Teaching on Borrowed Time: How the Teacher Loan Forgiveness Program Delays, But Does Not Prevent, Teacher Attrition

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Abstract

This paper examines how teachers respond to qualifying for either $5,000 or $17,500 in loan forgiveness by analyzing employment patterns before and after satisfying the Teacher Loan Forgiveness Program's (TLFP) five-year service requirement. Exploiting variation in teacher loan eligibility and school eligibility, I use a difference-in-difference-in-differences framework to estimate the causal impact of qualifying for loan forgiveness, extending prior literature that focuses solely on retention during the service period. Results indicate that while the TLFP temporarily boosts retention during a teacher's first five years, it induces a 1.7 percentage point increase in exits from Texas public schools after qualifying for loan forgiveness. This effect is more pronounced for teachers with high loan balances and those eligible for $17,500 in forgiveness. Further analysis of earnings and employment patterns indicates that teachers who leave after qualifying for forgiveness are more likely to transition into higher-paying jobs, particularly STEM teachers whose outside opportunities are more lucrative. Additionally, teachers who remain in public schools are more likely to take on additional work, suggesting that financial pressures persist even after qualifying for loan forgiveness. These findings underscore the limitations of one-time loan forgiveness incentives in sustaining long-term teacher retention.

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1 Introduction

Teacher shortages remain a persistent and growing challenge in the United States (García and Weiss, 2020). Recent estimates suggest a minimum of 36,000 vacant teaching positions and 163,000 roles filled by underqualified educators, with low-income schools and high-need subject areas bearing the brunt of the crisis (Carver-Thomas et al., 2021 & Nguyen et al., 2022). Declining enrollment in teacher preparation programs and high turnover rates exacerbate the issue, creating barriers to equitable education access (Podolsky and Kini, 2016, Ingersol et al., 2018, Ingersoll et al., 2019, Sargrad et al., 2019, Loeb and Myung, 2020, & Wilson and Kelley, 2022).

The consequences of teacher turnover extend beyond staffing challenges. High attrition disrupts student learning, with research linking frequent teacher changes to lower academic achievement (Ronfeldt et al., 2013). Moreover, teacher turnover imposes significant financial costs on school districts — replacing a single teacher costs an average of $25,000 after factoring in recruitment, hiring, and training expenses (Sutcher et al., 2019 & Learning Policy Institute, 2024). In high-turnover districts, the financial burden diverts resources from student-focused initiatives, further widening educational inequities.

To address these challenges, policymakers have implemented numerous initiatives aimed at reducing entry costs and incentivizing teachers to remain in the profession. As of July 2023, 18 states offer teacher-specific loan forgiveness programs, while others provide annual bonuses, retention incentives, mortgage assistance, and tax credits (Isola, 2023). At the federal level, programs like the Teacher Loan Forgiveness Program (TLFP) and Public Service Loan Forgiveness (PSLF) program aim to alleviate the financial burden of student loans in exchange for public service. Although initiatives to reduce entry costs are important for expanding the teacher pipeline, retention strategies are equally vital for maintaining a stable workforce. This study focuses on understanding how such retention incentives impact teacher decisions after fulfilling program requirements.

Using detailed data from Texas, this paper investigates the TLFP, which provides up to $17,500 in loan forgiveness for qualified teachers who serve in low-income schools for five consecutive years. Despite the program's popularity, alignment with the growing national focus on student debt relief, and a recent attempt to increase the maximum forgiveness amount to $30,000, limited research examines teacher behavior once financial incentives are removed (US Senate, 117th Congress, 2022). This paper fills this gap in the literature by examining how satisfying TLFP service requirements affects teacher retention, employment patterns, and career choices.

Another key aspect of this study is examining how the amount of loans a teacher holds and the forgiveness they qualify for influence their decisions. Teachers with high loan balances have a stronger incentive to meet the five-year service requirement to receive forgiveness, but this same incentive may drive them to leave the profession once they receive forgiveness. Understanding these dynamics is critical for designing programs that effectively balance retention and workforce stability.

Results suggest that satisfying program requirements does not affect teacher turnover rates

within Texas public schools, but does lead to a 1.7 percentage point (pp) (21.4%) increase in exits from the public school system. Effects on leaving the profession increase with higher student loan balances, with estimates for teachers who have more than $90,000 in loans 7.5 pp larger than those with less than $10,000 in loans. Similarly, effects for teachers who qualify for $17,500 in forgiveness are up to 4.5 pp larger than teachers who qualify for $5,000.

While earnings of teachers remaining in the public school system do not meaningfully change in response to qualifying for loan forgiveness, they are more likely to hold multiple positions, both within and outside the school system. On average, teachers with large loans balances and/or STEM degrees who exit public schools after qualifying for loan forgiveness transition into higher-paying fields. These findings underscore the importance of considering long-term outcomes when designing policies to address teacher shortages.

The structure of the remainder of the paper is as follows: Section 2 provides a comprehensive overview of the TLFP, while Section 3 details existing research on the impacts of student debt, loan forgiveness, and financial incentives for teachers, framing the unique contributions of this paper within the existing literature. Section 4 offers a thorough description of the data, and Section 5 outlines the methodological approaches used in analyses. Section 6 presents the key findings, and Section 7 concludes.

2   Teacher Loan Forgiveness Program

The TLFP, coordinated by the U.S. Department of Education, aims to address teacher shortages by incentivizing educators to work in low-income schools and high-need subjects. Eligible teachers must hold federal subsidized or unsubsidized loans issued after October 1st, 1998, and meet certification and service requirements. Teachers must be deemed "highly-qualified" by earning a bachelor's degree and obtaining full certification from the state in which they work.[1] Moreover, elementary teachers must demonstrate subject knowledge and teaching proficiency in reading, writing, mathematics, and basic elementary curriculum through additional certifications or licenses, while secondary teachers must pass a subject test, complete a degree, or earn an advanced certification in their subject.

The service component mandates five consecutive years of full-time teaching in low-income schools or educational service agencies, which are identified annually on the Teacher Cancellation Low Income (TCLI) Directory. States submit all qualifying schools to the Department of Education, typically using a cut-off of at least 30% of school enrollment coming from low-income or economically disadvantaged families.[2,3] The service requirement must be completed consecutively, but if a school loses its eligibility status during the teacher's tenure, the years served still count.

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[1] Certification and licensure requirements cannot be met by emergency, temporary, or provisional measures.

[2] Schools operated by the Bureau of Indian Education or that are in districts receiving Title I funds also qualify.

[3] Private schools do not qualify unless they are 501(c)(3) nonprofits, participate in Title I, and meet the state's low-income threshold. In 2017-18, 24.3% of private schools participated in Title I, with participating schools averaging 42% of student enrollment qualifying for free or reduced-price lunches, leaving few private schools eligible for TLFP forgiveness (Taie and Goldring, 2019).

Teachers meeting these criteria and who have made 60 monthly loan payments qualify for $5,000 or $17,500 in loan forgiveness. Secondary mathematics and science teachers and all special education (SPED) teachers qualify for $17,500, reflecting the higher demand in these fields. All other teachers qualify for $5,000. Teachers must submit the Teacher Loan Forgiveness Application — certified by their school of agency's chief administration offer — to each loan servicer to receive loan forgiveness. Since its inception, the TLFP has forgiven loans for more than 200,000 teachers, amounting to over $3 billion in loan forgiveness.

3 Literature Review and Contributions

3.1 Literature Review

This paper contributes to several strands of literature, particularly the impacts of financial incentives on teacher retention and the broader effects of student loan forgiveness on labor market outcomes. Existing research highlights the role of financial incentives, such as salary, raises, and bonuses, in addressing teacher shortages. Several papers have identified low salaries as a major driver of teacher attrition (Ashiedu and Scott-Ladd, 2012 & Dee and Goldhaber, 2017), especially for early-career teachers in low-income schools (Ingersoll, 2004, Ingersoll and May, 2012, Podolsky and Kini, 2016, & García and Weiss, 2020). Permanent salary increases have shown promise in improving retention (Feng, 2009), but these measures are costly and politically challenging to implement.

Consequently, policymakers have increasingly turned to temporary incentives. For example, Clotfelter et al. (2008) find that an annual $1,800 bonus reduced turnover among certified math, science, and SPED secondary teachers in targeted schools by 17%. Similarly, Cowan and Goldhaber (2018) report a 31-41% reduction in turnover rates from $5,000 yearly bonus to teachers in Washington State employed at high-poverty schools. Glazerman et al. (2013) find that selective transfer incentives of $20,000 paid in installments over two years to high-performing teachers positively impacted teacher retention during the payout window, but retention rates returned to normal levels afterwards.

Although increased compensation appears effective in incentivizing short-term teacher retention, limited research has considered decreasing debt as an alternative incentive. Pairing evidence that exogenous shocks that reduce debt encourage mobility (Di Maggio et al., 2020) with research showing higher debt levels encourage employment in higher-earning fields (Rothstein and Rouse, 2011 & Luo and Mongey, 2019), debt and debt reduction clearly have the potential to impact employment choices.

Evidence from other professions suggests student loan repayment programs in fact influence placement and retention patterns. Pathman et al. (2004) find that loan repayment programs for physicians encourage placement and retention in lower socioeconomic areas, while Scheckel et al. (2019) show that positions eligible for loan forgiveness attract more attention, especially for physicians with higher debt levels. Moreover, results of a survey conducted by the National

Association of Social Workers in Massachusetts show respondents perceive loan forgiveness as a possible source of preventing their turnover (Fakunmoju and Kersting, 2016). Lastly, Field (2009) studies the random assignment of financial aid packages to law students and finds those who received tuition waivers in exchange for committing to a public-interest position were 36% more likely to work in public-interest law than students offered loan forgiveness after completing such service.

Studies on teacher-specific loan forgiveness programs remain sparse. Feng and Sass (2018) find that Florida's Critical Teacher Shortage Program, which offered $10,000 in loan repayment staggered over four years, reduced middle and high school mathematics and science teacher turnover by 8.9-10.4%. Meanwhile, Russell (2020) studies school-level retention rates around the 30% threshold for TLFP eligibility in Massachusetts, New York, North Carolina, and South Carolina, but finds no impact when comparing barely eligible and ineligible schools.

Most relevant to this study is an analysis of school TLFP eligibility using teacher-level data in Michigan conducted by Jacob et al. (2024). In addition to increased power by using teacher retention rates, the authors further improve on previous research by restricting analysis to new teachers — the group most likely to pursue loan forgiveness, as they typically have higher student debt burdens and face early-career financial constraints and high attrition rates. Using a regression discontinuity design comparing teachers whose first-year school is close to the 30% threshold for TLFP eligibility, they first document that teachers do not sort into eligible schools — there are no significant differences across the threshold in teacher age, gender, race, or any school characteristics. They then show no differences in retention rates during years two through five, which they conclude shows school eligibility does not impact teacher employment choices. Lastly, the authors conducted a contingent value design using a survey of teachers separate from their analysis of retention outcomes. This revealed that teachers value schools that are TLFP-eligible at $500, which grows to $3,000 when explicitly stated as eligible. Teacher valuations are larger for those with federal loans and those eligible for more in forgiveness.

3.2 Contributions

While Jacob et al. (2024) significantly advanced the understanding TLFP impacts, this paper aims to provide further progress by addressing several limitations in their paper. First, I additionally consider teacher characteristics in determining eligibility. With granular data from Texas connecting teachers with their student loans, I am able to determine which teachers have eligible loans. Similarly, certification, licensing, and degree data allow for determining which teachers are "highly-qualified" and the first year of their employment meeting these requirements. Thus, I am able to provide more precise estimates of program effects by more accurately capturing eligibility requirements.

Second, this paper provides a more comprehensive analysis of the TLFP. Unlike prior studies that examine teacher retention during the service requirement window, this study extends analysis to include outcomes after teachers have satisfied the program's five-year requirement. By examining post-requirement outcomes, this study highlights the need for long-term perspectives when

evaluating the effectiveness of loan forgiveness programs, especially in terms of workforce stability and retention.

Moreover, I extend analysis beyond retention metrics to examine broader labor market outcomes for teachers who remain in the profession, as well as those who exit teaching. For teachers, I examine supplemental earnings, extracurricular employment, mobility, and quality.[4] For those who leave, I explore changes in their earnings and employment patterns. These expanded outcomes provide a more comprehensive view of how loan forgiveness influences not only retention but also the overall career trajectories and economic well-being of teachers.

The final major contribution of this work lies in its novel examination of heterogeneity in program effects. Understanding how the impact of loan forgiveness varies by debt levels and forgiveness amounts is essential for designing policies that effectively target high-need teachers and subjects. Teachers with higher loan balances or those eligible for greater forgiveness amounts may have distinct financial motivations and career trajectories compared to their peers. By explicitly considering these differences, this paper provides a framework for understanding how variations in incentive structures shape teacher behavior, offering critical insights for tailoring programs to meet a range of needs.

