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CAUGHT IN THE CROSSHAIRS OF EDUCATIONAL REFORM: HOW TEACHER LABOR MARKETS RESPOND TO POLARIZED EDUCATION POLICIES

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CAUGHT IN THE CROSSHAIRS OF EDUCATIONAL REFORM: HOW TEACHER LABOR MARKETS RESPOND TO POLARIZED EDUCATION POLICIES

DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the Graduate School
at the University of Kentucky

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ABSTRACT OF DISSERTATION

CAUGHT IN THE CROSSHAIRS OF EDUCATIONAL REFORM: HOW TEACHER LABOR MARKETS RESPOND TO POLARIZED EDUCATION POLICIES

Since the passage of No Child Left Behind (NCLB) teachers have been caught in the crosshairs of political debates about education policy (Davis, 2014; EPE Research Center, 2013a; Steiner & Woo, 2021; Woo et al., 2022; Zubrzycki, 2016). As political polarization between parties increased in the 2000s, debates about education policy became more acrimonious impacting teachers' work lives (Heltzel & Laurin, 2020; Iyengar, 2021; Layman et al., 2006). The topic of these debates ranges from curriculum changes such as Common Core and Critical Race Theory (CTR), school shootings and safety, battles over school choice and voucher programs, teacher activism about working conditions, and safety protocols during the COVID-19 pandemic. *I explore the impact Common Core and COVID-19 had on teacher labor markets including the teacher pipeline, teacher supply, and teacher demand*. First, I look at how Common Core potentially affected the teacher pipeline nationally as enrollment in teacher preparation programs is declining in four colleges across the United States. Second, I examine what impact COVID-19 had on teacher turnover (a proxy measure for the supply of teachers) in Kentucky. Finally, I examine the other side of the coin how COVID-19 altered the *demand* for teachers in Kentucky.

I examine the impact COVID-19 had on teacher demand and supply in Kentucky as well as the impact Common Core had on the teacher pipeline. I find that COVID-19 did have a causal effect on the number of job postings due to resignations in Kentucky. I observe that teacher turnover in Republican counties is associated with lower turnover both before and during COVID-19. I find no causal relationship between Common Core and the teacher pipeline. However, this research is still important and could lend to a more descriptive analysis in the future as teachers have reported an increase in stress due to increased political polarization.

KEYWORDS: teacher labor markets, Common Core, COVID-19, teacher turnover, teacher demand

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CAUGHT IN THE CROSSHAIRS OF EDUCATIONAL REFORM: HOW TEACHER LABOR MARKETS RESPOND TO POLARIZED EDUCATION POLICIES

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To all the teachers like Monica Garvey, Diane Dunham, Ruth Honomichl who changed my life and year after year re-commit to changing the world one classroom at a time. This journey was inspired by you and the influence you've had in my life. To my mother who before the idea of a growth mindset existed pushed me to pursue things beyond what I thought possible. To my wonderful husband who has supported me through the late nights and tears shed over this work (distno). You are my rock. Thank you for helping me spread my wings. Finally, to my children, I hope you cherish your education and encourage your partner to reach their full potential.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1. INTRODUCTION

1.1 Overview

Since the passage of No Child Left Behind (NCLB) teachers have been caught in the crosshairs of political debates about education policy (Davis, 2014; EPE Research Center, 2013a; Steiner & Woo, 2021; Woo et al., 2022; Zubrzycki, 2016). As political polarization between parties increased in the 2000s, debates about education policy became more acrimonious impacting teachers' work lives (Heltzel & Laurin, 2020; Iyengar, 2021; Layman et al., 2006). The topic of these debates ranges from curriculum changes such as Common Core and Critical Race Theory (CTR), school shootings and safety, battles over school choice and voucher programs, teacher activism about working conditions, and safety protocols during the COVID-19 pandemic. *I explore the impact Common Core and COVID-19 had on teacher labor markets including the teacher pipeline, teacher supply, and teacher demand*. First, I explore the other side of the coin how COVID-19 altered the *demand* for teachers in Kentucky. Second, I examine what impact COVID-19 had on teacher turnover (a proxy measure for the supply of teachers) in Kentucky. Finally, I look at how Common Core potentially affected the teacher pipeline nationally as enrollment in teacher preparation programs is declining in four colleges across the United States.

1.2 Chapter 1

Teacher shortages in America have likely been exacerbated by the COVID-19 pandemic (Bacher-Hicks et al., 2023; Bastian & Fuller, 2023; Camp et al., 2023; Goldhaber & Theobald, 2021, 2022, 2023). Prior to the pandemic, researchers identified

a clear teaching shortage in America, noting that teacher shortages were higher in low-income schools and hard-to-fill subject areas such as STEM and SPED, interest and enrollment in teacher preparation programs were declining, and school principals were reporting a higher frequency of shortages (García & Weiss, 2019a, 2019d; Nguyen et al., 2020b; Schmitt & DeCourcy, 2022). The literature on teacher supply issues is robust, particularly on teacher turnover which explores changes in teacher supply (Nguyen et al., 2020a). However, the literature on teacher demand is limited and relies heavily on principals' general impression of needs in the market making it difficult to know the full magnitude of teacher shortages (McVey et al., 2019; Schmitt & DeCourcy, 2022). This paper investigates the *other side of the coin* teacher demand, by exploring the actual changes in teacher demand. I do this by looking at the changes in the number of teacher job postings from year to year in Kentucky and examining if there is a causal relationship between the reason behind a job posting being created and the pandemic. No other teacher labor market research examines the impact COVID-19 had on teacher demand as well as the mechanism behind that change. Using a matching difference-in-difference model, I find that COVID-19 increased the number of teacher job postings created due to a teacher resignation by one third a job posting in Kentucky schools within the highest concentration of COVID-19 cases per capita.

Survey research suggests teachers felt caught in the cross-hairs of political debates about Common Core and COVID-19 (Davis, 2014; EPE Research Center, 2013a; Jochim & Lavery, 2015a; Polikoff, 2017a; Steiner & Woo, 2021; Strauss, 2020b; Woo et al., 2022; Zubrzycki, 2016). While the analysis on Common Core did not show an impact on the teacher pipeline, additional research is needed to explore if it did impact

teacher supply via teacher turnover. It has been documented in several states that COVID-19 did exacerbate teacher turnover (Bacher-Hicks et al., 2023; Bastian & Fuller, 2023; Camp et al., 2023; Goldhaber & Theobald, 2023). The analysis shows a strong correlation between lower teacher turnover and Republican counties. Although the first year of data in Kentucky does not show this trend, as additional years of data are added to the analysis, it is anticipated that a similar trend will be observed. Finally, demand for teachers did change during the pandemic, as more teachers left due to resignations. A lack of highly qualified teachers is worrisome because it negatively impacts student learning, places an additional burden on other education employees, and drains the education system of needed financial resources all of which undermine the basic aims of public education (Kraft & Papay, 2014a; Ladd & Sorenson, 2016; Ronfeldt et al., 2013a). While robust literature shows that wages, working conditions, and type of school impact teacher work affects the teacher labor market, little is known about how politicized policies impact teacher labor markets. Policymakers need to understand the impact politicized policy issues such as Common Core and COVID-19 have on the teacher labor market, so they can respond with informed policies that fully address the problem of recruitment and retention of teachers.

1.3 Chapter 2

School and teacher characteristics (Nguyen et al., 2020b) impact teacher turnover. While political ideology influences government employee turnover (Bolton et al., 2021a) no current academic study explores if and how the political ideology in a teacher's geographic region impacts teacher turnover (Grissom et al., 2016a; Nguyen et al., n.d.). The COVID-19 era offers a unique setting to test the impact of a county's political

ideology on teacher turnover because political ideology influenced education policy decisions at the state-, district-, and school level during COVID-19. The objective of this paper is to test whether county political ideology during COVID-19 differentially impacted teacher turnover rates in the state of Kentucky using a comprehensive data set tracking educators during the 2009-2010 to 2019-2020 academic school years (AY). Controlling for year-fixed effects and teacher, school, and district characteristics, the results of this study support the conclusion that COVID-19 was not associated with a sizable impact on the number of personnel leaving the workforce. However, Republican counties were more likely to experience a decrease in teacher turnover, during COVID-19.

1.4 Chapter 3

While a significant amount of research evaluates the impact of adopting Common Core standards on student achievement, researchers have not explored the impact Common Core has on teacher labor markets. Previous, research shows a decline in enrollment and completion of teacher preparation programs which is partially the result of low teacher compensation, and dissatisfaction with working conditions (Boyd et al., 2005a; Clotfelter et al., 2011a; Feng, 2009a; Hanushek et al., 2004a; Imazeki, 2005a; Podgursky et al., 2004a; Scafidi et al., 2007a). However, it is possible that other factors such as the adoption of Common Core may also play a role. This paper explores whether Common Core—a curriculum change that generated greater accountability like No Child Left Behind (NCLB)—is also a cause of the current reduction in enrollment and completion of teacher preparation programs using a difference-in-difference (DID) model.

1.5 Conclusion

I examine the impact COVID-19 had on teacher demand and supply in Kentucky as well as the impact Common Core had on the teacher pipeline. I find that COVID-19 did have a causal effect on the number of job postings due to resignations in Kentucky. I observe that teacher turnover in Republican counties is associated with lower turnover both before and during COVID-19. I find no causal relationship between Common Core and the teacher pipeline. However, this research is still important and could lend to a more descriptive analysis in the future as teachers have reported an increase in stress due to increased political polarization.

