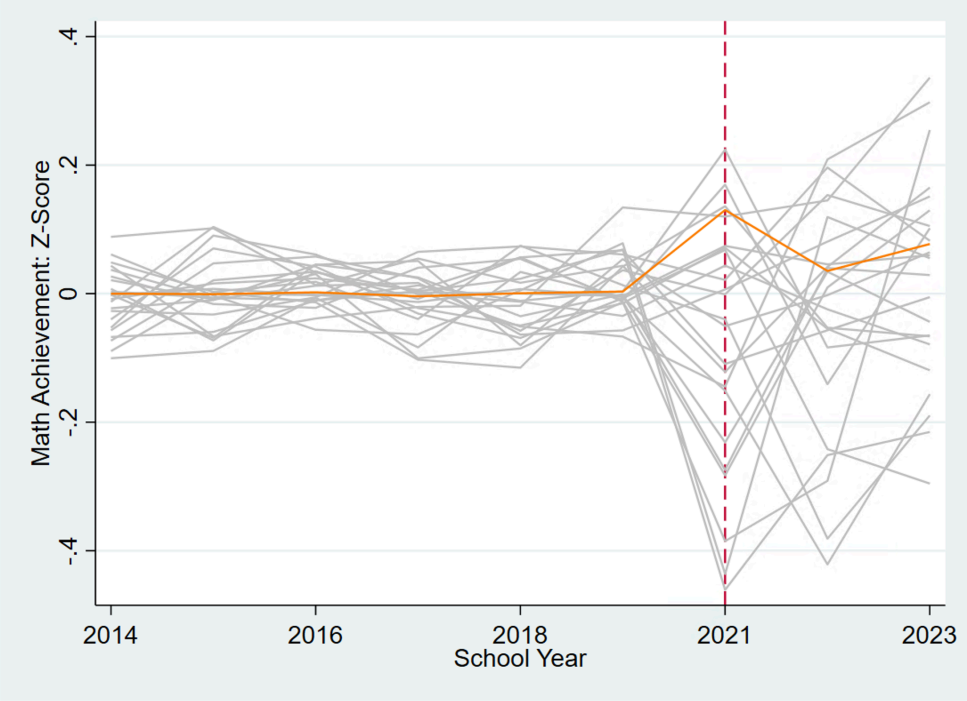


We also examined the impact of TIA on teacher turnover rates, specifically among educators with 3-5 years of experience within TIA districts, compared to a synthetic control unit. Before TIA's implementation, turnover patterns between the two groups were closely aligned. In the 2020-21 school year, immediately following the implementation of TIA, districts with TIA showed a significant reduction in teacher turnover—approximately 7 percentage points, or 66% overall—specifically among teachers with 3-5 years of experience. This substantial decrease contrasts with the relatively stable turnover rates observed in the synthetic control during the same period, suggesting that TIA has notably enhanced stability within this critical segment of the teaching workforce. Over the following years, TIA districts continued to exhibit lower turnover rates among these mid-career teachers compared to their counterparts in the synthetic control, which displayed higher variability and overall increased turnover rates.

Tests of Robustness

Consistent with Abadie et al. (2010), we conducted several robustness checks following our baseline analyses. First, we performed placebo tests by treating districts in the donor pool as if they had implemented TIA. This tests whether the observed effects of TIA could be attributed to the policy rather than unknown confounding factors attributable to TIA districts. Figure 4 displays the placebo test results for math achievement, with TIA districts shown by the solid orange line and placebo districts in gray. The vertical red dashed line indicates the first year following TIA implementation. Pre-implementation trends between TIA and control districts show similar patterns, supporting the validity of the synthetic control. Post-implementation, while placebo districts exhibit variable achievement patterns, TIA districts show a distinctive trajectory - an initial decline followed by recovery. This pattern, distinct from the broader variation seen in placebo tests, suggests the changes we observe are attributable to TIA rather than to external factors.

Figure 4. Synthetic Control Placebo Test, Math Achievement



Additionally, we adjusted the baseline year in our models, employing the models as if the first year of implementation of TIA was the year prior to actual implementation. Results from those

models were not statistically significant. We also applied a "leave-one-out" sensitivity analysis, where we individually excluded a donor district with a weight above 0.10. This sensitivity test ensures that the synthetic control unit is not contingent on a particular district. Throughout this iterative process, our models yielded similar results to our baseline findings.

Discussion

The Texas TIA program has introduced a significant shift in teacher compensation that intertwines financial incentives with high-stakes, data-driven performance of teachers in the state. This study was the first to evaluate TIA at a statewide level and provides insights into the impacts of this ambitious policy on teacher retention and student achievement for initial TIA program adopters. We summarize three main takeaways from our analysis.