4   Data

Data for this paper come from the Houston Education Research Center, which integrates post-secondary data from the Texas Higher Education Coordinating Board (THECB), certification records from the State Board for Educator Certification (SBEC), employment in Texas public schools and student outcome records from the Texas Education Agency (TEA), and all earnings reported to the Texas Workforce Commission (TWC). This dataset provides a unique opportunity to examine teacher trajectories before and after completing the TLFP's five-year service requirement.

The postsecondary files from the THECB contain all financial aid a teacher received, allowing me to determine which teachers have loans eligible for forgiveness from the TLFP and the amount of their loans. However, I do not observe which teachers apply for and receive loan forgiveness. As the TLFP operates alongside the PSLF program — and service years cannot simultaneously count toward both programs — some teachers may instead pursue loan forgiveness through PSLF or are unaware of the TLFP as less than 20% of teachers report participating (US Department of Education, 2021).[5] However, only 12.2% of all federal student loan forgiveness is attributable to PSLF, which also covers government organizations and non-profits, while the teacher-specific TLFP accounts for 22.1% of all federal loan forgiveness (Hanson, 2024); thus, most teachers pursuing loan forgiveness do so through the TLFP.[6] As the TLFP is teacher-specific, has a higher take-up rate,

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[4]Analysis of teacher quality is still in progress and will be incorporated in future iterations of this paper.

[5]PSLF forgives remaining federal loan balances after ten years of public service and 120 qualifying payments, which may particularly appealing for teachers with high loan balances.

[6]An additional complication may arise from the Teach for Texas Loan Repayment Assistance Program (TTL-RAP) for the last few years of this analysis. Starting in the 2016-17 school year, the state offered $2,500 in loan repayments each year for up to five years to qualified teachers in a critical shortage field or at a critical shortage

and a shorter time to forgiveness, it is the best-suited program to evaluate the impact of loan forgiveness eligiblity on teachers.

THECB files also indicate when and where a teacher graduated, as well as their major, which is needed to determine the "highly-qualified" requirement for secondary teachers. The SBEC records provide the basis for determining the remaining qualifications, detailing certification dates, type (standard, emergency, provisional, temporary, etc.), program option/field, and certifying organization/route.

TEA employment records track the location and employment intensity for all public school teachers, allowing me to derive annual indicators for employment within Texas public schools. Further, I construct school- and district-level retention indicators to explore turnover within the public school system. School characteristics provide the opportunity to analyze mobility across schools for teachers.

Records, base pay, and supplemental earnings of all teaching and non-teaching positions from within Texas public schools are included.[7] I also observe the grades and subject that a teacher instructs, allowing me to determine whether a teacher is eligible for $5,000 or $17,500 in loan forgiveness. Lastly, for teachers in testing grades and subjects, I observe student performance data from the Texas Assessment of Knowledge and Skills (TAKS) and State of Texas Assessments of Academic Readiness (STAAR) tests, enabling an evaluation of teacher effectiveness.

The TWC files provides quarterly wage reports from all employers in Texas, detailing both quarterly earnings and North American Industry Classification System (NAICS) sector of employment. This affords the opportunity to create outside earnings and employment variables and follow individuals who leave Texas public schools. Earnings data is adjusted to 2024 dollars using the Bureau of Labor Statistic's Consumer Price Index for All Urban Consumers (Series ID: CUUR0000SA0).

Lastly, combining the TEA and TWC employment records, I create an indicator for employment in a Texas private school. This requires an individual to have reported earnings from the NAICS 4-digit industry group or 6-digit national industry code for employment in "Elementary and Secondary Schools" and not be employed in Texas public schools in any position.[8] I then create an indicator for exit from the teaching profession, defined as not being employed in a Texas public or private school, but still having earnings reported to the TWC.[9] Lastly, I create an indicator denoting exit from the Texas workforce, either as a result of being unemployed in Texas or leaving the state.[10]

I restrict analysis to Texas public school teachers who earned a bachelor's degree from a public

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campus. Title I designation is not used to determine campus eligibility, but instead information provided by the Texas Education Agency. Shortage areas for the most recent year cover relatively few teachers — only those in bilingual education, career and technical education, technology applications and computer science, and special education (Texas Higher Education Coordinating Board, 2024). A teacher can simultaneously receive assistance from TTLRAP and TLFP/PSLF, but I cannot net out TTLRAP effects as a request to receive teachers in this program was denied.

[7]Supplemental pay is for any activities or duties beyond their teaching pay. This includes activities such as athletics, clubs, performing arts, tutoring, etc.

[8]See NAICS (2024) for a detailed breakdown of NAICS codes.

[9]If a teacher has no earnings, they may be a teacher in another state, so all individuals with missing TWC records for a given year are omitted from this analysis.

[10]For this paper, an individual is not in the Texas workforce if they have no earnings reported for an entire year.

in-state university whose first full-time, fully certified year in a Texas public school occurred between the 2003-04 and 2013-14 academic years. This provides eight years of post-entry observations for all teachers, capturing outcomes before and after the service requirement. Table 1 contains descriptive statistics for the teachers meeting these restrictions.

Among the 155,224 teachers meeting these criteria, 69.83% have loans eligible for TLFP forgiveness, while just under 30% do not have any student loans. The average loan balance among eligible teachers is $46,737 in 2024 dollars, with three-quarters owing more than $20,000 in loans and one-quarter more than $60,000.[11] 80.19% of eligible teachers qualify for $5,000 in loan forgiveness, with the remaining 19.81% eligible for $17,500. Of those eligible for $17,500, 76.7% are secondary mathematics or science teachers and 23.3% are SPED teachers.

Panel A: Loan Descriptives		Panel B: Eligible Loan Distribution		Panel C: Loan Forgiveness Descriptives	
Outcome	**Value**	**Statistic**	**Amount**	**Amount**	**Percent**
% with Loans	70.58%	25th Percentile	$21,092	$5,000	80.10%
Average Loan Balance	$51,731	Median	$37,402	$17,500	19.90%
% with TLFP Eligible Loans	69.74%	Mean	$46,757		
Average Eligible Loan Balance	$46,757	75th Percentile	$61,884		
Teachers	155,224	Teachers	108,258	Teachers	109,258

Table 1. Employment and School Characteristics

5 Methodology

This paper employs two primary empirical strategies. First, to examine whether teachers sort into TLFP-eligible schools, I use a regression discontinuity design (RDD) that leverages the 30% economically disadvantaged threshold that determines a school's inclusion on the TCLI Directory. Second, to estimate the impact of satisfying the TLFP service requirement, I employ a difference-in-difference-in-differences (DDD) design, which accounts for variation in both school eligibility and teacher loan eligibility.

5.1 Regression Discontinuity Design

To assess whether teachers sort into TLFP-eligible schools, I test discontinuities in observable teacher characteristics at the 30% eligibility threshold. Specifically, I check for balanced covariates

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[11]Deflated using the Bureau of Labor Statistic's College Tuition and Fees price index (Series ID: CUUR0000SEEB01).

using Equation 1:

$$X_i = \alpha + \beta Above_{is,t=1} + \theta \tilde{R}_{is,t=1} + \lambda(Above_{is,t=1} \times \tilde{R}_{is,t=1}) + \epsilon_{is} \tag{1}$$

where X_i represents an observable teacher characteristic, such as race/ethnicity, gender, age, certification route (traditional/alternative), student loan balance, or forgiveness eligibility amount; $Above_{is,t=1}$ is an indicator for whether teacher i's initial school is above the 30% economically disadvantaged threshold; and $\tilde{R}_{is,t=1}$ denotes the centered percentage of economically disadvantaged students at teacher i's initial school. The coefficient of interest, β, captures whether there are systematic differences in teacher characteristics at the threshold. A significant positive estimate on teacher loan balances would suggest that teachers with higher loan balances disproportionately sort into TLFP-eligible schools. The optimal bandwidth is approximately 10 pp, selected using Calonico et al. (2014).

While the 30% economically disadvantaged threshold is not a strict cutoff for inclusion on the TCLI Directory, it closely aligns with actual eligibility. For the 2003-04 to 2013-14 school years — which correspond to the initial teaching years used in this paper — 96.5% of schools above the threshold are included, compared to only 9.0% of schools below it. First-stage estimates indicate a strong relationship between the threshold and inclusion, ranging from 55 pp for the optimal bandwidth to over 75 pp for larger bandwidths. Figure A.1 in the Appendix visualizes this relationship, plotting the proportion of schools on the TCLI Directory in bins of width 2.5.

As over 80% of public schools in Texas appear on the TCLI Directory in a given year, applying an RDD to estimate retention or other long-term outcomes would significantly reduce power and limit external validity. Therefore, I use the RDD solely to examine sorting behavior, contributing to the literature by explicitly incorporating student loan balances as a sorting mechanism — a factor largely absent in prior studies.

5.2 Difference-in-Difference-in-Differences

To assess the long-term effects of satisfying TLFP program service requirements, I employ a DDD approach that exploits variation in both loan eligibility and initial school eligibility. Using retention as an illustrative outcome, a simple difference-in-differences (DiD) approach would likely violate the parallel trends assumption, as TLFP-eligible and ineligible schools may have different underlying retention patterns.[12] Additionally, teachers with eligible loans may have stronger incentives to remain in teaching before qualifying for forgiveness, introducing potential selection biases. The DDD framework mitigates these concerns by leveraging variation across both school eligibility and individual loan status, allowing for cleaner identification of the effect of satisfying TLFP requirements.

The validity of the DDD estimator also depends on a parallel trend assumption, which is more

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[12]See Borman and Dowling (2008) for a thorough review of factors impacting teacher attrition. The authors identify school attributes as one of the key moderators.

plausible in this context and is explored in later analysis. Continuing with the retention example, this assumption requires that, in the absence of the TLFP service requirement, the relative retention rates of teachers with eligible loans at eligible and ineligible schools would trend similarly to those of teachers without eligible loans at eligible and ineligible schools (Olden and Møen, 2022). Intuitively, this estimator captures the difference (before and after the five-year service requirement) in the DiD estimator comparing teachers with eligible loans at TLFP-eligible and ineligible schools to teachers without eligible loans at TLFP-eligible and ineligible schools. Equation 2 outlines this estimator:

$$
\begin{aligned}
Y_{ist} = \ &\beta_0 + \beta_1 TCLI_{is,t=1} + \beta_2 Loans_i + \beta_3 After5Years_{it} + \\
&\beta_4 (TCLI_{is,t=1} \times Loans_i) + \beta_5 (TCLI_{is,t=1} \times After5Years_{it}) + \\
&\beta_6 (Loans_i \times After5Years_{it}) + \\
&\beta_7 (TCLI_{is,t=1} \times Loans_i \times After5Years_{it}) + \\
&\gamma X_{is,t=1} + Cohort_i + \epsilon_{ist}
\end{aligned}
\tag{2}
$$

where $TCLI_{is,t=1}$ in an indicator that equals 1 if teacher i's initial school s is on the TCLI directory; $Loan_i$ is an indicator that equals 1 if teacher i has loans eligible for forgiveness under the TLFP; and $After5Years_{it}$ is an indicator that equals 1 starting in the sixth year after teacher i initially begins teaching. $X_{is,t=1}$ captures teacher race, gender, advanced degrees, age at entry, and certification route and initial school characteristics, including percent economically disadvantaged, charter status, and elementary/secondary designation. Cohort fixed effects, $Cohort_i$, are also included to control for differences across entering teacher cohorts.

Y_{ist} covers a range of employment-related outcomes. These include indicators for employment location, distinguishing whether a teacher remains in Texas public schools, transitions to private schools, or exits teaching entirely. Additionally, Y_{ist} captures whether a teacher is employed in multiple positions either within or outside of teaching, as well as earnings outcomes. For teachers who remain in Texas public schools, school characteristics are also included as outcomes. Finally, forthcoming analyses will incorporate teacher value-added measures to assess potential effects on instructional effectiveness. The coefficient of interest, β_7, provides the average treatment effect of satisfying the TLFP service requirement based on a teacher's initial placement.

Importantly, the $After5Years_{it}$ variable does not require teachers to remain at the same or even a TLFP-eligible school for five consecutive years, as imposing such a restriction would introduce selection bias.[13] Additionally, because I cannot observe which teachers apply for or receive loan forgiveness, the estimated coefficients reflect the effect of initial placement at a TLFP-eligible school after five years — effectively an intent-to-treat estimate of an intent-to-treat effect. Given known frictions to program participation, such as low awareness and take-up rates (US Department of Education, 2021), these estimates likely represent a lower bound on the effect of receiving loan forgiveness. To account for within-school correlations, standard errors are clustered at the teacher's

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[13]Among teachers with eligible loans who start their careers at a TLFP-eligible school and remain in the profession for at least five years, 88.0% teach at an eligible school for the full five years. In contrast, only 84.9% of teachers without eligible loans remain at an eligible schools during their first five years in the public school system.

initial school.