CHAPTER 2. THE OTHER SIDE OF THE COIN: THE REASONS BEHIND THE CHANGE IN DEMAND FOR TEACHERS DURING COVID-19 IN KENTUCKY

2.1 Introduction

Teacher shortages in America have likely been exacerbated by the COVID-19 pandemic (Bacher-Hicks et al., 2023; Bastian & Fuller, 2023; Camp et al., 2023; Goldhaber & Theobald, 2021, 2022, 2023). A lack of highly qualified teachers is worrisome because it negatively impacts student learning, places additional burden on other education employees, and drains the education system of needed financial resources all of which undermines the basic aims of public education (Kraft & Papay, 2014a; Ladd & Sorenson, 2016; Ronfeldt et al., 2013a). Prior to the pandemic, researchers identified a clear teaching shortage in America, noting that teacher shortages were higher in low-income schools and hard-to-fill subject areas such as STEM and SPED, interest and enrollment in teacher preparation programs were declining, and school principals were reporting a higher frequency of shortages (García & Weiss, 2019a, 2019d; Nguyen et al., 2020b; Schmitt & DeCourcy, 2022). The literature on teacher supply issues is robust, particularly on teacher turnover which explores changes in teacher supply (Nguyen et al., 2020a). However, the literature on teacher demand is limited and relies heavily on principals' general impression of needs in the market making it difficult to know the full magnitude of teacher shortages (McVey et al., 2019; Schmitt & DeCourcy, 2022). While media portrayals suggest a broad sweeping teaching shortage, teacher labor markets in the United States do not operate as one massive labor market. Rather they are small localized markets, created by local—school, district, and state employment policies (Dee & Goldhaber, 2017; McVey et al., 2019; Sanderson Edwards et al., 2022). Thus, schools in low-income and improvised areas are more likely to be heavily impacted by the

COVID-19 pandemic (García & Weiss, 2019d; Schmitt & DeCourcy, 2022; Sutcher et al., 2019). The stress and pressures of COVID-19 on teachers, aggravated the driving forces behind teaching shortages. While it is unlikely that the American education system will face an external shock like the pandemic again, educators and policymakers are still dealing with the impact COVID-19 had on teacher retention and recruitment. To overcome the negative impacts COVID-19 had on teacher supply and demand, policymakers need to clearly understand ***what*** impact COVID-19 had on teacher shortages and ***why*** or what reasons caused teaching shortages. Policy makers should know the root cause behind teacher vacancies during the pandemic, so they can respond with informed policies that fully address the problem of recruitment and retention of teachers. For example, policy makers would respond differently if a teacher shortage were being caused by higher levels of retirement rather than if more early career teachers were leaving the profession. In the later situation, districts and instructional coaches would focus on developing mentorship programs and other curriculum supports for new teachers whereas in the former efforts would need to be focused on helping senior teachers adjust to new technology and changing expectations in teaching.

This paper investigates the other side of the coin teacher demand, by exploring the actual changes in teacher demand instead of using survey responses or reported shortage areas by principals during the pandemic. I do this by looking at the changes in the number of teacher job postings from year to year in Kentucky and examining if there is a causal relationship between the reason behind a job posting being created and the pandemic. No other teacher labor market research examines the impact COVID-19 had on teacher demand as well as the mechanism behind that change. Using a matching

difference-in-difference model, I find that COVID-19 increased the number of teacher job postings created due to a teacher resignation by one third a job posting in Kentucky schools within the highest concentration of COVID-19 cases per capita.

2.2 Literature

The literature on teacher shortages lacks a clear and consistent definition and measurement of teacher supply, demand, and shortages (Schmitt & DeCourcy, 2022). A teacher shortage occurs when teacher demand is greater than teacher supply. Despite measurement difficulties, researchers documented a clear and real teacher shortage prior to the pandemic (Aragon, 2016a; Sutcher et al., 2016a). After the 2008 recession, concerns about the teacher labor supply and demand emerged as schools across the United States responded to constrained budgets while at the same time enrollment in teacher preparations began to decline (Aragon, 2016b; Sutcher, Leib & nda, Carver-Thomas, 2016; US Department of Education, 2022). In the mid-2010s, with student enrollment on the rise, schools tried to return to pre-recession student-to-teacher ratios but found difficulties in hiring teachers especially in hard-to-fill positions like SPED and STEM (Sutcher et al., 2016a, 2019).

In the Learning Policy Institute (LPI) 2016 report on teacher shortages, they estimated a national teacher shortage of roughly 110,000 by the 2017-2018 AY. The year prior to COVID-19, Pennington McVey and Trinidad, did a comprehensive analysis of the Teacher Shortage Area (TSA) reports and found that shortages were higher at the end of the period, reaching a peak between the 2003-2004 AY and 2008-2009 AY and maintaining their elevated levels(McVey et al., 2019; Schmitt & DeCourcy, 2022). The

Economic Policy Institute (EPI) also released a series of five reports on teacher labor markets prior to the pandemic, they found that "the teacher shortage is even larger when teacher credentials are factored in" (García & Weiss, 2019a, 2019d, 2019c, 2019e, 2019b). Prior to the COVID-19 pandemic, teacher shortages were already a growing concern in the United States. I will examine how the external shock of COVID-19 affected teacher shortages by looking at how the demand for teachers changed during the pandemic in Kentucky.

2.2.1 The Cost of Teacher Attrition

Teacher attrition is worrisome because it negatively impacts student learning, places additional burdens on other education employees, and drains the education system of needed financial resources. Student learning and achievement is hindered when there are high levels of teacher turnover(Kraft & Papay, 2014a; Ladd & Sorenson, 2016; Ronfeldt et al., 2013a). High levels of teacher turnover disrupt students' learning and makes it harder for students to access highly effective teachers (Boyd et al., 2005b; Carver-Thomas & Darling-Hammond, 2019a; Chetty et al., 2014b; Sorensen & Ladd, 2020a). While this affects all students, it harms low-income students inequitably (Cowan et al., 2016; Schmitt & DeCourcy, 2022).

Additionally, teacher shortages negatively impact other employees at the school. During the COVID-19 pandemic when teachers were out sick or vacant positions were left open teachers and principals were asked to cover these classes. That means teachers were either covering two classes, giving up a prep time to cover a class, or principals were being taken away from their leadership and management responsibilities. The IES School Pulse Survey found that for the 2022-2023 AY, forty-three percent of respondents

were still concerned about the lack of substitute teachers.[1] When there are high levels of teacher shortages, resources are spread too thin leading to teacher and principal burnout. In Maine, one school principal noted, "It seemed like they never had enough substitute teachers, and out of a staff of 110, she had to hire replacements for 17 roles. 'Part of that was retirement, but part of it was they were just burnt out. They couldn't work in that world of grey."[2] A strong positive correlation exists between principal and teacher turnover.[3] A recent study found that during the pandemic teacher, substitute, and administrative support shortages were all correlated with principal job dissatisfaction (Kaufman et al., 2022).

Finally, the cost to replace a teacher is expensive. Based on national data it costs approximately $21,000 dollars to replace a teacher. This estimate could be higher or lower depending on local state and district characteristics (Carver-Thomas & Darling-Hammond, 2017a).[4] Alaska, a state with high teacher retention problems, estimates it spends 20 million per year on teacher attrition(DeFeo et al., 2017). In 2007, it was estimated that the cost of teacher turnover annually was $7.3 billion (Carroll, 2007). The financial cost of high teacher turnover robs education of needed resources further crippling the teaching profession from being viewed as a serious career option(García & Weiss, 2019a; Sorensen & Ladd, 2020a).

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[1] https://ies.ed.gov/schoolsurvey/spp/

[2] https://www.edsurge.com/news/2022-07-06-principals-are-on-the-brink-of-a-breakdown

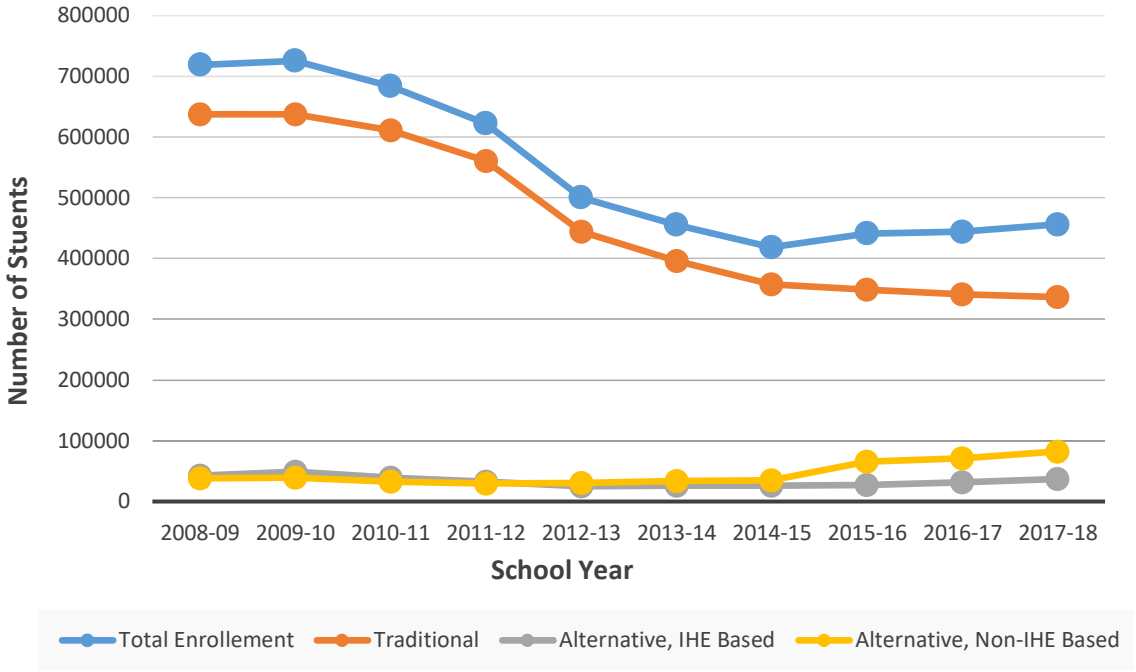
[3] Many studies explore how principal turnover impacts teacher turnover. However, studies struggle to isolate the causal impacts of teacher and principal turnover. It is unclear if one is causing the other.