First, implementing TIA has moderately and meaningfully impacted student math and reading achievement. Our analysis shows that while both math and reading scores faced declines following the pandemic, TIA districts exhibited a smaller drop than their observably similar districts. This suggests that TIA may have provided a buffer against the broader disruptions caused by the pandemic, underscoring the potential role of significant merit bonuses for effective teachers in districts that experienced the most significant crisis affecting schools in modern history.

Second, the data indicate that TIA has mitigated teacher turnover, notably in the challenging post-pandemic educational landscape. This outcome highlights the potential of well-structured pay-for-performance systems to retain teachers in a state grappling with persistent teacher shortages and high turnover rates, especially in high-need and rural areas.

Lastly, our findings reveal particularly pronounced effects among teachers with 3-5 years of experience. This subset of educators, often at a critical juncture in their likelihood of remaining in the profession, demonstrated the largest effects related to TIA. The retention rates for these early career teachers significantly improved compared to their peers in non-TIA districts. Furthermore,

the student achievement data for classes taught by these teachers also showed more marked improvements in both math and reading scores compared to newer and more veteran teachers. This suggests that TIA may be most effective in enhancing the stability and performance of teachers who are in the formative stages of cementing their long-term teaching strategies and commitments to the profession.

Beyond the baseline findings that TIA positively shaped student achievement and teacher retention, the magnitude of the effect differed across years of implementation. For both math and reading, the largest differences in achievement between TIA and non-TIA districts are observed in the first year (2020-21), although differences are still observed in later years. This inconsistency in magnitude differs from other studies, such as Dee and Wyckoff (2015) who show larger effects from the DC IMPACT program in the second year. On the other hand related to teacher turnover, our findings shows that TIA has great promise to have beyond initial year of implementation effects. Figure 3 shows the differential effect of TIA on teacher retention widens in the last year observed in this study. This finding is also different compared to prior studies, such as Glazerman and Seifullah (2012). The authors found that the effect of Chicago Public Schools' Teacher Advancement Program (TAP) on teacher retention was concentrated for teachers observed in the first year of the program.

While effects over time differ when compared to prior studies, there is reason to believe these differences over time should be expected. An important characteristic of TIA is the way its merit incentive system operates. Teachers who receive a designation under TIA are awarded merit-based financial incentives for a period of at least five years. This structure likely contributes to a consistent impact on teacher retention, as teachers' compensation and recognition is sustained for multiple years. This consistency in additional compensation each year may allow teachers to plan for future benefits, reinforcing their decision to stay within the profession.

Student achievement, on the other hand, acts as a lever determining designation during just one year, and teachers do not have to maintain the same achievement levels to receive additional compensation over the next five years. To receive a permanent increase in salary in the DC IMPACT program, teachers had to demonstrate effectiveness for two consecutive years (Dee & Wyckoff, 2015). Although uncovering the mechanisms underlying differences in TIA effects over time is beyond the scope of this study, we speculate differences can be attributed to the significantly different structures of each merit-pay program.

Implications

These findings no doubt provide good news to Texas policymakers who established this unprecedented investment in teacher compensation through the largest merit pay system in the country. The evidence that TIA has positively impacted both teacher retention and student achievement supports the initiative's foundational goals and justifies the substantial financial commitment involved. The results bolster the case for the continued implementation and possible expansion of TIA, although more research is needed to determine whether additional expansions and investments in the policy result in additional benefits. For the initial TIA cohort of school districts, evidence of the outcomes that were shaped by the policy serves as a compelling argument for maintaining current investments in TIA as a performance-based compensation and suggest TIA is elevating educational quality and equity across the state. This success not only validates the TIA's approach to merit-based compensation but also offers several implications for policymakers, school administrators, and stakeholders.

First, the positive impact of TIA on teacher retention, particularly among teachers with 3-5 years of experience, suggests that multi-year merit-based incentive structures can be effective in stabilizing the teaching workforce. Unlike programs with short-term financial incentives, TIA's model of sustained compensation for designated teachers supports longevity in the teaching

profession. Policymakers should consider the importance of structuring pay-for-performance programs to provide long-term financial incentives that foster teacher commitment to the profession and mitigate attrition.