To evaluate the parallel trends assumption, I provide event studies using Equation (3):

$$Y_{ist} = \beta_0 + \beta_1 TCLI_{is,t=1} + \beta_2 Loans_i + \beta_3 (TCLI_{is,t=1} \times Loans_i) +$$
$$\sum_{j=-4}^{3} \delta_j (D_{ij} \times TCLI_{is,t=1}) + \sum_{j=-4}^{3} \omega_j (D_{ij} \times Loans_i) +$$
$$\sum_{j=-4}^{3} \kappa_j (D_{ij} \times TCLI_{is,t=1} \times Loans_i) +$$
$$\gamma X_{is,t=1} + Cohort_i + \epsilon_{ist} \tag{3}$$

where j indexes years relative to satisfying the five-year service requirement and D_{ij} is an indicator for event time. κ_j are the coefficients of interest, capturing the dynamic effects of loan forgiveness eligibility over time and are plotted in event study graphs to assess the parallel trends assumption.

To examine the earnings patterns of individuals who leave Texas public schools before and after qualifying for loan forgiveness, I extend the DDD framework to a quadruple difference (DDDD) approach by introducing an additional term that identifies when individuals are no longer employed as teachers in Texas public schools. This approach compares earnings from teaching positions in Texas public schools to earnings from non-teaching positions for individuals who exit before satisfying TLFP service requirements and those who exit after satisfying them. By adding this fourth dimension, the DDDD framework isolates the differential effect of loan forgiveness eligibility on outside labor market transitions. Equation (4) outlines the specification used for this analysis:

$$Y_{ist} = \beta_0 + \beta_1 TCLI_{is,t=1} + \beta_2 Loans_i + \beta_3 After5Years_{it} + \beta_4 Left_{it} +$$
$$\beta_5 (TCLI_{is,t=1} \times Loans_i) + \beta_6 (TCLI_{is,t=1} \times After5Years_{it}) +$$
$$\beta_7 (Loans_i \times After5Years_{it}) + \beta_8 (Loans_i \times Left_{it}) +$$
$$\beta_9 (TCLI_{is,t=1} \times Left_{it}) + \beta_{10} (After5Years_{it} \times Left_{it}) +$$
$$\beta_{11} (TCLI_{is,t=1} \times Loans_i \times After5Years_{it}) + \beta_{12} (TCLI_{is,t=1} \times Loans_i \times Left_{it}) +$$
$$\beta_{13} (TCLI_{is,t=1} \times After5Years_{it} \times Left_{it}) + \beta_{14} (Loans_i \times After5Years_{it} \times Left_{it}) +$$
$$\beta_{15} (TCLI_{is,t=1} \times Loans_i \times After5Years_{it} \times Left_{it}) +$$
$$\gamma X_{is,t=1} + Cohort_i + \epsilon_{ist} \tag{4}$$

where $Left_{it}$ is an indicator equal to 1 if teacher i is no longer employed as a teacher in Texas public schools, and β_{15} is the coefficient of interest. I extend Equation 3 in a similar manner to explore pre-trends.

Teachers who leave the profession after qualifying for loan forgiveness may respond to their new financial situation in one of two ways. If they feel financially secure, they might pursue new employment based on non-monetary factors, such as job satisfaction, work-life balance, or personal interests. Conversely, if they still carry significant loan balances and had remained in teaching

primarily for the prospect of forgiveness, they may prioritize higher-paying positions to improve their financial stability. Understanding whether post-forgiveness exits are driven by earnings considerations is critical, as it provides insight into the role of teacher salaries as a factor driving attrition. If teachers leave in pursuit of significantly higher salaries elsewhere, this suggests that loan forgiveness alone may not be sufficient to retain educators in the long term without broader compensation reforms.

The extent to which teachers' decisions to remain in or exit the profession are influenced by financial considerations may also vary by loan balance and forgiveness amount. Teachers with higher debt burdens may be more likely to pursue higher-paying opportunities after qualifying for forgiveness, while those with lower balances may be more financially flexible in their employment choices. To explore this heterogeneity, I create group indicators for loan balance, forgiveness amount, and their interaction.

Loan balances are categorized as follows: <\$10,000, \$10,001-\$20,000, \$20,001-\$40,000, \$40,001-\$60,000, \$60,001-\$90,001, and \$90,001 or more, based on the 10th, 25th, 50th, 75th, and 90th percentiles of student loan balances. For loan forgiveness, teachers are grouped by eligibility for \$5,000 or \$17,500, with the latter further disaggregated by elementary SPED, secondary SPED, secondary science, and secondary mathematics. This breakdown allows for an exploration of whether a teacher's field of study and outside labor market options interact with loan forgiveness. Lastly, for their interaction, I collapse back to either \$5,000 or \$17,500 in loan forgiveness due to small sample sizes and then assign teachers to the above loan groups. Reference groups for these three analyses are teachers with less than \$10,000 in loans, teachers eligible for \$5,000 in forgiveness, and teachers with less than \$10,000 in loans eligible for \$5,000 in forgiveness, respectively. Equation 5 shows the modification to Equation 2 for this analysis:

$$
\begin{aligned}
Y_{ist} = {} & \beta_0 + \beta_1 TCLI_{is,t=1} + \beta_2 Loans_i + \beta_3 After5Years_{it} + \\
& \beta_4 (TCLI_{is,t=1} \times Loans_i) + \beta_5 (TCLI_{is,t=1} \times After5Years_{it}) + \\
& \beta_6 (Loans_i \times After5Years_{it}) + \\
& \beta_7 Group_i + \beta_8 (TCLI_{is,t=1} \times Loans_i \times After5Years_{it} \times Group_i) + \\
& \gamma X_{is,t=1} + Cohort_i + \epsilon_{ist}
\end{aligned}
\tag{5}
$$

where $Group_i$ denotes teacher i's categorization in the group of interest for a given analysis and β_8 is a vector of coefficients providing estimated effects for the reference groups and each other group relative to this estimate. I alter Equation 4 in a similar manner to explore the earnings of those who leave public schools.

6 Results

6.1 Teacher Sorting

Using Equation 1, Table 2 examines teacher sorting into eligible schools at the optimal bandwidth and three surrounding bandwidths. Figures A.2 and A.3 further illustrate average teacher characteristics in 1 pp bins of economically disadvantaged enrollment around the eligibility threshold for the TCLI Directory. Results show no evidence of teachers sorting based on loan balances or forgiveness amounts. Additionally, teachers at barely eligible and ineligible schools do not differ significantly in terms of advanced degrees, certification routes, age, or gender. However, racial composition shifts slightly: the proportion of white teachers increases by 3.4 pp, while the proportion of Hispanic teachers decreases by 3.3 pp as schools cross into eligibility. This shift reflects a broader pattern in the Texas teacher labor market, as white teachers are more likely to work in schools serving higher-income students. Given that nearly 80% of Texas schools are on the TCLI Directory, competition for positions in eligible schools is low, making the absence of sorting by student loan amounts or forgiveness eligibility unsurprising.

Variable	(1) Optimal BW	(2) +/-5	(3) +/-15	(4) +/-20
Eligible Loans	1280	1883	129	-583
	(1187)	(1758)	(999)	(865)
Total Loans	411	829	-317	-768
	(1339)	(1950)	(1137)	(980)
Forgiveness Amount: $17,500	-0.018	0.017	-0.008	-0.024*
	(0.0145)	(0.0215)	(0.0122)	(0.0105)
Proportion with TEACH Grant	-0.003	-0.007	-0.001	0.000
	(0.0049)	(0.0072)	(0.0042)	(0.0037)
Advanced Degree	0.022	0.012	0.015	0.011
	(0.0160)	(0.0236)	(0.0135)	(0.0116)
Traditional Route	0.018	0.016	0.018	0.026*
	(0.0157)	(0.0230)	(0.0131)	(0.0113)
Age	-0.036	-0.207	-0.133	-0.252*
	(0.2056)	(0.2992)	(0.1745)	(0.1510)
White	0.034**	0.061***	0.027*	0.017
	(0.0141)	(0.0209)	(0.0119)	(0.0104)
Black	-0.004	-0.010	-0.006	-0.008
	(0.0079)	(0.0118)	(0.0067)	(0.0059)
Hispanic	-0.033***	-0.051***	-0.026***	-0.012
	(0.0118)	(0.0175)	(0.0100)	(0.0087)
Asian	-0.001	-0.002	-0.002	-0.002
	(0.0041)	(0.0061)	(0.0035)	(0.0030)
Female	0.020	0.007	0.011	0.021*
	(0.0143)	(0.0210)	(0.0119)	(0.0103)
Teachers	14,783	6,836	20,896	28,481

*p<0.10; **p<0.05; ***p<0.01.

Table 2. Teacher Sorting into Eligible Schools

6.2 Employment and Earnings

Table 3 presents estimates from Equation 2 on teacher employment choices. Panel A reports the effect of satisfying the TLFP service requirement on overall employment choices. Meeting the five-year TLFP service requirement leads to a significant 1.7 pp decrease in the likelihood of remaining a teacher in Texas public schools — a 21.4% increase relative to the average exit rate among non-treated teachers after their fifth, sixth, and seventh years. This effect is primarily driven by a 0.7 pp decline in the likelihood of remaining in the Texas workforce. However, there is no significant movement into private schools or complete exit from the teaching profession.

Panel A: Employment Outcomes (All)	
Outcome	**Estimate**
Teacher in Texas Public Schools	-0.017***
	(0.0050)
In Texas Private Schools	0.002
	(0.0024)
In Teaching	0.004
	(0.0036)
In Texas Workforce	-0.007*
	(0.0042)
Teacher-Year Observations[a]	1,087,298

Panel B: School Characteristics (Teachers in Texas Public Schools)	
Outcome	**Estimate**
School Retention	-0.003
	(0.0061)
District Retention	-0.004
	(0.0055)
Eligible School	0.011*
	(0.0066)
% Economically Disadvantaged	-0.008
	(0.2536)
Teacher-Year Observations	979,837

[a]983,361 for "In Teaching" as I cannot rule out an individual not in the Texas workforce is not a teacher in a different state.
*p<0.10; **p<0.05; ***p<0.01.

Table 3. Employment and School Characteristics

The event study in Figure 1 suggests that some of the estimated effect on remaining in Texas public schools stems from an anticipatory effect, with teachers at initially eligible schools staying at slightly higher rates in years two through four, likely in expectation of loan forgiveness. While these estimates are marginally significant and remain below 1 pp, they indicate that some teachers

may delay their exit to qualify for forgiveness. However, retention declines noticeably between years five and six — when teachers satisfy the service requirement — and continues to drop in subsequent years. Figures A.4-A.6 show event studies for the remaining outcomes, indicating a similar anticipatory effect on remaining in the workforce.
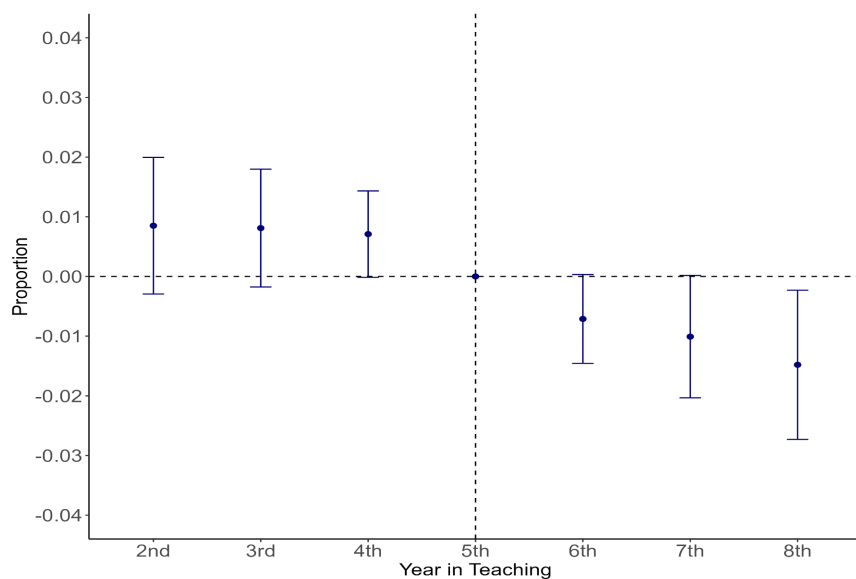

Figure 1. Event Study - Teacher in Texas Public Schools

While the DDD framework helps address concerns about non-parallel trends, it does not fully eliminate behavioral responses to expected loan forgiveness. Rather than limitation of this approach, these anticipatory effects highlight how teachers adjust their employment decisions based on expected financial incentives: retention is temporarily boosted as teachers remain in the public school system to qualify, but afterwards, retention effects fade, leading to an increase in exits. This pattern reinforces the role of loan forgiveness as a short-term retention tool rather than a long-term stability measure.