[4] https://learningpolicyinstitute.org/product/the-cost-of-teacher-turnover

2.2.2 Teacher Supply

Teacher supply can be defined as the number of individuals (of working age) qualified and ready to teach. One way researchers measure this is by adding up the number of individuals who have completed a teacher preparation program or could easily become qualified to teach. While an accurate definition researchers note this measurement approach often indicates that there is a surplus of teachers, not a current teacher shortage (Dee & Goldhaber, 2017; Schmitt & DeCourcy, 2022) because it doesn't take into consideration if these individuals are seeking to work or willing to work under the current conditions (i.e. salary, benefits, work-level stress). Furthermore, Title II data collected by the US Department of Education shows a steady decline in enrollment and completion of teacher preparation programs since 2010 (see Figure 1). This pattern is also observed in state-level data despite increases in college enrollment.[5] Recent surveys indicate waning interest in the teaching profession and for the first time more parents reporting they would not like their child to become a teacher or even discouraging their child from entering the profession (PDK, 2018, 2022; Schmitt & DeCourcy, 2022; Stringer, 2018a).

[5] Enrollment in alternative teacher licensure programs does not make up the difference in low levels of enrollment in traditional programs.



*Data from the U.S. Department of Education, "Title II Reports"[6]

Figure 2.1 Enrollment in Teacher Preparation Programs by Program Type

Another measure often used to look at teacher supply is teacher turnover. Teacher turnover "is the change in the number of teachers from one year to the next in a particular school setting" (Sorensen & Ladd, 2020a). While teacher turnover can inform us about teacher shortages it does have limitations. High levels of teacher turnover can indicate a potential teacher shortage if those teachers exit the profession and if the demand for teachers remains constant. Despite limitations, the literature on teacher turnover prior to COVID-19 is robust and extensive (Nguyen et al., 2020b). A recent meta-analysis provides a comprehensive examination of 120 studies on teacher turnover and highlights how school, teacher, and external characteristics influence teacher turnover and retention (Ngyuen et al., 2020). Schools with a higher population of low-income and minority

[6] https://title2.ed.gov/Public/Home.aspx

students, experience higher rates of teacher turnover (Carver-Thomas & Darling-Hammond, 2019a; Cowen et al., 2012a; Gagnon & Mattingly, 2015a). Teacher turnover is higher among less effective teachers and more effective teachers often transfer to higher-performing schools (Boyd et al., 2005, 2013). Salary increases, teacher evaluations, and merit pay are all associated with lower turnover rates (Grissom et al., 2016b). Since COVID-19 a small body of literature has emerged exploring the impacts of COVID-19 on teacher turnover.

2.2.3 Teacher Turnover Post COVID-19

Teachers faced many challenges during the COVID-19 pandemic. Some of these include a switch from in-person to remote learning, dealing with higher absenteeism from students and staff, concerns about health and safety, PPE requirements or the lack thereof, as well as communicating these requirements with students and parents. Teachers have reported increased levels of stress and higher intentions of leaving the profession as a result of COVID-19 (Pressley et al., 2021; Steiner & Woo, 2021; Walker, 2022).

Newspapers and other media sources have echoed colloquial teacher concerns, reporting that there would be a mass exodus from the teaching profession due to COVID-19 (Kamenetz, 2022; López Restrepo & Chang, 2022; Natanson, 2022; Singer, 2021; Streeter Gray Leslie, 2021). As the first year of teacher turnover data became available (2020-2021 AY), studies found that while there was a modest uptick in teacher turnover, experts did not see a dramatic shift in teacher turnover. However, as additional years of data have become available many states have found significant changes in teacher turnover (Bacher-Hicks et al., 2023; Barnum, 2021, 2022; Bastian & Fuller, 2023; Camp

et al., 2023; M. K. Diliberti & Schwartz, 2021; Goldhaber & Theobald, 2021, 2022; Harbatkin et al., 2023).

Analysis of statewide administrative data has been done in Massachusetts, Washington, North Carolina, and Arkansas. During 2021-2022 AY, teachers leaving the Massachusetts teaching force increased by 15 percent compared to the previous school year. (Bacher-Hicks et al., 2023b). Teacher attrition rates in the 2022-2023 AY were up almost half a percentage point higher than any other time in Washington's state history (Goldhaber & Theobald, 2023). Similar results are found in North Carolina where teacher attrition moved from 12.1 percent in 2020-2021 AY to 15.6 percent in 2021-2022 AY(Bastian & Fuller, 2023). Finally, in Arkansas, Camp and McGee found a significant increase in teacher turnover during the 2022-2023 AY (Camp et al., 2023). While most of the research focuses on teacher turnover, one study in Illinois looks at both teacher shortages and support staff and finds teacher shortages are small while support staff shortages are high(Bruno, 2022).

Survey research corroborates these state turnover findings by measuring teachers' stress levels, job satisfaction, and intention to leave the profession. For example, a RAND study using district survey results found that teacher turnover increased by four percentage points above pre-pandemic levels. This study also found that teacher turnover was higher in urban districts and low-income school districts, while principal turnover was higher in rural districts (Diliberti & Schwartz, 2023). Furthermore, survey results indicate that teachers have faced increased difficulties in teaching during the pandemic, experienced lower rates of job satisfaction, reported more mental health concerns, increased the number of hours worked, and have a stronger desire to leave their

profession (Carver-Thomas et al., 2021; M. K. Diliberti & Schwartz, 2021; Steiner & Woo, 2021b; Walker, 2022; Baker et al., 2021; Gicheva, 2022; Hilger et al., 2021; Moser & Wei, 2021; Pressley, 2021; Pressley et al., 2021).

While it has been documented that teacher turnover has increased and teachers' mental, emotional, and physical workloads have increased since COVID-19, these studies have not used a causal modeling approach and the administrative data sets do not allow exploration of the motivations behind teachers' departure. This paper adds a unique perspective to this literature by leveraging an administrative data set from Kentucky that looks at teacher job postings and the reasons behind the creation of those postings. Using a matching difference-in-difference model, I explore if COVID-19 impacted the number of job postings in Kentucky at the school level and how the justification or reasoning for those job postings changed or did not change because of the pandemic.

2.2.4 Teacher Demand

Teacher demand is often measured as the number of teachers a school needs to hire for the year. The measurements and estimation of teacher shortages vary widely due to data limitations. While educators make up one of the largest groups of public servants, data sets are not systematically kept across schools, districts, or states making it difficult for researchers to use the same measurements. As a result, most studies can only estimate the magnitude of teacher shortages, without knowing the real demand for teachers. Furthermore, reports from principals are biased due to constrained budgets. A principal might need four more teachers but can only afford two more. For example, since the 1990-1991 AY the US Department of Education has states report teacher shortages based on the subject area and releases an annual report on Teacher Shortage Areas (TSA).

However, states do not report the number of teachers needed in a specific subject area rather they indicate that a specific subject area has a shortage making it difficult to know the real magnitude of a teacher shortage, or how many positions need to be filled (McVey et al., 2019; Schmitt & DeCourcy, 2022). The literature prior to the pandemic focuses on these reports from principals and limits the types of analysis that can be done.

Since the pandemic, principals have been reporting higher levels of vacancies and attribute these vacancies to fewer applicants not an increase in the number of job postings (Zuo et al., 2022). At the beginning of the 2022-2023 AY, 53 percent of schools reported being understaffed and 60 percent stated they have had open support staff positions since the beginning of the pandemic.[7] While survey reports suggest that there are higher levels of vacant positions post-COVID-19, few studies using administrative data have been done to corroborate these findings. A recent study done in Illinois begins to examine the impact of COVID-19 on the demand side by examining job postings. They find that teacher shortages are small on average but shortages among support staff are high (Bruno, 2023).

While the supply side of teacher turnover has been examined pre and post-COVID-19, the other side of the coin, teacher demand has not been examined as thoroughly especially after COVID-19. This paper adds to the literature on teacher demand by exploring teacher job postings in Kentucky during COVID-19, something not currently done in the teacher demand literature. Furthermore, while principals are reporting higher number of vacancies, they attribute this to fewer applicants. This paper

[7] U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, School Pulse Panel 2021–22 and 2022–23.

will explore if there has been an increase in the number of job postings since the pandemic and examines if the motivation behind teacher job postings being created has shifted as a result of COVID-19.

2.3 Theory

The Kentucky Educator Placement (KEPS) data set provides all teacher job postings from 2012-2013 AY to 2021-2022 AY as well as eight different reasons or justifications for the creation of those job postings. These reasons include—resignation, retirement, death, new positions, termination, leave of absence, transfer, and a miscellaneous category "other." Seven of the eight justifications for a teacher job posting reflect changes in the supply, demand, or mobility of teachers. For example, the number of new positions is reflective of demand for teachers and resignation reflects the supply of teachers. Table 1 below shows the different categorizations. Because there is limited information on the miscellaneous category of other, I am not able to assign other to one of these groups.

Table 2.1 Classification of Reasons for a Teacher Job Posting

Supply	**Demand**	**Mobility**
Resignation, Retirement, Leave of Absence, Death, and Termination	New Positions	Transfer

There is however some evidence to provide context and background to the teacher labor market conditions in Kentucky prior to COVID-19. First, national estimates suggest that localized teacher labor markets were in a shortage before the pandemic. Based on analysis from TSA surveys, McVey et al find that Kentucky has reported a teacher shortage in special education, science, and foreign language every year from 1998 to 2018. However, the reported TSA shortages only indicate a shortage in these specific areas; they do not provide insight into the magnitude of the shortage. This suggests that specific subject areas were at least experiencing shortages before the pandemic in Kentucky.

One examination of the entire teacher labor market in Kentucky suggests that between 2009 and 2015, more teachers left the profession in 2012 than in any other school year possibly due to a new academic standard implemented in Kentucky known as Unbridled Learning (Curl, 2019). More recent data from KYSTATS shows that teacher attrition fluctuated in Kentucky before COVID-19 with a clear drop in teacher attrition between the 2018-2019 to 2019-2020 AY (Table 2.2 and Figure 2.2). At the same time, the number of job postings has steadily increased since 2012-2013 AY, with a sharp increase between 2020-2021 to 2021-2022 AY (Table 2.2 and Figure 2.2). Additional insights into the forces driving the increase in the total number of job postings are found in Table 2.3. The total number of job postings due to resignation steadily increased from year to year reaching an all-time high in the 2021-2022 AY. The number of teachers who retired peaked after the first full school year of the pandemic in 2020-2021 AY. The number of teachers transferring has also steadily increased over time reaching an apex in the 2021-2022 AY.