Second, although TIA showed moderate impacts on student achievement overall, the variability over time points to the complexity of sustaining such gains, at least in terms of magnitude. The strongest impacts were observed in the first year, with smaller but still positive effects continuing in subsequent years. This trend underscores that while performance-based pay can act as a catalyst for improving student outcomes in the short-term, more information is needed to ensure the state and school districts are providing the targeted support necessary to maintain those outcomes over time. The findings also highlight that differences in the design and implementation of pay-for-performance programs can lead to varying long-term impacts. Unlike other merit-pay programs, where permanent salary increases required sustained high performance over multiple years, TIA's structure provides recurring incentives without the necessity for consistent annual performance. The conceptual underpinnings of this compensation model supports teacher retention outcomes but may present challenges for sustaining consistent improvements in student outcomes. Policymakers and stakeholders ought to consider other malleable mechanisms that can be used to encourage the continuous improvement in student achievement while maintaining the integrity of school districts' local designation system that may or may not integrate periodic re-evaluations or additional criteria for teachers to receive additional compensation in future years.

Moreover, the pronounced effects observed among teachers with 3-5 years of experience highlight the potential of targeted incentive programs to stabilize the teaching workforce during the critical early years of teaching. Policies that target mid-career teachers- who have moved beyond the challenges of initial teaching but are still solidifying their long-term career plans- can be particularly

effective. This insight aligns with research suggesting that mid-career teachers are at a pivotal point for in-service factors that drive their motivation to remain in the profession (Boyd et al., 2011).

Finally, the implications of this study extend to the broader policy discussions on educational equity and ways in which incentive structures can be used to recruit and maintain effective educators in high-need schools. As a policy, TIA incentivizes teachers to teach in schools with greater proportions of students who are economically disadvantaged as well as in schools in more rural areas of the state. While data limitations prevent us from examining movement among designated teachers, it is worth noting that students in TIA districts tend to perform lower on standardized assessments in the state over the years observed in this study. This is shown in all figures presented in this study, as the standardized achievement of students both pre- and post-TIA implementation is lower than the state average (i.e., z-scores of achievement are below zero). That means the positive effects of TIA on student achievement are taking place in lower performing, likely higher need school districts. That warrants additional attention and praise from policymakers and stakeholders. TIA shows promise to not only address teacher shortages but also contribute to reducing educational disparities across districts. Policymakers should continue to prioritize and refine strategies that ensure lower performing school districts have access to the resources needed to implement TIA.

Limitations and Future Research

While this study provides insights into TIA and its initial effects on teacher retention and student achievement, we note several limitations and areas for future research. First, the timing of the TIA's implementation coincided with the COVID-19 pandemic, an event that disrupted education systems globally and introduced significant variability into school operations, student learning environments, and teacher practices. Although we present compelling evidence with supplementary tests of robustness, the pandemic is an inherent confounding factor that may have

influenced both the policy's impact and the measures used to evaluate student and teacher outcomes. Another limitation of this study is its sole use of a quantitative, quasi-experimental design. While this approach allows for large-scale analysis of the effects of TIA, it does not provide insights into the mechanisms through which TIA produces these effects. As a result, the study cannot determine the specific practices, behaviors, or strategies that contribute to the observed improvements in retention and achievement. Further research is needed to explore how and why TIA drives these positive outcomes. This study also focuses solely on the outcomes of students in grades 4 through 8 and their teachers, even though nearly all teachers across grades and content areas are eligible for TIA. The findings, therefore, cannot be generalized to all teachers and grade levels without further study. Additionally, the analysis is restricted to the first cohort of 26 TIA-participating districts. Given that the state has significantly expanded TIA adoption, the inferences drawn from this study apply only to these initial districts and their specific implementation contexts. Lastly, this study does not have access to individual teacher designation data, limiting the analysis to aggregate effects across participating districts. Without detailed data on specific teacher designations and their direct impact, the study cannot provide insight into how varying levels of TIA designations influence teacher and student outcomes. Reporting only aggregate effects restricts the ability to assess differential impacts tied to specific TIA recognition levels. Addressing these limitations in future research would strengthen the understanding of TIA's role in educational improvement and support more nuanced policy discussions.

Conclusion

TIA provides compelling evidence that strategic, merit-based compensation models can play a critical role in addressing key challenges in education. By demonstrating positive impacts on both teacher retention and student achievement, particularly in lower-performing districts, TIA highlights the potential of targeted financial incentives to support and sustain educational outcomes. The

findings of this study reinforce the importance of policies that balance immediate gains with long-term benefits, emphasizing the need for thoughtful program structures that consider the diverse experiences and needs of educators. As states and policymakers look to design or enhance teacher incentive programs, the lessons from TIA offer a valuable blueprint for leveraging teacher compensation to achieve meaningful, sustained improvement in education for students.

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