Panel B of Table 3 presents estimates on school characteristics for teachers who remain in Texas public schools. While estimates on school and district retention are not significant, the event study in Figure 2 shows higher retention rates in early years of teaching, again suggesting strategic employment choices to ensure they satisfy the service requirement. Estimates in the third row indicate that teachers are 1.1 pp (1.5%) more likely to be employed at a school on the TCLI directory, suggesting that they continue working in low-income schools after meeting the service requirement.[14]

The findings in this table indicate that loan forgiveness serves as a short-term retention incentive, encouraging teachers to stay in the public school system and in eligible schools during the five-year period. However, once the financial incentive is removed, retention effects fade, and exits from the profession increase. This pattern highlights the program's limited long-term impact on teacher

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[14]Event studies for this outcome and school % economically disadvantaged are in Figures A.7 and A.8.

workforce stability, suggesting that while it delays attrition, it does not fundamentally alter long-term retention trends. This is in contrast to the TLFP's goal of addressing teacher shortages in low-income schools by incentivizing teachers to remain in the profession, indicating that the program provides a temporary solution that is not an effective long-term strategy for retaining teachers.
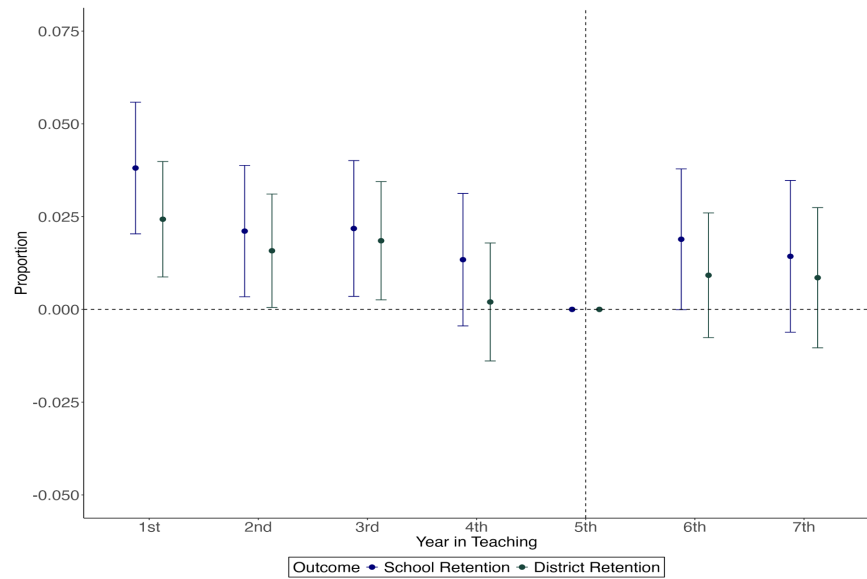

Figure 2. Event Study - Retention

Table 4 examines how earnings change for teachers in Texas public schools and those who leave the public school system after qualifying for loan forgiveness. Panel A presents results for teachers who remain in Texas public schools. While total earnings from outside the public school system remain unchanged, there is a 0.8 pp (10%) increase in the likelihood of having non-zero earnings from outside sources. Similarly, the probability of holding a non-teaching position within Texas public schools alongside a teaching role increases by 0.3 pp, and supplemental earnings rise by $95 (5%).

Panel A: In TXPS		Panel B: Not in TXPS	
Outcome	**Estimate**	**Outcome**	**Estimate**
Outside Earnings	28.81	Change in Earnings	-771.52
	(60.51)		(787.96)
Any Outside Earnings	0.008*	Increase in Earnings	-0.012
	(0.0045)		(0.0187)
Supplemental Pay	94.62**	$10,000+ Increase in Earnings	-0.015
	(42.30)		(0.0141)
Multiple Positions within TXPS	0.003**	$10,000+ Decrease in Earnings	0.021
	(0.0011)		(0.0147)
Teacher-Year Observations	994,069	Teacher-Year Observations	972,028

*p<0.10; **p<0.05; ***p<0.01.

Table 4. Earnings

While qualifying for loan forgiveness may reduce financial concerns for many, some teachers may overestimate its impact, leading them to seek additional employment or earnings upon realizing that forgiveness did not provide as much financial relief as anticipated. For context, using the average student loans for teachers with TLFP-eligible loans as the principal amount and assuming a standard 10-year repayment plan and a 6.8% monthly interest rate,[15] after five years of payments, the average teacher would still owe \$27,316.[16] For the 80.10% of teachers who qualify for \$5,000 in loan forgiveness, this would only cover about 18% of their remaining balance. Thus, many teachers would likely still hold substantial loan burdens, prompting them to pursue additional income sources even after qualifying for loan forgiveness. In contrast, teachers without eligible loans would not have been factoring loan forgiveness into their financial planning, meaning their employment decisions were likely unaffected by expectations of debt relief.

Event study plots of these outcomes provide further support for these findings. Figures 3 and 4 show that the estimated increase in supplemental pay and non-teaching positions are relative to lower levels of these outcomes prior to qualifying for loan forgiveness, suggesting that teachers may have been anticipating the financial relief from loan forgiveness. In contrast, the event study for outside earnings shown in Figure A.9 reveals well-behaved pre-trends and a noticeable jump in earnings during the seventh and eighth years of a teacher's career.[17] These results suggest that, while teachers may have expected loan forgiveness to ease their financial concerns, their continued debt burden led them to pursue outside earnings more actively after satisfying the service requirement.
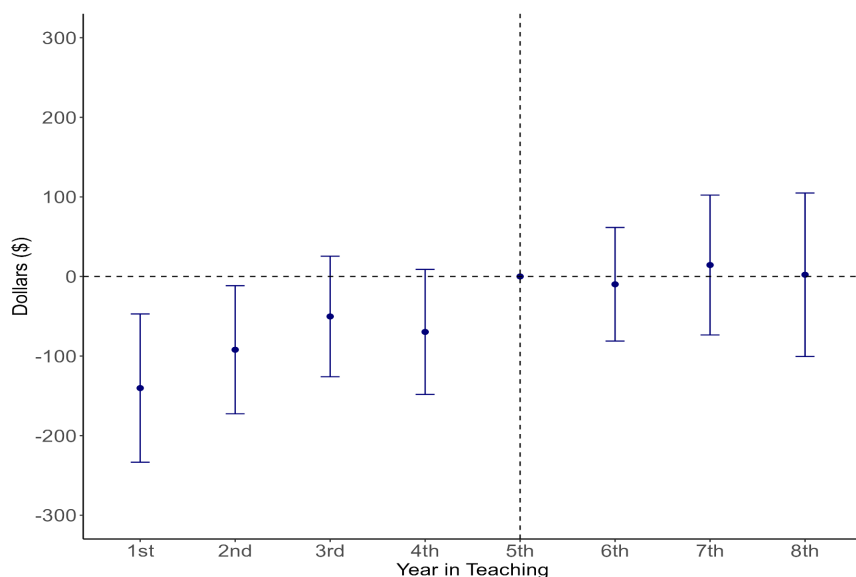

Figure 3. Event Study - Supplemental Pay

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[15]Interest rates for Stafford subsidized and unsubsidized undergraduate loans were fixed at 6.8% between 2006 and 2013, covering the majority of loans and loan origination dates for these teachers.

[16]See Appendix Section A.2 for a detailed breakdown of these calculations.

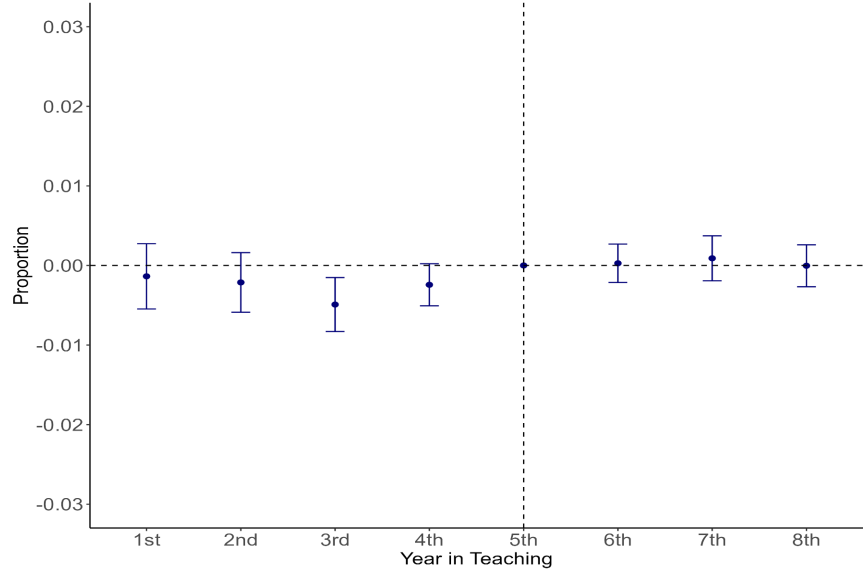[17]See Figure A.10 for the event study for amount of earnings.

Figure 4. Event Study - Multiple Positions within TXPS

Panel B of Table 4 presents estimates from Equation 4. For teachers who exit the public school system, there is no clear movement toward higher- or lower-earning positions for those who leave after five years.[18] Given that teachers exit for both financial and non-financial reasons, this result is not unexpected. However, further analysis, explored in subsequent sections, breaks down these results by teachers with larger loan burdens or those with a wider range of outside options, revealing more nuanced patterns in employment shifts.

6.3 Heterogeneity

6.3.1 Student Loan Balances

Table A.1 explores heterogeneity in employment outcomes by student loan balances using Equation 5. The first column shows estimated effects on remaining a teacher within Texas public schools. For teachers with less than $10,000 in loans — many of whom likely paid off their debts within five years, as a standard repayment schedule would leave at most $5,839 for those who had $9,999 in loans, with many in this group having even lower balances without additional payments prior to loan forgiveness[19] — there is no effect on their choice to remain in the Texas public school system. Given that they stand to benefit the least from loan forgiveness, this result aligns with the notion that the removal of the incentive would also have the least impact.

However, for teachers with higher student loan balances, meeting the service requirement had a substantially larger effect on retention. Compared to teachers with less than $10,000 in loans, those with $40,001-$60,000, $60,001-$90,000, and $90,001+ in loans were 2.0, 3.3, and 7.5 pp less likely to remain in Texas public schools, respectively. Column (2) shows no systematic impact

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[18]Event studies for these outcomes are in Figure A.11-A.14.

[19]See Appendix Section A.2 for general formula used to calculate remaining loan balances.

on the likelihood of transitioning to a private school, regardless of loan balance, while estimated effects for remaining in teaching are up to 1.2 pp smaller than the effect on teachers with less than $10,000 in loans. The final column shows that individuals with less than $10,000 in loans are 1.1 pp less likely to be in the Texas workforce, while those with more than $60,000 in loans are 1.2-2.2 pp more likely to remain in the Texas workforce relative to this group, likely due to their higher outstanding loan balances.

Panel A of Table A.2 presents results on the earnings outcomes of teachers in Texas public schools. Teachers with less than $10,000 in loans are 1.1 pp more likely to have any reported outside earnings after five years and 0.3 pp more likely to hold a non-teaching position alongside their teaching assignment. Given their low debt levels, the reason for this increase in additional employment is unclear — it may reflect personal preferences, labor market conditions, or other unobserved factors rather than financial necessity. With the exception of larger increases in supplemental pay of $99-$125 for teachers in the top two loan balance categories, these results provide little evidence that loan balance size meaningfully influences the earnings effects of satisfying TLFP requirements for teachers remaining in Texas public schools.

Panel B of Table A.2 presents results on the earnings outcomes of former teachers who leave Texas public schools. Column (1) shows that teachers with less than $10,000 in loans experience an average decrease of $3,727 in annual earnings after leaving Texas public schools after the five-year service requirement. In other words, teachers who remain in the system long enough to qualify for loan forgiveness but then exit tend to transition into lower-paying jobs or positions with smaller earnings gains compared to their previous salaries as public school teachers. Given their smaller or zero loan balances, these teachers may have prioritized non-financial factors in their job search, such as job satisfaction, location, or work-life balance, rather than maximizing earnings.

By contrast, the remaining rows of column (1) indicate that earnings losses become less negative — or even turn positive — for teachers with higher loan balances. For instance, teachers with more than $90,000 in student loans earn $6,082 more each year on average than those with less than $10,000, suggesting that larger outstanding debt influences post-exit employment choices. These teachers may have actively sought higher-paying jobs due to ongoing loan repayment obligations, reinforcing the idea that loan forgiveness temporarily retained them in public schools, but financial pressures shaped their long-term career trajectories. The remaining columns of Panel B align with the first column's results — teachers with the lowest loan balances are less likely to move into higher-paying jobs and more likely to transition into lower-paying positions, while these effects diminish as loan balances increase.