While this data provides a snapshot of the teacher labor market in Kentucky, it is difficult to reconcile the teacher attrition numbers versus the number of new job postings. These numbers come from different data sources. Ideally, all reasons contributing to teacher attrition—death, leave, other, resignations, retirement, and firing would add up to the number of teachers leaving the profession. However, this is not the case, suggesting that the datasets are measuring different aspects of the teacher labor market. The Kentucky data set suggests that teacher retention was relatively level with an increased number of teaching positions.

Table 2.2 Teacher Attrition and Salary

Year	**Teacher Salary**	**Attrition**	**Total # of Teachers**	**Attrition Rate**	**# of Job Postings**
2012-2013	$46,202.73	4,241	42,832	9.9%	5588
2013-2014	$47,319.19	4,331	42,287	10.2%	6021
2014-2015	$48,596.95	3,771	41,507	9.1%	6645
2015-2016	$49,199.29	4,117	42,012	9.8%	6795
2016-2017	$51,015.87	3,676	42,146	8.7%	7075
2017-2018	$52,498.53	3,636	42,177	8.6%	7392
2018-2019	$54,590.69	3,823	41,927	9.1%	8789
2019-2020	$56,300.38	3,332	42,304	7.9%	7799
2020-2021			42,526	0.0%	7676
2021-2022			43,445	0.0%	10553

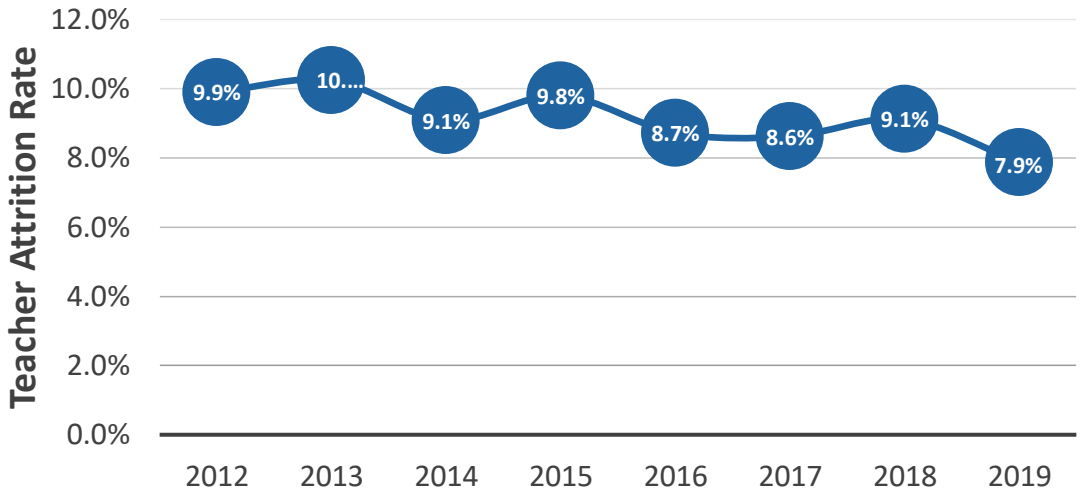


Figure 2.2 Teacher Attrition Rates in Kentucky

Table 2.3 Kentucky's Total Number of Teacher Job Postings by Reason for Job Postings

Year	Total	Death	Leave	New Position	Other	Resign	Retire	Fired	Transfer
2012-2013	5588	55	83	1045	573	1687	729	526	890
2013-2014	6021	38	88	1289	270	1859	853	726	898
2014-2015	6645	24	97	1247	274	2111	917	814	1161
2015-2016	6795	12	58	1436	320	2233	878	778	1080
2016-2017	7075	14	76	1653	274	2261	900	772	1125
2017-2018	7392	16	60	1998	305	2269	961	663	1120
2018-2019	8789	18	72	2454	504	2655	820	803	1463
2019-2020	7799	20	53	1595	449	2626	768	734	1554
2020-2021	7676	24	74	1719	444	2342	1014	582	1477
2021-2022	10553	17	64	2092	744	3791	980	822	2043

With this information as a backdrop, even if the teacher labor market were in equilibrium in Kentucky, the free-market equilibrium might not be providing enough resources to schools as public goods are often undersupplied to the market. What follows is a brief discussion of how each of the job posting reasons might impact the supply or demand of teachers in Kentucky. This discussion is limited by the fact that (a) the initial equilibrium is uncertain and (b) while I will hypothesize directional changes due to

supply and demand, I do not know the magnitude of those changes and therefore can't predict if the shifts in supply and demand create a shortage, surplus, or equilibrium.

2.3.1 Supply

I predict that job postings due to resignation, retirement, and leave of absence will increase after the pandemic in Kentucky. Each of these reasons is likely to decrease the supply of teachers. I base this hypothesis on recent studies that suggest that one in four teachers report a desire to leave the teaching profession due to the stress of the pandemic (M. K. A. Y. Diliberti & Schwartz, 2023) and that a teacher's stated intention to leave the profession is strongly correlated to their actual decision to leave or stay in the profession and even more strongly correlated with their psychological commitment to stay (Grant & Brantlinger, 2023; Harbattkin et al., 2023). An increasingly difficult working environment is likely to push teachers to leave the profession either through a choice to resign, an earlier-than-planned retirement, or an unanticipated leave of absence.

2.3.2 Demand

While COVID-19 had an impact on mortality, it is anticipated that the death rate will be so low that a substantial change due to COVID-19 deaths will not occur. Finally, I do not anticipate COVID-19 to impact the number of teachers that will be terminated.

Based on the competing factors of an economic recession coupled with massive COVID-19 relief funds from the federal government it is likely that demand for teachers could both decrease and increase. Without knowing more information about the magnitude of these changes, it is difficult to predict which force will have a greater magnitude. During times of economic stagnation, the creation of new jobs decreases. As

a result, one hypothesis is that the number of job postings due to the creation of a new position during the pandemic will decrease. On the other hand school districts were given federal money to help address pandemic concerns known as Elementary and Secondary School Emergency Relief (ESSR) funding. These additional dollars could be used to create new job postings, thus increasing the number of job postings due to the creation of a new position. I control for ESSER spending by using the amount of ESSER funds each district was given. Research on this topic is mixed. Principals report that an increase in the number of open positions is due to a lack of applicants not the creation of new jobs (Schmitt & DeCourcy, 2022; Zuo et al., 2022). However, researchers using administrative data show that states such as Washington increased the number of staff because of ESSER funding and will have layoffs as the funding ends (Goldhaber et al. 2024).

2.3.3 Transfer

Because of the prediction that teacher supply will decrease, this will create opportunities for teachers to move to a better or more desired school that meets their preferences. Support for this theory is grounded in studies that find high-performing teachers transfer from low-performing schools (Simon & Johnson, 2015).

2.3.4 Total Number of Job Postings

The supply and demand forces during the pandemic will have differential impacts on the total number of job postings in Kentucky. While I predict that the supply of teachers will decrease due to resignation, retirement, and leave of absence during COVID-19; it is unclear whether demand for teachers will increase or decrease, and it

isn’t certain what the magnitude of the changes to supply and demand will be. This paper will examine if the magnitude of these changes decreases, increases, or has a null impact on the total number of job postings in Kentucky.

2.4 Data

KEPS is an administrative data set from the Kentucky Department of Education (KDE) that lists all education-related job postings from 2014-2015 AY to 2021-2022 AY. Descriptive statistics of the data are found in Figures 2.3-2.4. Figure 2.3 shows the total number of job postings over time in the KEPS data. This includes all administrators, district personnel, and teachers in Kentucky. Over time the number of vacancies increased by 54 percent and the number of vacant teaching positions had a sharp increase in the 2021-2022 AY after the onset of the pandemic. Figure 2.4 shows the total number of vacancies by different job types. The three main job categories at the school level are teaching positions, school-wide support staff, and school administration. When broken down by job category teacher job postings still increased in 2021-2022 AY.