These results suggest that while loan forgiveness temporarily retains teachers, it does not necessarily contribute to long-term retention in public education — particularly for those with the highest loan balances. The positive relationship between loan balances and post-exit earnings suggests that continued financial pressures are a key driver of teacher attrition. This finding is relevant to recent policy discussions on increasing forgiveness amounts: while higher forgiveness levels could reduce financial strain and extend retention, it remains unclear whether they would fundamentally

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alter long-term employment decisions.

6.3.2 Loan Forgiveness Amount Eligibility

Column (1) of Table A.3 presents employment outcomes by the amount of loan forgiveness for which a teacher qualifies, using teachers eligible for $5,000 as the reference group. Given that 80% of eligible teachers fall into this category, the 1.2 pp decrease in their likelihood of remaining a teacher in Texas public schools closely aligns with the overall estimates presented in Table 3. However, retention effects are more pronounced for teachers eligible for $17,500 in loan forgiveness. Elementary and secondary SPED teachers are 3.2 and 4.5 pp, respectively, less likely to remain in the Texas public school system than teachers eligible for $5,000 in forgiveness. The effects are somewhat smaller for secondary math and science teachers at 2.3 and 1.6 pp, respectively.

Notably, column (3) highlights that both science/math and SPED teachers are significantly more likely to exit teaching than those eligible for $5,000 in forgiveness. This is particularly concerning given that these subject areas receive the highest loan forgiveness amounts specifically due to persistent teacher shortages. Despite the additional incentive, teachers in these fields continue to leave at higher rates.

While the attrition of math and science teachers may be explained by their greater outside earnings potential, the high exit rates among SPED teachers are equally troubling but likely driven by different factors. Unlike STEM teachers, SPED teachers do not have the same breadth of outside job opportunities, meaning their exits could additionally reflect job-specific challenges such as burnout, high caseloads, lack of support, or difficult working conditions. This raises important policy questions about whether loan forgiveness alone is sufficient to address teacher shortages in these critical fields, or if broader efforts are needed to improve long-term retention.

Columns (1) and (2) of Panel A in Table A.4 show that satisfying the TLFP service requirement has little impact on the outside earnings of those remaining in the public school system, regardless of forgiveness amount eligibility and subject. However, Column (3) indicates that qualifying for loan forgiveness increases supplemental pay by a marginally significant $82 for teachers eligible for $5,000 in forgiveness, with effects for secondary mathematics teachers $123 larger. This pattern may again reflect the expected financial relief of loan forgiveness not fully materializing, prompting some teachers to seek additional income through supplemental pay, though the mechanism driving the increases in these two groups is unclear.

Panel B of Table A.4 highlights how a teacher's outside options shape their post-exit earnings. While there is no significant impact for teachers eligible for $5,000 in loan forgiveness, teachers in secondary math and science — who qualified for $12,500 more in forgiveness — experience significantly larger post-exit earnings gains. Compared to teachers in the $5,000 group, they earn $920–$1,953 more per year on average, are 2.6–2.7 pp more likely to transition to a higher-paying position, and are 3.3–4.8 pp more likely to see their earnings increase by at least $10,000.

Notably, secondary SPED teachers also experience significantly larger post-exit earnings increases, suggesting that financial pressures, rather than just working conditions, contribute to their

attrition. While math and science teachers may leave for higher-paying jobs outside of education, SPED teachers have more limited options and may instead transition into better-paying roles within education.[20] This pattern suggests that, despite receiving the highest loan forgiveness amounts, both STEM and secondary SPED teachers are financially responsive to outside opportunities, reinforcing the idea that forgiveness alone is not enough to ensure retention.

6.3.3 Student Loan Balances and Loan Forgiveness Amount Eligibility

Table A.5 explores how employment outcomes vary by the intersection of loan balances and loan forgiveness eligibility amounts. Column (1) shows no significant impact of qualifying for loan forgiveness on the reference group — teachers with less than $10,000 in loans eligible for $5,000 in forgiveness. However, for nearly all other teachers, qualifying for forgiveness significantly reduces the likelihood of remaining a teacher in Texas public schools.

The magnitude of this effect increases with both loan balance and forgiveness amount. The largest effects are observed for teachers with more than $90,000 in loans, who are 7.7 to 8.8 pp less likely to remain in Texas public schools compared to the reference group. Within each loan balance category, teachers eligible for $17,500 in forgiveness experience 1-3 pp larger declines in retention than those eligible for $5,000. This again reflects the differences in outside labor market opportunities discussed in the previous section.

Moreover, while teachers with the lowest loan balances and $5,000 forgiveness eligibility are 1.2 pp more likely to remain in teaching, this effect disappears and even becomes negative for teachers with higher debt levels. The magnitude of the negative effect grows with loan balance, reaching up to 3.3 pp for teachers with the highest debt levels. Within each loan group, effects are approximately 2 pp larger in magnitude for teachers eligible for $17,500 in loan forgiveness.

The likelihood of remaining in the workforce expectedly grows as debt levels increase, but differences by forgiveness amount within each loan group are negligible. This is unsurprising, as most teachers with loan balances must continue working regardless of whether they receive $5,000 or $17,500 in forgiveness. While higher forgiveness amounts reduce financial strain, they do not eliminate the need for continued earnings. Thus, the primary effect of loan forgiveness appears to influence whether teachers stay in public schools rather than whether they remain employed.

Panel A of Table A.6 shows little evidence that qualifying for loan forgiveness significantly affects the earnings of teachers who remain in Texas public schools. The only exception is for teachers with more than $90,000 in loans eligible for $17,500 in forgiveness, who experience a $217 larger increase in outside earnings and are 2.3 pp more likely to have non-teaching income compared to those with less than $10,000 in loans eligible for $5,000 in forgiveness. Beyond this, estimates on earnings for teachers who remain in public schools are generally small and not statistically significant.

In contrast, earnings estimates for teachers who leave the profession follow the same patterns observed in Tables A.2 and A.4: teachers with low loan balances experience little to no earnings gains, while teachers with higher loan balances see significantly larger earnings increases — up

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[20]Future iterations of this paper will explore employment sector in addition to earnings.

to nearly $3,000. Moreover, teachers with similar loan balances who qualify for $17,500 in loan forgiveness consistently transition to higher-paying jobs at greater rates than those eligible for only $5,000 — estimates are generally $1,000–$2,000 higher. Additionally, teachers in this group are more likely to experience a $10,000+ increase in earnings and less likely to see a large earnings decline, reinforcing the role of financial incentives in exit decisions.

7 Conclusion

The results of this study indicate that while the TLFP serves as a short-term retention incentive, it does not meaningfully impact long-term employment patterns for teachers. Educators remain in public schools to fulfill the five-year service requirement, yet a significant increase in exits occurs once they qualify for loan forgiveness. This effect is particularly pronounced among teachers with high student loan balances, suggesting that the current structure of the TLFP falls short in addressing their financial constraints. Rather than fostering sustained retention, the program may delay attrition rather than prevent it, highlighting the need for more comprehensive policies that go beyond one-time financial relief to support teachers' long-term career stability in public education.

These findings raise several important policy considerations. While increasing loan forgiveness amounts could extend retention by alleviating financial concerns, this alone is unlikely to prevent long-term attrition unless paired with broader workforce improvements. For example, targeted salary increases, structured career advancement pathways, and improved working conditions may offer more sustainable solutions. The challenge is particularly pressing for teachers in high-need fields — special education and secondary math and science — who have the highest exit rates despite qualifying for the largest loan forgiveness amount. This suggests that financial incentives alone — regardless of amount — may be insufficient to retain educators in these critical subject areas.

Earnings patterns further underscore the role of financial considerations in teachers' employment decisions. Teachers who remain in public schools after qualifying for forgiveness often take on additional work, indicating that loan forgiveness does not fully alleviate financial pressures. Meanwhile, those who exit are more likely to transition into higher-paying jobs, particularly in STEM fields where outside opportunities are more lucrative. These results highlight the need for competitive salaries in retention efforts — without addressing underlying pay disparities, loan forgiveness can only be a temporary stopgap. Future policy interventions should take a comprehensive approach, combining financial incentives with structural reforms that enhance job stability, professional satisfaction, and compensation, particularly in subject areas most vulnerable to shortages.

Future research should evaluate the wide array of incentive structures used to attract and retain teachers, as most remain understudied — particularly beyond their initial payout windows. Programs that offer incremental loan forgiveness over a longer period, rather than a lump sum after five years, may have different effects on retention, yet little is known about their long-term impact. Similarly, the TEACH Grant, which converts to a loan if service requirements are not met, has

not been rigorously examined in terms of its influence on teacher career trajectories. State-level fellowship programs, retention bonuses, and salary-based interventions also vary widely in design, but no clear evidence exists on which structures are most effective in sustaining a stable workforce. Without comparative research on both short- and long-term effects, policymakers are left designing programs without clear evidence to guide their decisions, unsure of which incentives best promote teacher retention. Future studies should prioritize evaluating these different models to identify the most effective strategies for supporting educators throughout their careers.

Another important avenue for future research is evaluating impacts on teacher quality. Understanding whether financial incentives affect not just retention but also the effectiveness of teachers in the classroom is critical for assessing the overall benefits of these programs. Additionally, examining the quality of teachers who leave the profession is essential — if loan forgiveness not only increases exit rates but also leads to the departure of high-performing teachers, this could have unintended negative consequences. Future analyses will incorporate measures of teacher quality to provide a more comprehensive evaluation of the TLFP.

A key limitation of this study — and most research in this field — is the lack of direct data on program participation. While this paper improves upon previous work by refining eligibility criteria, take-up rates for loan forgiveness programs remain low, meaning many eligible teachers never actually receive forgiveness. Accurately estimating program impacts — instead of program eligibility impacts — requires linking loan forgiveness receipt to teacher outcomes. Given the billions of dollars of public investment in these programs, policymakers and taxpayers deserve to know whether these funds are effective in achieving their intended goals. Additionally, while this study focuses on Texas, replication in other states with varying teacher labor market conditions would enhance external validity and provide insight into how regional policy differences influence retention patterns.

Ultimately, these findings suggest that while loan forgiveness can be an effective tool for short-term retention, it must be part of a broader strategy that accounts for teachers' long-term financial and career considerations. Without complementary policies to improve working conditions and compensation structures, loan forgiveness alone may do little more than delay attrition, rather than resolve persistent teacher shortages in high-need schools and subject areas.

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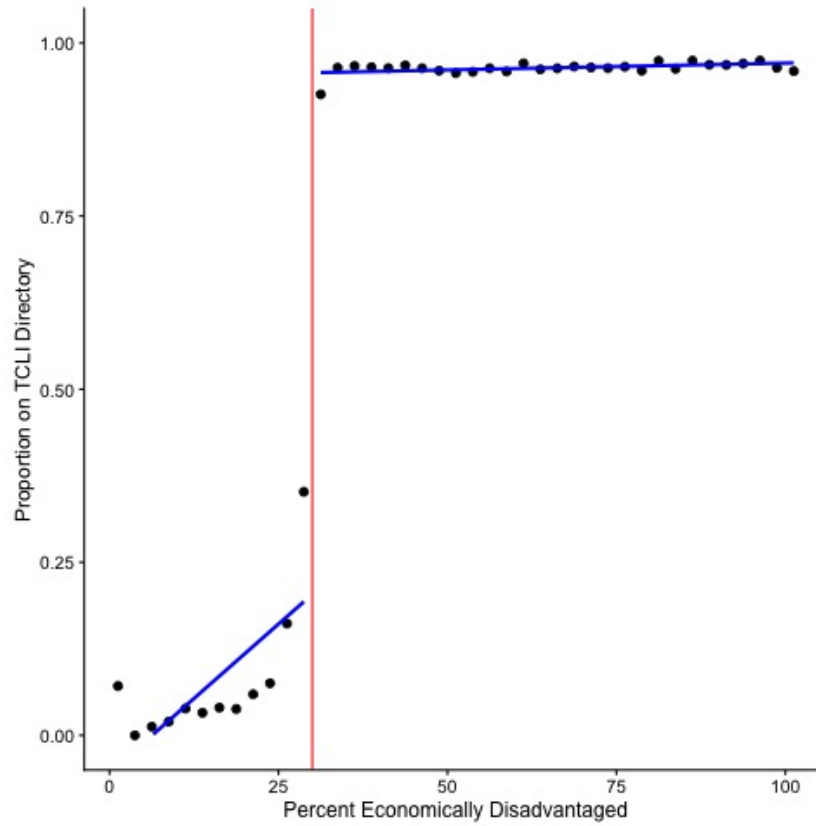
A   Appendix

A.1   Figures and Tables
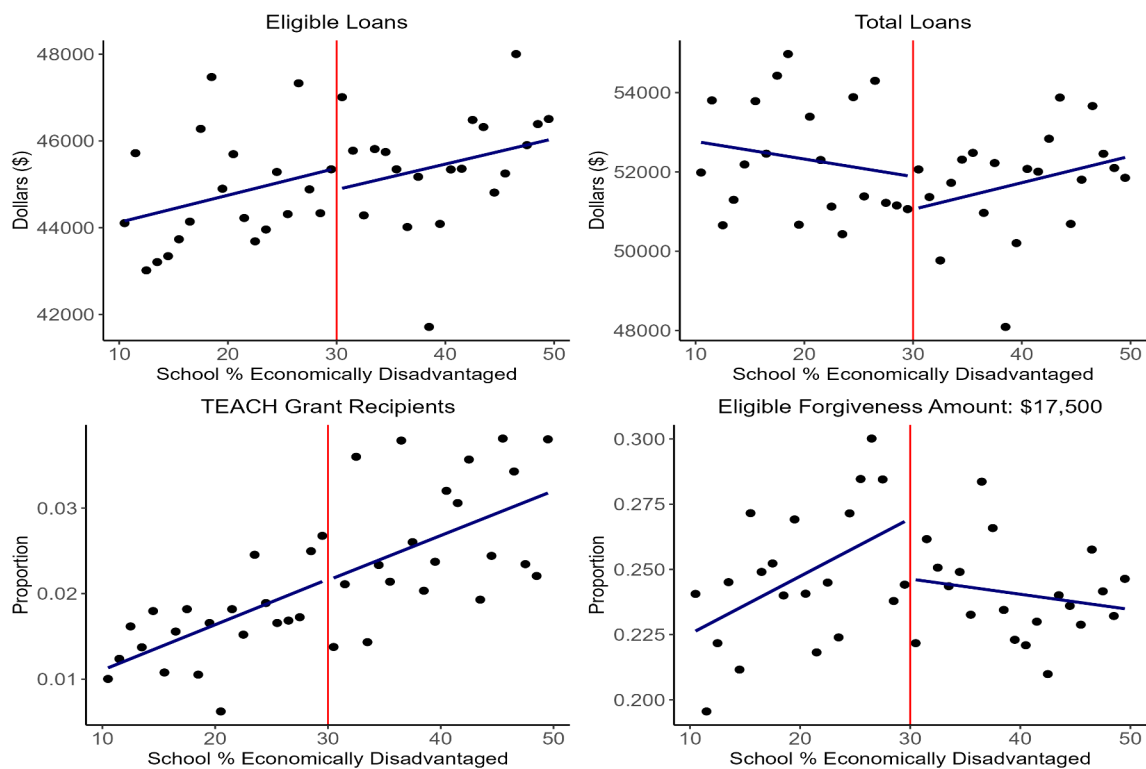

Figure A.1. First Stage.

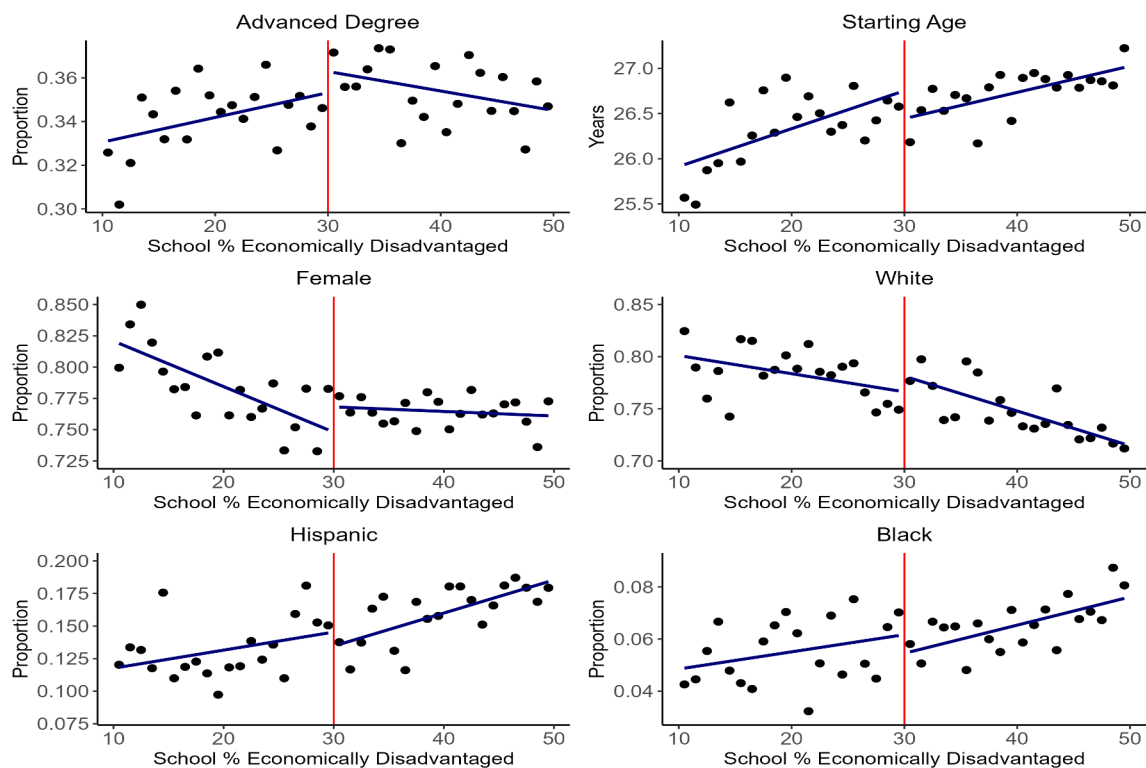**Figure A.2.** RD Sorting Plots — Aid and Forgiveness.

Figure A.3. RD Sorting Plots — Teacher Demographics.
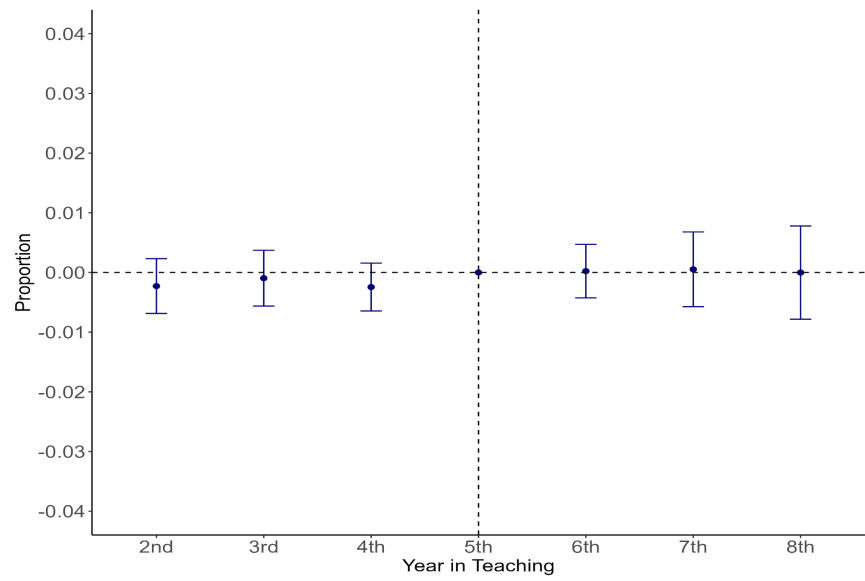
Figure A.4. Event Study - In Texas Private Schools
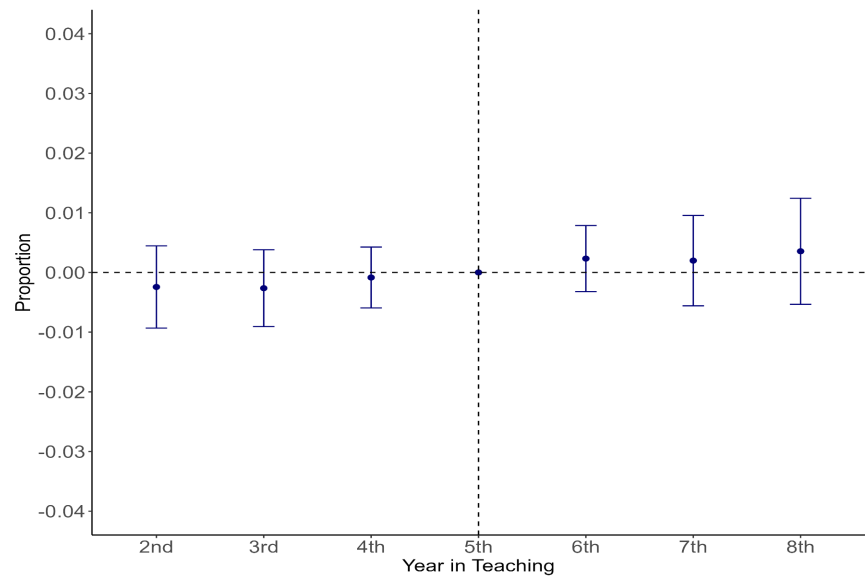
Figure A.5. Event Study - In Teaching
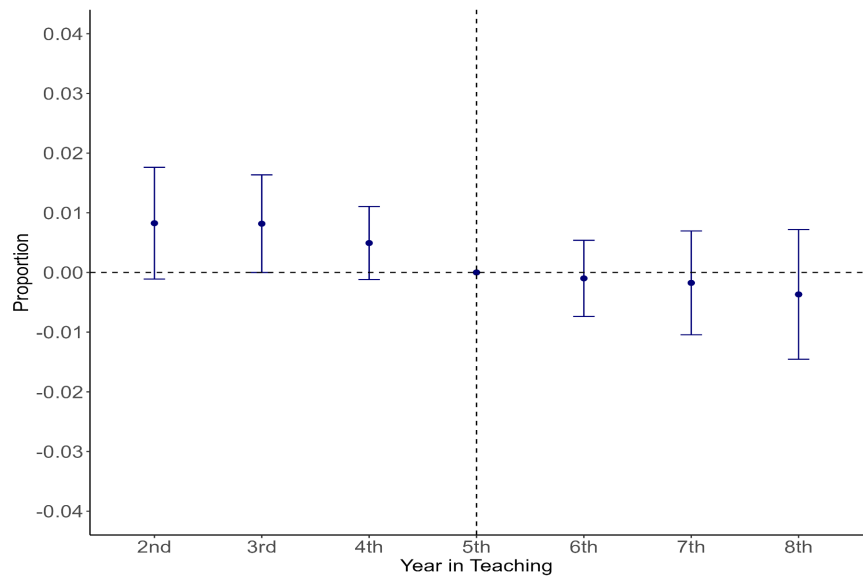
Figure A.6. Event Study - In Texas Workforce
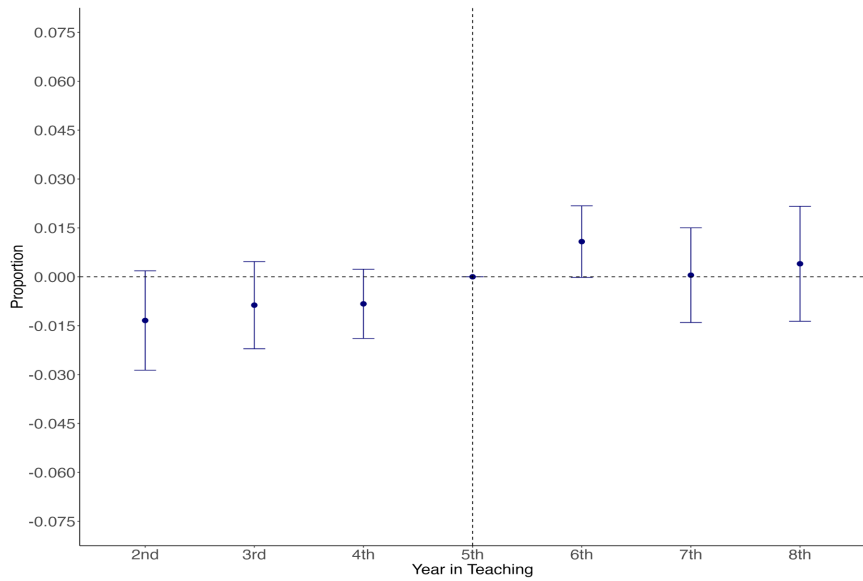
Figure A.7. Event Study - On TCLI Directory