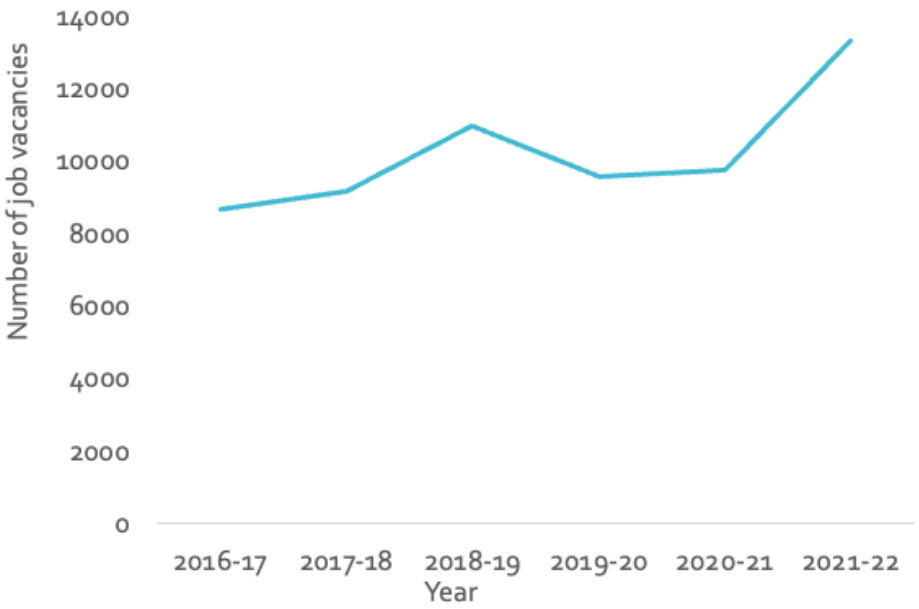


Figure 2.3 Total Number of Teacher Vacancies in Kentucky

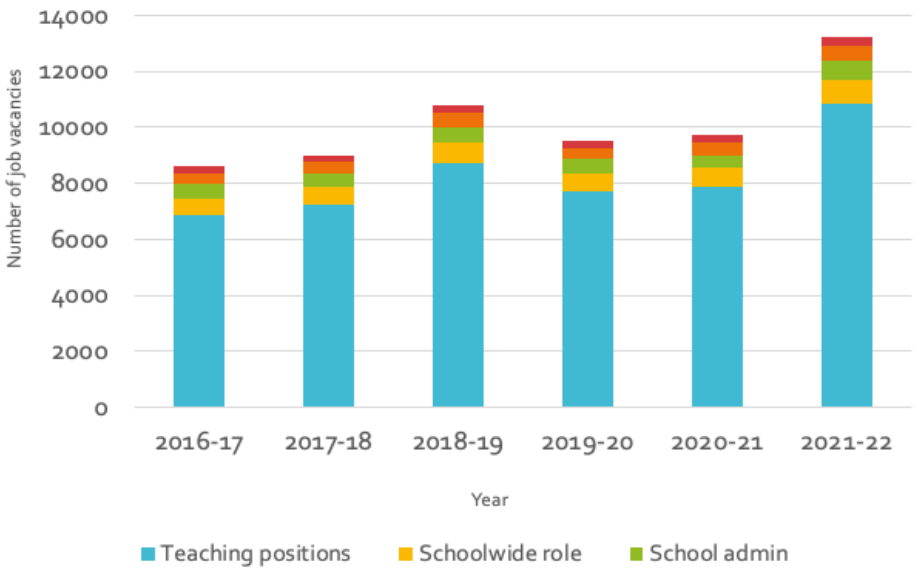


Figure 2.4 Total Number of Job Vacancies by Reason for Job Posting

Finally, this paper looks not only at the total number of job postings but the reasons driving the creation of those jobs Figure 2.5 shows the number of jobs created for each of

the eight reasons provided in KEPS data. The graph suggests that the number of job postings created by a resignation started increasing in the 2020-2021 AY.

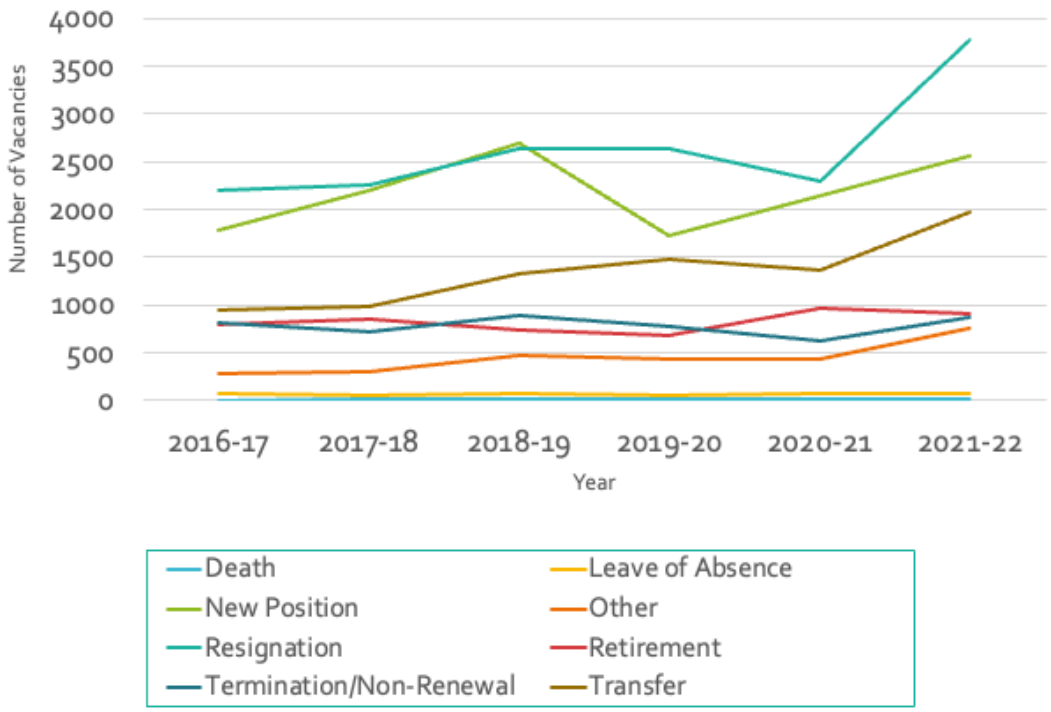


Figure 2.5 Total Number of Job Vacancies by Reason for Job Posting

2.4.1 Cleaning Data

After removing district-level job postings (12,113) and preschool job postings (2,466) due to collapsing at the school level there were 66,277 job postings from 2014-2015 AY to 2021-2022 AY. Job postings were collapsed at the school level rather than the district level to maintain greater power when creating treatment and control groups for the matching difference-in-difference estimation. After collapsing at the school level there were 9,881 observations at the school level. Only A1 schools which are traditional

public schools as defined by KDE were included in the dataset.[8] This limits the data set to 9,336 observations. Six observations or three schools were dropped because of missing covariates. To create treatment and control groups only schools in the highest and lowest tertiles for COVID-19 exposure are included.[9] The data set prior to matching includes 6,037 observations at the school level, which represents 1,249 schools and 39,873 job postings.

Because I am estimating a causal relationship, I use a matching method. Matching controls for "the confounding influence of pretreatment control variables in observational data" thereby creating greater balance between treatment and control groups and providing potentially more valid causal inference about the impact of COVID-19 (Iacus et al., 2012). Propensity Score Matching (PSM) is used because of its ability to address balance and retain power in the analysis as the sample size prior to matching is small.

The final sample of schools is matched on several observable characteristics prior to treatment—average number of job postings, number of free and reduced lunch, enrollment, number of teachers, reading test scores, average teacher salary, and median household income. Propensity score matching is calculated by fitting a probit regression using the first nearest neighbor without replacement—meaning observations cannot be used more than once. The propensity score matches one treatment variable to each control thus the average treatment effect among the control population is estimated. I

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[8] Non-A1 schools are district operated schools that specialize in CTC, preschool, special education programs, and home school. An A1 school is "under administrative control of a principal or head teacher and eligible to establish a school-based decision-making council. An A1 school is not a program operated by, or as part of another school" (KDE, 2023).

[9] Schools COVID-19 exposure was determined by county level COVID-19 cases per capita in 2020.

keep the same pre-treatment variables to match for all nine regressions despite changes in the outcome variables so that the treatment and control groups are uniform throughout the analysis and comparable. I match on total number of job postings because this variable provides a broad overview of changes in teacher job postings at each school. Once treatment and control groups are established. I employ a difference-in-difference model to examine the effect of the treatment. Enrollment and the number of full-time teachers are used to account for the size of schools. Additionally, free and reduced lunch, average teacher salary, and median household income account for different socioeconomic factors between schools. Finally, to ensure school achievement is balanced between groups, I also match on-average student reading test scores. The final sample has 298 schools with 2,325 observations; this is 38% of the unmatched schools. The descriptive comparison of the matched sample in Table 2.6 of the appendix provides a general overview of baseline characteristics between schools with high versus low COVID-19 exposure and Figure 2.11 in the appendix shows the standardized mean differences between treatment and control groups. Overall, schools with a high COVID-19 exposure compared to schools with a low COVID-19 exposure are similar on most baseline characteristics examined suggesting balanced treatment and control groups.

Covariates from the KEPS data set include total number of job postings at a school, as well as the reason for the vacancy, school type, position category, subject area, vacancy type, and reason for the vacancy. Prior to the pandemic, schools in Kentucky on average had 6.6 job postings per school year. After matching schools in the treated group had 6.4 job postings on average while schools in the control group had 5.7 job postings on average. The data set does not indicate if job postings were posted at the beginning,

middle or end of the school year. Thus, the total number of job postings is a count of the number of job postings listed each academic school year and I am not able to examine within the year or timing of when positions are posted. Additionally, I cannot track a job posting from one year to the next to see if the posting has remained vacant from one school year to the next. If the position is posted for each academic year it would be included in that total count for that year. There are eight potential reasons for the creation of a job posting—(1) resignation, (2) retirement, (3) death, (4) new position, (5) termination, (6) leave of absence, (7) transfer, and (8) other. Each job posting is coded with one reason for the creation of the job posting. So each school has a total number of job postings that were created due to these eight reasons. The number of job postings for each reason when added together equals the total number of job postings for that school. Like with the total number of job postings the data is only provided for the academic school year within year differences can't be explored. The KEPS data set had thirteen different school types. School types were coded discreetly into five categories—(1) Elementary, (2) Middle, (3) High School, (4) Pre-K to 12th grade, and (5) not applicable.[10] Because I collapsed the data at the school level, all other covariates from the KEPS data set are percentages of the total number job postings at the school. There are twenty-one different position categories in the original data set, these were narrowed down to three areas—(1) support staff, (2) teachers, and (3) principals.[11] Subject area is

[10] The elementary category includes all 4-5 intermediate schools; Knd-3rd grade; Knd-6th grade; Pre-school-5th grade; Pre-school-8th grade. The middle school category includes all job postings labeled as Middle School 6-8. The high school has all 8th to 12th grade, 9th to 12th grade, and 5th to 12th grade schools. (4) Pre-K to 12th grade, and (5) not applicable

[11] Support staff includes school nurses, psychologists, social workers, literacy specialists, and media librarians. Teachers include all preschool, primary, kindergarten, elementary, middle school, high school, gifted and talented, exceptional child, and home-bound school instructors.

standardized to ten areas—(1) art and music, (2) CTE, (3) English, (4) General, (5) physical education, (6) STEM, (7) Social Studies, (8) Special Education, (9) Tutor, and (10) World Languages. Finally, job postings are classified as either full or part-time positions.

Other covariates such as the Elementary and Secondary School Emergency Relief Fund (ESSER), teacher salary, and student achievement are also gathered from KDE. ESSER funding was available to school districts in the 2020-2021 AY to 2021-2022 AY to help schools in their COVID-19 response. ESSER funding could be used to create new teaching positions and is critical to control for when exploring if COVID-19 increased the number of teaching positions. The tracking of ESSER funds is only available at the school district level. All schools within the same district have the same level of ESSER funding. All years prior to 2019-2020 AY are coded as zero for ESSER funds. The average teacher salary is also only available at the district level. Current average salaries for the 2021-2022 AY are not yet available and the 2020- 2021 AY are serving as placeholders until those salaries become available. Student-level achievement data was gathered from KDE at both the school and district level from 2014 to 2021. Data for the school year beginning in 2019-2020 AY is not available via NCES or KDE website due to the COVID-19 pandemic which resulted in limited statewide testing from 2019 – 2020 AY. KDE achievement scores were standardized by year and grade with a mean of zero and standard deviation of one and all student and district-level achievement data for 2019 were coded as zero.

The Common Core of Data (CCD) from the Department of Education provided detailed school-level covariates from the 2014-2015 AY to the 2021-2022 AY. The

Common Core Directory data set provides enrollment numbers, the number of students on free and reduced lunch, Title-I status, and the number of full-time teachers for each school.

County-level covariates include median household income, unemployment rates, and COVID-19 case counts per capita. Median household income data is from the US Census Bureau. Unemployment rates by county are from the US Department of Labor and Statistics and COVID-19 case counts per county are from USAFacts. The unemployment rate is used as a proxy measure for other job opportunities teachers might have in their community. The number of COVID-19 cases per county in 2020 is divided by the population of each county in 2020 to calculate the COVID-19 cases per capita. I use the first year of COVID-19 cases as my exposure variable because in later years the tracking and measurement of COVID-19 cases was not tracked in the same way and the impact of COVID-19 was most strongly felt within the first academic year. This variable, divided into tertiles (Q1, Q2, Q3), is the exposure variable and determines treatment and control groups in the difference in difference model. The lowest tertile (Q1) is the control group with low COVID-19 exposure, and the highest tertile (Q3) is the treatment group with the highest COVID-19 exposure.

The pandemic started in March of the 2019-2020 AY. Thus, the timing of treatment starts in the 2019-2020 AY. All schools in Kentucky moved to a remote learning option for the remainder of the 2019-2020 AY. Because I cannot look at within year differences, I also consider that the impact of COVID-19 might not be felt on the teacher labor market until the following school year (2020-2021 AY). To test the

sensitivity of the timing of this treatment effect, I also look at the effect if treatment begins in the 2020-2021 AY.

To check the robustness of the analysis, I did a sensitivity analysis with a Comparative Interrupted Time Series (CITS) and found similar results (see Appendix 1: Table 2.8).

2.5 Methods

In order to identify a causal relationship between COVID-19 and the total number of job postings as well as changes in the reasoning behind those job postings, a quasi-experimental design is employed. Because COVID-19 impacted everyone, treatment and control groups can be assigned based off on a dosage effect of COVID-19 exposure and a matching difference-in-difference (DID) estimation is used.

The difference-in-difference model is estimated as follows:

$$Y_{it} = B_0 + B_1 COVID_{itq} + B_2 Post_{it} + B_3 COVID_{itq} * Post_{it} + B_4 Year_t + B_5 County_{it} + B_6 School_{it} + B_7 District_{it} + \alpha_i + \gamma_t + \varepsilon_{it}$$

Y_{it} is the outcome variable for a given school and year. The model is estimated for nine different outcomes—total number of job postings, resignation, retirement, death, new position, termination, leave of absence, transfer, and other. Each of these variables is a count of the number of job postings a school had in a particular school year.

$COVID_{itq} * POST_{it}$ represents treatment interacted with pre and post COVID-19 time periods. This is the main explanatory variable and captures three school years (2019-2020 to 2021-2022 AY) of post COVID-19 exposure. The treatment variable COVID is

assigned based on the COVID-19 cases by county in 2020 divided by the county population—COVID-19 cases per capita. The treatment variable is then divided into tertiles with the lowest tertile with the least COVID-19 exposure per capita assigned as the control group. The COVID-19 tertiles are then interacted with Post. Post is a dichotomous variable coded as "0" prior to the 2019-2020 AY and coded as "1" starting in the 2019-2020 AY. School and year-fixed effects are included. County-level covariates include median household income and the unemployment rate. Both of these control for the fact that teachers could choose to exit the market for a better wage or find jobs that better fit their tastes and preferences. School-level characteristics include Title I schools, number of full-time teachers, free-reduced lunch, enrollment numbers, and school type, as well as variables that describe job postings at the school level including position category and subject area. Position category and subject area are calculated as percentages of the total number of job postings at a school each (i.e. number of math teaching positions divided by the total number of job postings). District-level covariates include student achievement, ESSER funds, and average teacher salary. Standard errors are clustered as the school level. School and year-fixed effects are noted by α γ.

Additionally, an event analysis for each outcome variable is performed to evaluate if the treatment group would have followed as similar trend as the control group prior to the start of the COVID-19 pandemic. Prior to COVID-19 exposure, I expect the outcomes to be similar over time between groups.

2.6 Results

For all nine outcomes, I conducted an event study, which allows for an examination of parallel trends, a critical assumption for a difference-in-difference model. The parallel trends assumption states that trends in the outcome variables prior to treatment are parallel and would have continued to be parallel without treatment. Therefore, event study estimates prior to treatment should be near zero and statistically insignificant. The event study for the total number of job postings, other, termination, and resignations are in Figures 2.6-2.9. The event study for the total number of job postings, other, and termination show coefficients close to zero and statistically insignificant prior to treatment. The event analysis suggests the set of matched schools were similar in the number of total job postings, other, and termination prior to COVID-19. This gives a degree of reassurance that potential confounding is minimized when assessing the effect of COVID-19 on job postings. Prior to COVID-19 we did not observe evidence of different outcomes between treatment groups across any of the nine outcomes. Yet, schools in the treated group tended to have a lower number of job postings due to termination. The coefficients for teacher vacancies due to resignation in Figure 2.9 are statistically insignificant, and while the coefficients are further away from zero suggesting a possible difference or bias between the treatment and control groups any bias that would come from this difference is in the opposite direction of the treatment effect that is observed. Additionally, an event study was done on teacher vacancies due to resignation without matching. The coefficients for teacher vacancies due to resignation prior to COVID-19 without matching in Figure 2.10 are statistically insignificant and are closer to zero than the matched sample; this gives an added degree of confidence in the

conclusion regarding resignation. Event studies and analysis for all other outcomes are in the appendix Figure 2.12-2.20.

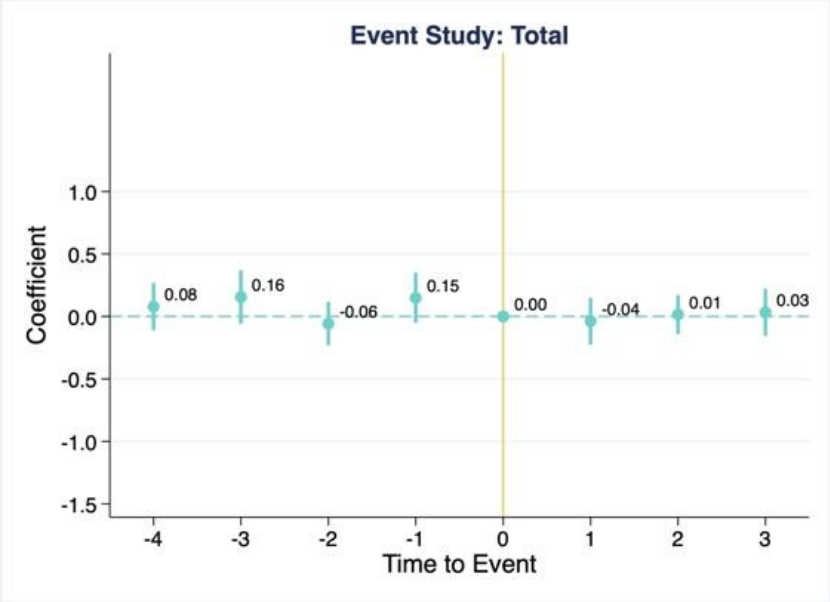

Figure 2.6 Event Study: Total # of Job Postings

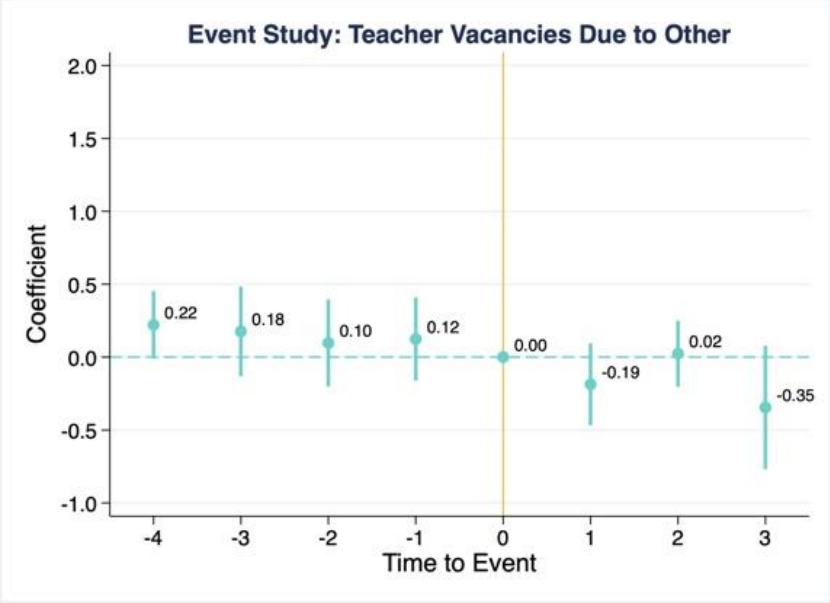

Figure 2.7 Event Study Teacher Vacancies Due to "Other"