Figure A.8. Event Study - School Percentage Economically Disadvantaged

Figure A.9. Event Study - Any Outside Earnings
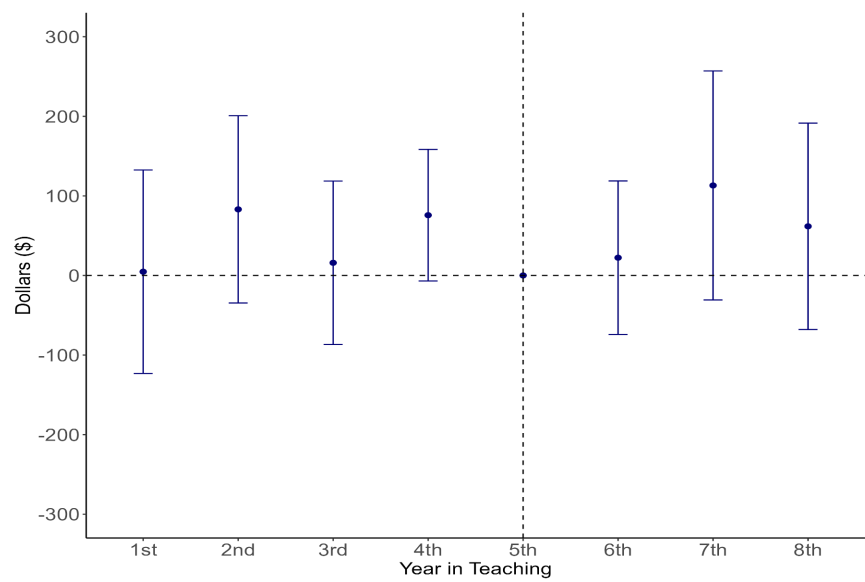
Figure A.10. Event Study - Outside Earnings
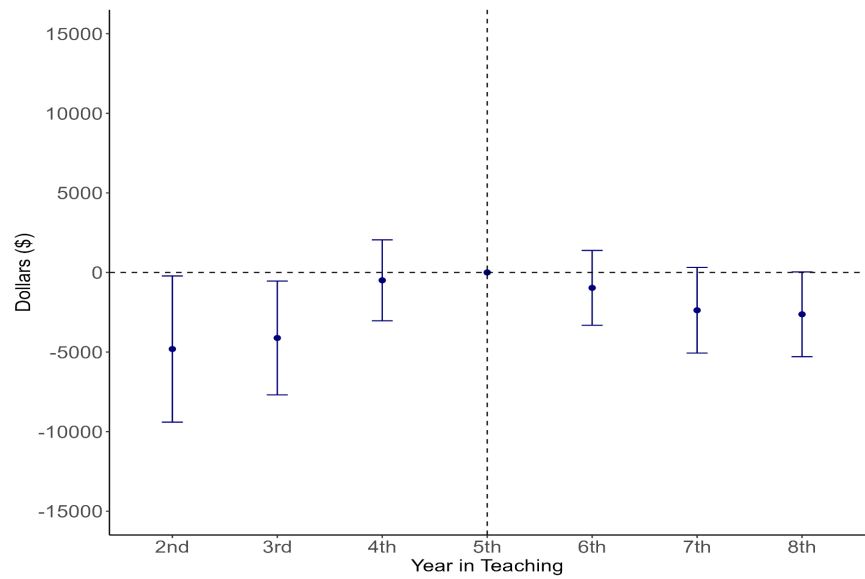
Figure A.11. Event Study - Change in Earnings
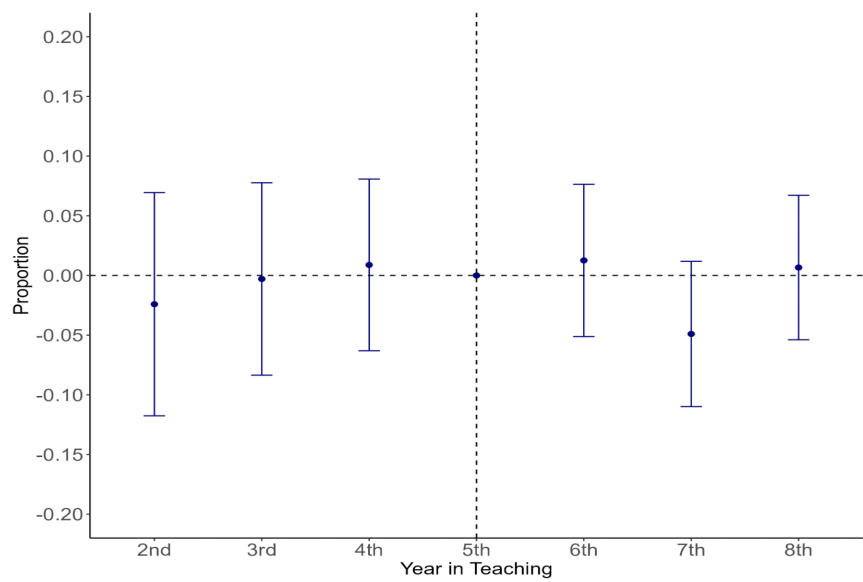
Figure A.12. Event Study - Increase in Earnings
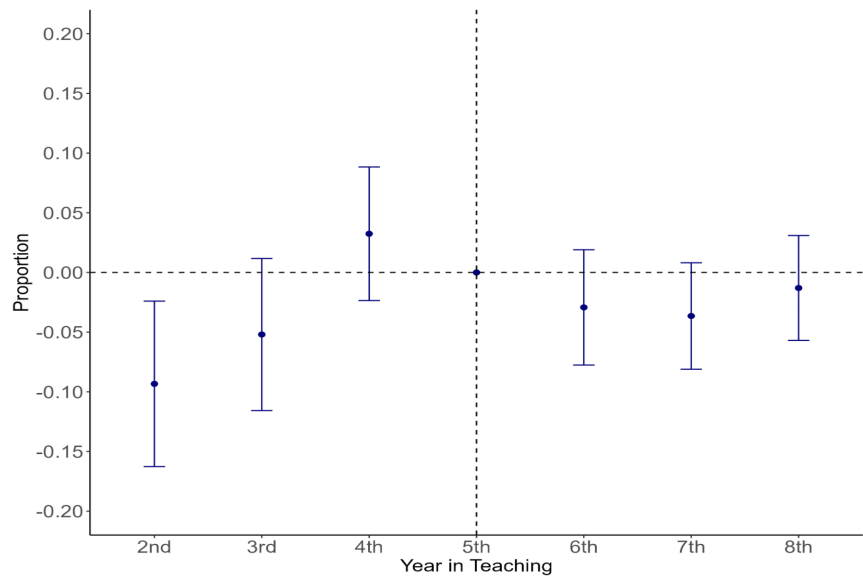
Figure A.13. Event Study - $10,000+ Increase in Earnings
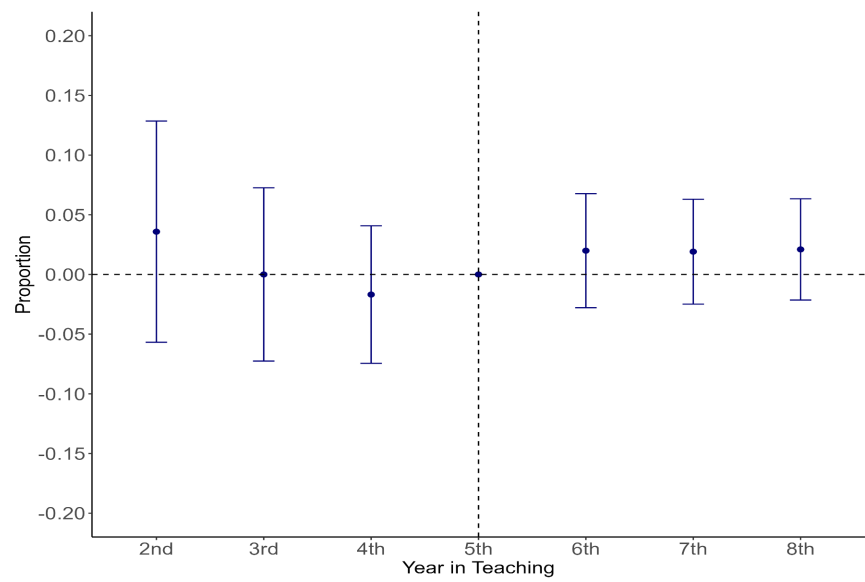
Figure A.14. Event Study - $10,000+ Decrease in Earnings

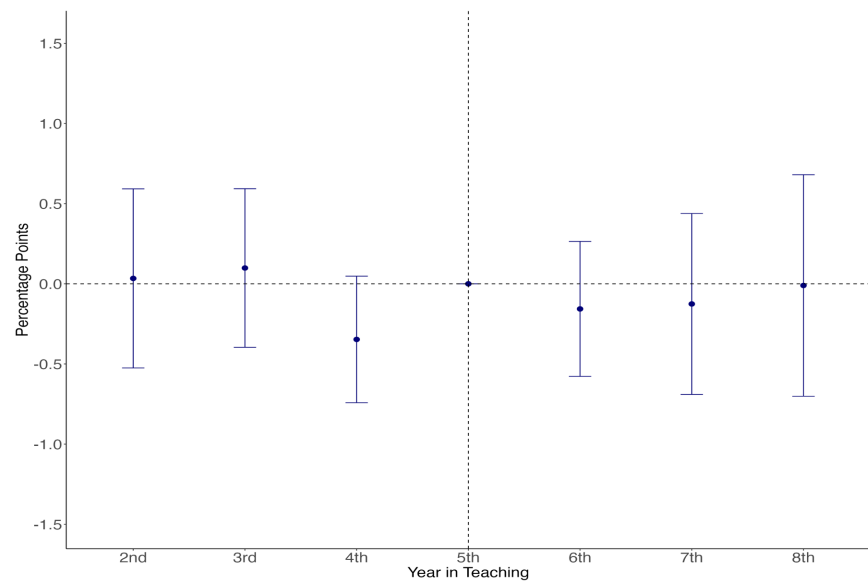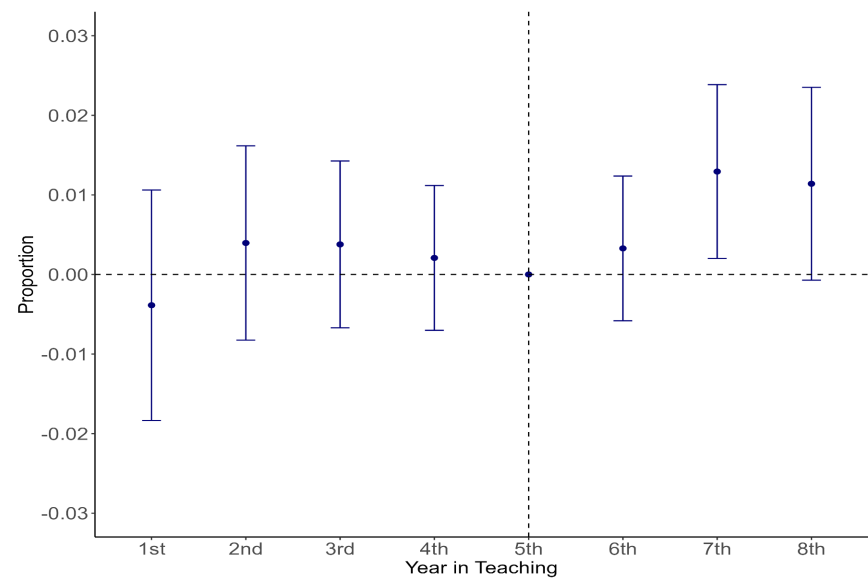| Eligible Loan Group	(1) Teacher in Texas Public Schools	(2) In Texas Private Schools	(3) In Teaching	(4) In Texas Workforce
Reference: <$10,000	0.004	0.002	0.011**	-0.011**
	(0.0064)	(0.0031)	(0.0042)	(0.0051)
$10,001-$20,000	-0.003	-0.004	-0.004	-0.003
	(0.0055)	(0.0025)	(0.0029)	(0.0042)
$20,001-$40,000	-0.009*	-0.002	-0.005**	-0.003
	(0.0048)	(0.0023)	(0.0026)	(0.0036)
$40,001-$60,000	-0.020***	0.000	-0.008***	0.003
	(0.0051)	(0.0024)	(0.0028)	(0.0038)
$60,001-$90,000	-0.033***	0.003	-0.009***	0.012***
	(0.0054)	(0.0026)	(0.0029)	(0.0038)
$90,001+	-0.075***	0.005*	-0.012***	0.022***
	(0.0058)	(0.0028)	(0.0033)	(0.0041)
Teacher-Year Observations	1,087,298	1,087,298	983,861	1,087,298

*p<0.10; **p<0.05; ***p<0.01.