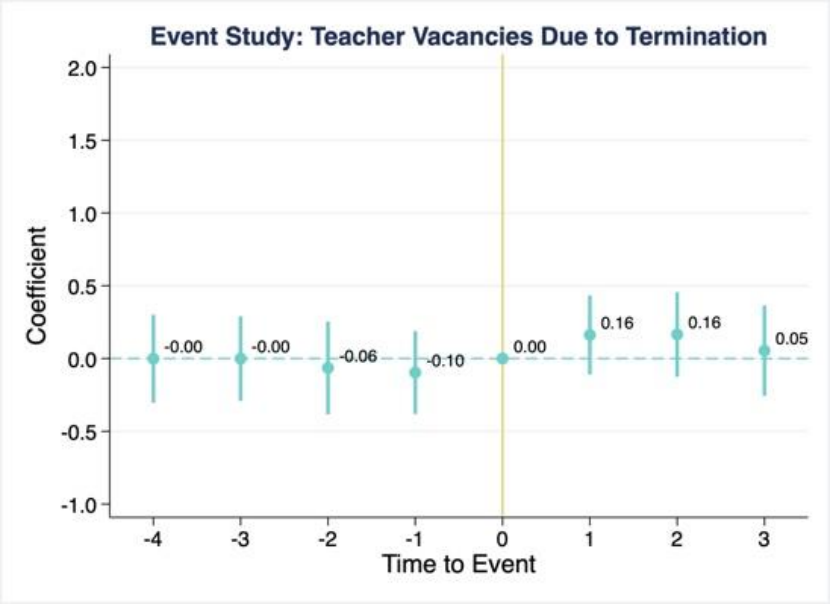

Figure 2.8 Event Study: Teacher Vacancies Due to Termination

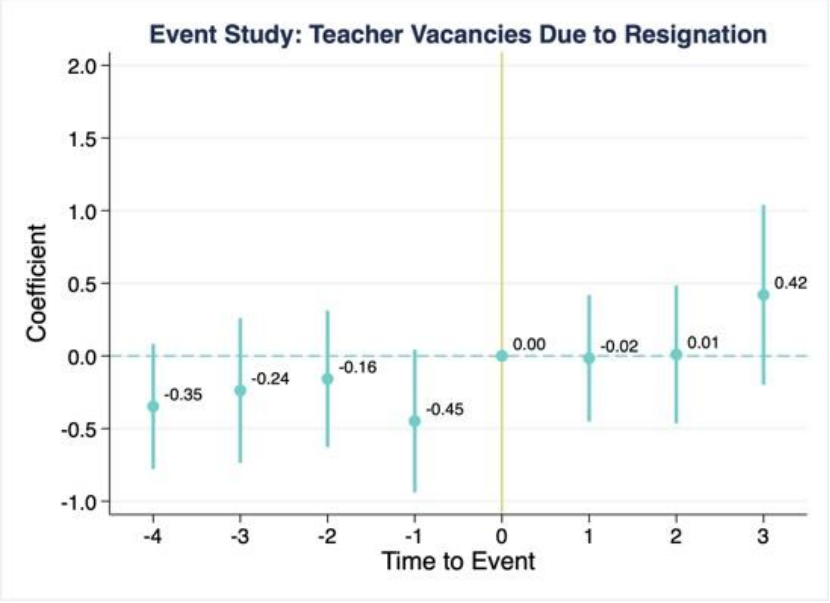

Figure 2.9 Event Study: Teacher Vacancies Due to Resignation

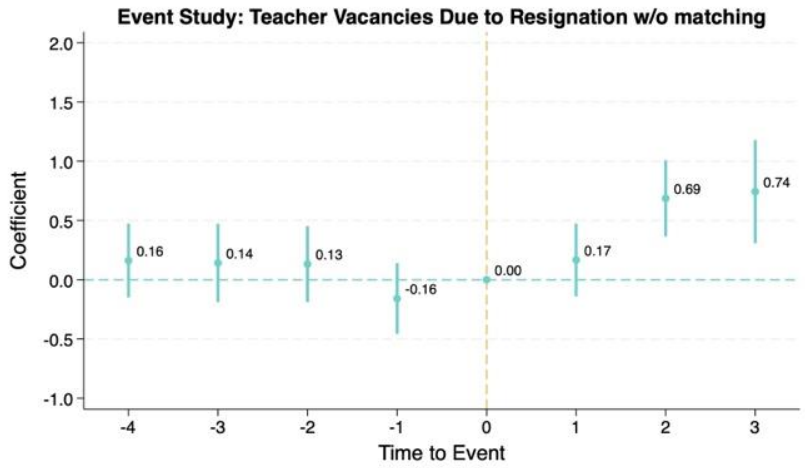

Figure 2.10 Event Study: Teacher Vacancies Due to Resignation w/o matching

Schools in Kentucky with a higher COVID-19 exposure compared to schools with a low exposure, experienced a decrease of .07 job postings with a standard error of .04. Thus, schools with a higher COVID-19 exposure did not experience a statistically significant increase or decrease in total number of teacher job postings compared to control group (see Table 2.4 column 1). (For detailed results see Appendix 1: Table 2.7). However, when looking under the hood at changes in the different reasons for the creation of a job posting during COVID-19, the number of job postings created due to a teacher resignation increased. Schools in the top tertile of COVID-19 exposure had an increase in more than one-third of a job posting due to resignation compared to the control group with the lowest exposure to COVID-19 (see Table 2.4 column 6). Specifically, the treated group had an increase of .36 job postings due to resignation during COVID-19 with a standard error of .15. Additionally, in comparison to the 2014-2015 AY, all school years leading up to COVID-19 AY, saw an increase in job postings due to resignation.

The number of job postings created due to the miscellaneous reason "other" decreased for schools in the higher exposure group. The miscellaneous reason other accounted for a reduction in .29 of a job posting compared to the group of schools with lower COVID-19 cases per capita with a confidence interval of .10. The other category had a statistically significant impact on the number of job postings in the two years prior to COVID-19 (see Table 2.4, column 5).

Relative to the 2014-2015 AY, job postings due to new positions increased by 0.85 jobs per school; however, there was not enough evidence to observe a difference between schools at the lowest versus highest tertile of covid cases per capita (see Table 2.4 column 4). Similarly, relative to the 2014-2015 AY, the number of job postings created due to retirement decreased for each school year observed in the data set; yet, there was not enough evidence to observe a statistically differential effect by exposure group (see Table 2.4 column 9).

A teacher being fired did have a small impact of an increase in .16 of a job posting in the treated group, compared to schools with low COVID-19 exposure (see Table 2.4 column 4). Detailed results for the total number of job postings and each reason can be found in Appendix 1: Table 2.7.

To test the sensitivity of the timing of the treatment effect, I also look at the effect of treatment beginning in the 2020-2021 AY, instead of 2019-2020 AY. For the reason of resignation, statistical significance remains the same with a slight increase in the magnitude (see Appendix 1: Table 2.10, column 6). The reason other has a slight decrease in magnitude while remaining significant (see Appendix 1: Table 2.10, column 5). Teacher job postings created due to termination are no longer statistically significant

and all other estimates remain statistically insignificant (see Appendix 1: Table 2.10, column 9).

Finally, Appendix 1: Table 2.8, shows the CITS robustness analysis. The results suggest an even stronger association between COVID-19 and the changing reasons behind a teacher job posting in Kentucky. Both the magnitude of the coefficients and strength of the statistical significance are stronger than those found in the difference-in-difference estimate. However, these models do not have as strong causal properties.

Table 2.4 Matching Diff-in-Diff Estimates: Impact of COVID-19 on Teacher Job Postings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total	**Death**	**Leave**	**New Position**	**Other**	**Resign**	**Retire**	**Fired**	**Transfer**
COVID*POST	-0.07	-0.02	-0.03	-0.16	-0.29***	0.36**	-0.05	0.16**	-0.04
	(0.04)	(0.02)	(0.02)	(0.11)	(0.10)	(0.15)	(0.10)	(0.08)	(0.11)
Year (2014)									
2015-2016	-0.01	0.00	-0.02	-0.06	-0.31	0.42**	-0.31***	0.09	0.18*
	(0.06)	(0.02)	(0.03)	(0.11)	(0.23)	(0.19)	(0.11)	(0.12)	(0.11)
2016-2017	-0.01	0.00	0.02	-0.08	-0.42	0.55***	-0.32***	-0.00	0.24**
	(0.07)	(0.01)	(0.03)	(0.12)	(0.26)	(0.21)	(0.12)	(0.13)	(0.11)
2017-2018	0.12	0.01	-0.01	0.03	-0.52*	0.68***	-0.34**	-0.00	0.27*
	(0.08)	(0.02)	(0.04)	(0.17)	(0.31)	(0.25)	(0.14)	(0.14)	(0.14)
2018-2019	0.07	-0.00	0.02	-0.03	-0.72*	0.79**	-0.72***	0.18	0.53***
	(0.11)	(0.02)	(0.05)	(0.21)	(0.39)	(0.31)	(0.18)	(0.18)	(0.20)
2019-2020[+]	0.02	0.01	0.01	-0.05	-0.58	0.94**	-0.80***	-0.04	0.53**
	(0.12)	(0.03)	(0.05)	(0.23)	(0.44)	(0.38)	(0.22)	(0.20)	(0.22)
2020-2021[+]	0.07	0.04	-0.05	0.85***	-0.19	-0.21	-0.69***	-0.12	0.44**
	(0.09)	(0.04)	(0.05)	(0.24)	(0.19)	(0.32)	(0.20)	(0.19)	(0.22)
2021-2022[+]	0.06	0.03	-0.05	0.09	-0.47	0.68	-0.81***	0.01	0.58**
	(0.11)	(0.04)	(0.06)	(0.27)	(0.43)	(0.42)	(0.24)	(0.22)	(0.25)
Robust standard errors in parentheses									
*** p<0.01, ** p<0.05, * p<0.1 [+] COVID-19 AYs									

2.7 Discussion

Overall, these results provide insights into the other side of the coin—demand for teachers—during the pandemic in Kentucky whereas current papers focus on the supply of teachers. There was not enough evidence to observe a causal effect of COVID-19 exposure on the total number of job postings in Kentucky schools. This finding is supported in the literature by reports from principals indicating that while schools have more open job postings since COVID-19 the openings are due to a lack of applicants not an increase in the number of total job postings (Zuo et al., 2022).