Table A.1. Employment Heterogeneity - Loan Balance

Panel A: In TXPS				
Eligible Loan	**(1)**	**(2)**	**(3)**	**(4)**
				Multiple
	Outside	**Any Outside**	**Supplemental**	**Positions**
Group	**Earnings**	**Earnings**	**Pay**	**within**
				TXPS
Reference: <$10,000	75.52	0.011**	43.73	0.003**
	(71.92)	(0.0053)	(51.83)	(0.0014)
$10,001-$20,000	-108.20**	-0.005	-7.03	-0.002*
	(52.10)	(0.0038)	(43.18)	(0.0010)
$20,001-$40,000	-64.74	-0.006*	40.49	0.000
	(48.83)	(0.0034)	(38.28)	(0.0009)
$40,001-$60,000	-18.36	-0.007**	47.88	-0.001
	(51.55)	(0.0036)	(39.76)	(0.0010)
$60,001-$90,000	-68.04	-0.002	125.10***	0.000
	(54.15)	(0.0039)	(41.79)	(0.0010)
$90,001+	44.55	0.009*	99.46**	-0.001
	(63.96)	(0.0046)	(46.28)	(0.0010)
N	995,753	995,753	995,753	995,753

Panel B: Not in TXPS				
Eligible Loan	**(1)**	**(2)**	**(3)**	**(4)**
	Change in	**Increase in**	**$10,000+**	**$10,000+**
Group	**Earnings**	**Earnings**	**Increase**	**Decrease**
			in Earnings	**in Earnings**
Reference: <$10,000	-3727.30***	-0.039*	-0.031**	0.028*
	(1272.16)	(0.0201)	(0.0151)	(0.0155)
$10,001-$20,000	1510.79**	0.022**	0.015**	-0.004
	(743.97)	(0.0097)	(0.0072)	(0.0065)
$20,001-$40,000	1965.61***	0.025***	0.014**	-0.002
	(658.81)	(0.0085)	(0.0064)	(0.0058)
$40,001-$60,000	2344.30***	0.022**	0.014**	-0.001
	(667.46)	(0.0088)	(0.0067)	(0.0060)
$60,001-$90,000	4552.18***	0.038***	0.021***	-0.019***
	(697.40)	(0.0090)	(0.0068)	(0.0059)
$90,001+	6082.36***	0.040***	0.019***	-0.019***
	(845.00)	(0.0091)	(0.0069)	(0.0061)
N	971,986	971,986	971,986	971,986

*p<0.10; **p<0.05; ***p<0.01.

Table A.2. Earnings Heterogeneity - Loan Balance

Forgiveness Amount	(1) Teacher in Texas Public Schools	(2) In Texas Private Schools	(3) In Teaching	(4) In Texas Workforce
Group				
Reference: $5,000	-0.012**	0.002	0.008**	-0.008*
	(0.0051)	(0.0024)	(0.0036)	(0.0042)
$17,500, Elementary SPED	-0.032***	0.002	-0.005	0.007
	(0.0085)	(0.0040)	(0.0044)	(0.0061)
$17,500, Secondary SPED	-0.045***	0.010*	-0.009	0.002
	(0.0111)	(0.0059)	(0.0058)	(0.0072)
$17,500, Secondary Science	-0.023***	-0.007***	-0.026***	-0.001
	(0.0059)	(0.0025)	(0.0041)	(0.0043)
$17,500, Secondary Mathematics	-0.016***	-0.003	-0.020***	0.003
	(0.0050)	(0.0022)	(0.0032)	(0.0036)
N	1,087,298	1,087,298	983,861	1,087,298

*p<0.10; **p<0.05; ***p<0.01.

Table A.3. Employment Heterogeneity - Forgiveness Amount

Panel A: In TXPS				
Forgiveness Amount	(1) Outside Earnings	(2) Any Outside Earnings	(3) Supplemental Pay	(4) Multiple Positions within TXPS
Group				
Reference: $5,000	17.27	0.007	81.85*	0.003**
	(60.83)	(0.0045)	(42.35)	(0.0011)
$17,500, Elementary SPED	145.93	0.001	-39.78	0.003***
	(98.42)	(0.0057)	(40.86)	(0.0007)
$17,500, Secondary SPED	103.80	0.018**	157.90	-0.005***
	(86.49)	(0.0088)	(116.72)	(0.0016)
$17,500, Secondary Science	43.10	0.007	32.39	-0.001
	(56.54)	(0.0042)	(60.11)	(0.0007)
$17,500, Secondary Mathematics	39.72	0.002	122.56**	-0.001
	(45.07)	(0.0036)	(48.47)	(0.0006)
N	995,753	995,753	995,753	995,753
Panel B: Not in TXPS				
Forgiveness Amount	(1) Change in Earnings	(2) Increase in Earnings	(3) $10,000+ Increase in Earnings	(4) $10,000+ Decrease in Earnings
Group				
Reference: $5,000	-1026.64	-0.018	-0.021	0.024*
	(791.94)	(0.0187)	(0.0142)	(0.0148)
$17,500, Elementary SPED	-154.63	0.016	-0.002	-0.011
	(355.63)	(0.0124)	(0.0086)	(0.0072)
$17,500, Secondary SPED	1380.47***	0.028*	0.017	-0.019**
	(509.05)	(0.0148)	(0.0118)	(0.0089)
$17,500, Secondary Science	1953.76***	0.027***	0.048***	-0.011**
	(337.66)	(0.0076)	(0.0069)	(0.0053)
$17,500, Secondary Mathematics	920.75***	0.026***	0.033***	0.001
	(263.55)	(0.0068)	(0.0056)	(0.0047)
N	971,986	971,986	971,986	971,986

*p<0.10; **p<0.05; ***p<0.01.

Table A.4. Earnings Heterogeneity - Forgiveness Amount

Loan and Forgiveness Amount Group	(1) Teacher in Texas Public Schools	(2) In Texas Private Schools	(3) In Teaching	(4) In Texas Workforce
Reference: <$10,000 & $5,000	0.008	0.002	0.012***	-0.012**
	(0.0067)	(0.0032)	(0.0043)	(0.0054)
<$10,000 & $17,500	-0.024**	0.000	-0.011	0.005
	(0.0122)	(0.0054)	(0.0076)	(0.0090)
$10,001-$20,000 & $5,000	-0.002	-0.004	-0.001	-0.004
	(0.0059)	(0.0028)	(0.0031)	(0.0046)
$10,001-$20,000 & $17,500	-0.031***	-0.002	-0.026***	0.002
	(0.0095)	(0.0044)	(0.0058)	(0.0072)
$20,001-$40,000 & $5,000	-0.011**	-0.001	-0.004	-0.003
	(0.0053)	(0.0025)	(0.0028)	(0.0040)
$20,001-$40,000 & $17,500	-0.023***	-0.004	-0.020***	0.004
	(0.0073)	(0.0034)	(0.0043)	(0.0055)
$40,001-$60,000 & $5,000	-0.020***	0.001	-0.006**	0.003
	(0.0056)	(0.0027)	(0.0030)	(0.0042)
$40,001-$60,000 & $17,500	-0.041***	-0.002	-0.026***	0.007
	(0.0081)	(0.0038)	(0.0050)	(0.0058)
$60,001-$90,000 & $5,000	-0.032***	0.004	-0.005	0.013***
	(0.0059)	(0.0029)	(0.0032)	(0.0043)
$60,001-$90,000 & $17,500	-0.061***	-0.003	-0.033***	0.012**
	(0.0087)	(0.0041)	(0.0052)	(0.0060)
$90,001+ & $5,000	-0.077***	0.006*	-0.009***	0.023***
	(0.0064)	(0.0031)	(0.0035)	(0.0046)
$90,001+ & $17,500	-0.088***	0.000	-0.031***	0.020***
	(0.0094)	(0.0045)	(0.0062)	(0.0064)
N	1,087,298	1,087,298	983,861	1,087,298

*p<0.10; **p<0.05; ***p<0.01.

Table A.5. Employment Heterogeneity - Loan Balance and Forgiveness Amount

Panel A: In TXPS				
Loan and Forgiveness Amount Group	**(1)** Outside Earnings	**(2)** Any Outside Earnings	**(3)** Supplemental Pay	**(4)** Multiple Positions within TXPS
Reference: <$10,000 & $5,000	42.98	0.010*	41.10	0.004**
	(72.55)	(0.0054)	(53.60)	(0.0014)
<$10,000 & $17,500	195.12	0.008	12.85	-0.003**
	(140.81)	(0.0086)	(117.83)	(0.0012)
$10,001-$20,000 & $5,000	-85.44	-0.006	-29.00	-0.002*
	(55.36)	(0.0041)	(46.38)	(0.0011)
$10,001-$20,000 & $17,500	-35.57	0.004	119.02	-0.003*
	(76.63)	(0.0067)	(85.82)	(0.0017)
$20,001-$40,000 & $5,000	-41.72	-0.006*	19.68	0.000
	(50.79)	(0.0036)	(42.26)	(0.0010)
$20,001-$40,000 & $17,500	13.70	0.00	148.52**	-0.001
	(70.10)	(0.0053)	(61.50)	(0.0012)
$40,001-$60,000 & $5,000	11.37	-0.007*	43.75	-0.001
	(54.74)	(0.0039)	(43.25)	(0.0011)
$40,001-$60,000 & $17,500	27.84	-0.002	83.09	0.000
	(75.67)	(0.0058)	(70.05)	(0.0014)
$60,001-$90,000 & $5,000	-32.85	0.000	135.93***	-0.001
	(58.25)	(0.0042)	(45.55)	(0.0011)
$60,001-$90,000 & $17,500	-45.02	-0.004	89.18	0.000
	(78.36)	(0.0065)	(73.96)	(0.0013)
$90,001+ & $5,000	35.60	0.007	110.82**	-0.002
	(69.46)	(0.0051)	(50.85)	(0.0012)
$90,001+ & $17,500	232.09**	0.023***	73.21	-0.002
	(115.88)	(0.0083)	(79.65)	(0.0015)
N	995,753	995,753	995,753	995,753

Panel B: Not in TXPS				
Loan and Forgiveness Amount Group	**(1)** Change in Earnings	**(2)** Increase in Earnings	**(3)** $10,000+ Increase in Earnings	**(4)** $10,000+ Decrease in Earnings
Reference: <$10,000 & $5,000	-1973.38**	-0.038*	-0.029*	0.035**
	(825.09)	(0.0204)	(0.0154)	(0.0158)
<$10,000 & $17,500	857.24	-0.007	0.007	-0.017
	(613.23)	(0.0184)	(0.0133)	(0.0114)
$10,001-$20,000 & $5,000	446.76	0.015	0.010	-0.003
	(356.31)	(0.0107)	(0.0079)	(0.0075)
$10,001-$20,000 & $17,500	2039.16***	0.041**	0.040***	-0.023**
	(525.81)	(0.0165)	(0.0127)	(0.0100)
$20,001-$40,000 & $5,000	532.25*	0.019**	0.007	-0.004
	(318.51)	(0.0094)	(0.0072)	(0.0065)
$20,001-$40,000 & $17,500	1862.25***	0.042***	0.046***	-0.012
	(412.76)	(0.0117)	(0.0094)	(0.0081)
$40,001-$60,000 & $5,000	413.17	0.009	0.008	-0.005
	(340.39)	(0.009)	(0.0075)	(0.0068)
$40,001-$60,000 & $17,500	1927.76***	0.063***	0.039***	-0.005
	(440.39)	(0.0123)	(0.0103)	(0.0088)
$60,001-$90,000 & $5,000	1660.48***	0.030***	0.013*	-0.023***
	(350.74)	(0.0100)	(0.0076)	(0.0068)
$60,001-$90,000 & $17,500	2229.88***	0.058***	0.050***	-0.022**
	(443.61)	(0.0130)	(0.0104)	(0.0087)
$90,001+ & $5,000	2174.41***	0.033***	0.010	-0.022***
	(783.40)	(0.0102)	(0.0078)	(0.0069)
$90,001+ & $17,500	2978.76***	0.054***	0.036***	-0.031***
	(463.60)	(0.0136)	(0.0109)	(0.0090)
N	971,986	971,986	971,986	971,986

*p<0.10; **p<0.05; ***p<0.01.

Table A.6. Earnings Heterogeneity - Loan Balance and Forgiveness Amount

A.2 Remaining Loan Balance

To calculate remaining loan balance after five years of payments, I use a principal equal to the average loan balance of teachers with TLFP-eligible loans, as shown in Panel B of Table 1. I use the interest rate for Stafford subsidized and unsubsidized undergraduate loans that was fixed at 6.8% from 2006-2013 and assume a standard 10-year repayment term. I then calculate monthly payments using the standard loan payment formula below:

$$M = \frac{P * r}{1 - (1 + r)^{-n}} \tag{6}$$

where M is the monthly payment, P is the principal, r is the monthly interest rate, and n is the loan term in months. This becomes:

$$M = \frac{46757 * (0.068/12)}{1 - (1 + 0.068/12)^{-120}} = \$537.91$$

I then calculate the remaining loan balance after five years of payments, assuming no prepayment or missed payments, as shown below:

$$Balance = P * (1 + r)^t - M * \frac{(1 + r)^t - 1}{r} \tag{7}$$

which becomes:

$$Balance = 46757 * (1 + 0.068/12)^{60} - 537.91 \frac{(1 + 0.068/12)^{60} - 1}{0.068/12} = \$27,316.28$$