Looking at the results from the eight justifications for a teacher job posting provides an under-the-hood view of what caused changes in demand for teachers during COVID-19 something currently missing in the literature. As predicted, this analysis observes a causal link between teacher resignations and the pandemic. Specifically, schools in Kentucky with a higher exposure to COVID-19 had a little over a one-third increase in teacher job postings due to resignations when compared to similar schools with a low COVID-19 exposure. Considering schools in the treatment and control group had an average of 6.6 job postings prior to treatment an increase in .36 of a job posting would have a meaningful impact on the total number of job postings. This finding seems reasonable due to teachers reporting an increase in the number of hours worked, increased stress levels, elevated levels of emotional distress, and a higher intention to leave the profession since the start of the pandemic. Furthermore, a sensitivity analysis was performed that provides more evidence to support the parallel trends assumption. In this analysis, an even stronger relationship is observed when performing the DID without matching for teacher vacancies due to resignations (Table 2.5). Schools in this sample

with a higher COVID-19 exposure had an increase in .46 of a job posting, almost one-half of job posting (detailed results Appendix 1: Table 2.9). While other studies report an increase in teachers' intention to leave or higher teacher turnover rates, they can't link those intentions to leave to a specific job posting or higher teacher turnover rates to a specific reason a teacher left the profession (Camp et al., 2023; Goldhaber & Theobald, 2023; Harbattkin et al., 2023; Nguyen et al., 2022).

Table 2.5 Diff-in-Diff Estimate: Impact of COVID-19 on Teacher Job Postings due to Resignation

	(1)
	Resignation w/o Matching
COVID* Post	0.46***
	(0.11)
Year (2014)	
2015	0.32***
	(0.09)
2016	0.30***
	(0.10)
2017	0.42***
	(0.14)
2018	0.58***
	(0.17)
2019	0.80***
	(0.21)
2020	0.58***
	(0.19)
2021	1.11***
	(0.22)

The miscellaneous category of other and termination provided the most surprising results. COVID-19 cases per capita had a causal impact on the number of job postings for other reasons for schools in Kentucky. Kentucky schools in the highest tertile of COVID-19 exposure had a .29 decrease in job postings due to other reasons. It's hard to postulate without additional details of what is captured by the "other" category and why the COVID-19 pandemic decreased the number of job postings in this category. Additionally, termination increased the number of teacher job postings by a smaller magnitude only .16 of a job posting in the treated Kentucky schools. This could be due to teachers resisting COVID-19 safety protocols or schools needing to downsize during the pandemic.

When comparing Kentucky schools with high COVID-19 exposure to schools with low COVID-19 exposure, resignations from the 2015-2016 AY to the 2019-2020 AY were statistically significant and increased the number of job postings each year. These patterns are consistent with the literature on teacher turnover suggesting that teachers are leaving the profession due to low wages, increasing responsibility, stress, and burnout (J. F. Bleiberg & Kraft, 2023; Nguyen et al., 2020a; Nguyen & Kremer, 2022; Pressley, 2021; Pressley et al., 2021; Walker, 2022; Zamarro et al., 2022).

2.8 Conclusion/Limitations

While the supply side of the teacher labor market has been examined pre and post-COVID-19, the other side of the coin, teacher demand has not been examined. The results of this quasi-experimental study suggest that the total number of teacher job postings did not change between schools with high and low exposures to COVID-19 but

when exploring the reasonings behind those job postings schools in Kentucky with the highest COVID-19 exposure compared to schools with the lowest COVID-19 exposure did experience a one-third increase in teacher job postings due to a teacher resigning. This analysis highlights that education policy experts in the teacher labor markets need to understand not only the total impact, but what is happening underneath the surface because when exploring just the total number of job postings it appears that COVID-19 had no impact, but when looking at the reasons behind teacher job postings being created an effect is found—the number of teacher job postings created due to teacher resignation did increase during the pandemic. Policymakers need to be aware of these subtilities, so they know the real impact of teacher shortages on principals, teachers, and students.

Currently, this analysis considers the impact of the first three years of COVID-19 upon the number of teacher job postings. However, as the literature and surveys note, COVID-19 had a lagged and compounding effect on the stress teachers were feeling. As more data becomes available, testing the model with additional years of COVID-19 exposure will provide further insights into the relationship between COVID-19 and the number/reasons for teacher job postings. This study provides a potential uniform approach for assessing such data as it becomes available.

This analysis is the first to explore the impact COVID-19 had on teacher labor markets focusing on the demand side using a quasi-experimental design. Due to limitations of data, most researchers are unable to use quasi-experimental designs in general. To leverage a quasi-experimental design, individual job postings were collapsed to the school level. The matching difference-in-difference model uses a dosage effect to compare schools within counties with a low level of COVID-19 exposure to those with

the highest level of COVID-19 exposure. While not a perfect control group considering COVID-19 impacted everyone, it does provide a test for how different levels of COVID-19 spread within a school district affected demand for teachers. Furthermore, the model controls for many factors as indicated in the literature that would impact the number of vacancies or new teaching positions at a school such as student performance, enrollment, number of students on free and reduced lunch, Title-I status, median income of households, and the unemployment rate as a proxy measure of other job opportunities for teachers. Additionally, the model controls for district-level ESSER funds to help minimize the effect of the federal relief packages for school districts. One additional variable that could be added into the model is school mode—virtual or in-person. While this would be an improvement in the analysis it would likely only affect the 2020-2021 AY when schools were switching between both modes as COVID-19 cases per capita fluctuated per county. After the 2020-2021 AY school year, most schools returned to in-person learning in Kentucky. Of note, the matching reduced the sample to thirty-eight percent of the original sample. While this comes at a loss of precision, it increases the confidence in having comparable treatment and control groups.

As noted previously, teacher labor markets in the United States are generally local markets that need to be explored at the state or lower levels. This paper addresses this concern by specifically looking at the teaching market in Kentucky. Furthermore, Kentucky is an important market to explore because it is a state with a high concentration of rural and low-income communities and there is a strong association in the literature between high teacher turnover and rural/low-income areas.

This paper fills a gap in the literature on teacher labor markets by exploring (1) the other side of the coin—demand for teachers, (2) the impact COVID-19 had on teacher labor markets, (3) looking at under the hood of teacher demand by exploring the reasons a teacher job posting was created, (4) using a quasi-experimental design, (5) exploring a niche teacher labor market Kentucky.

CHAPTER 3. COVID-19 POLITICAL IDEOLOGY AND TEACHER TURNOVER IN KENTUCKY

3.1 Introduction

For the past two years news outlets such as the Wall Street Journal, NPR, and the New York Times have reported about the Great Resignation referring to the roughly 33 million people who have left their jobs in the wake of COVID-19 (Goldhaber, D. & Theobald, R. 2022). Some school districts opted for online instruction such as in Chicago and Los Angeles. Other states such as Indiana, Mississippi, and Tennessee moved to in-person instruction. During the summer of 2020, a teacher in Arizona died from COVID-19 while teaching summer school and sharing a classroom with her colleagues.[12] Thus, teachers working in school districts that returned to in-person instruction wrestled with the option to quit and lose their income, retire early if possible, or take on the health risks. This was especially difficult for those teachers in an at-risk category due to age or other illnesses. Some states witnessed protests and teachers calling in sick and some teachers opted to quit or take early retirement rather than returning to the classroom. This paper analyzes not only if teacher turnover increased during the pandemic in Kentucky, but due

[12] https://www.nbcnews.com/news/us-news/beloved-arizona-teacher-dies-coronavirus-two-others-sharing-classroom-also-n1233672

to the highly politicized environment around COVID-19, it examines how turnover was impacted by the interaction of the pandemic with the political ideology of a county.

3.2 Literature Review

3.2.1 Teacher Turnover

The greatest predictor of a student's success outside the home is the quality of their teachers (Chetty et al., 2014c; Hanushek, 2011a; Rivkin et al., 2005). Teacher attrition can limit students' access to a highly effective teacher via a decreasing labor supply (Kraft & Papay, 2014b; Ronfeldt et al., 2013b; Sorensen & Ladd, 2020b; Westley, 2011) and the heavy costs associated with it (Boyd et al., 2005c; Carver-Thomas & Darling-Hammond, 2019b).

The literature on teacher turnover is robust (Nguyen et al., 2020b). A recent meta-analysis provides a comprehensive examination of 120 studies on teacher turnover and highlights how school, teacher, and external characteristics influence teacher turnover and retention (Ngyuen et al., 2020).

School characteristics influence a teacher's mobility and attrition. Researchers have examined how the following school features impact teacher turnover: funding, student-to-teacher ratios, school size, student achievement, the percentage of minority populations, urbanicity, percentage of low-income students, number of instructional coaches, access to materials, number of students on an individualized education plan (IEP), school discipline, quality of resources including teaching resources and professional development, administrative support, and school level. Among these factors, teacher attrition rates are higher for schools with more low-income and minority students

(Title-I schools) which furthers income inequality (Carver-Thomas & Darling-Hammond, 2019b; Grissom et al., 2016a; Nguyen et al., 2020b). Recent studies indicate that teacher turnover in low-income areas is also highly correlated with rural areas, especially in the South (Carver-Thomas & Darling-Hammond, 2019b; Cowen et al., 2012b; Gagnon & Mattingly, 2015b). Additionally, teacher turnover is heightened at the middle school level. Negative perceptions of administrative support, lower quality of professional development and mentoring, as well as higher rates of student discipline, are all associated with teacher turnover (Grissom et al., 2016a; Nguyen et al., 2020b). There is mixed evidence on whether school size impacts teacher turnover (Hanushek et al., 2004b; Nguyen et al., 2020b).

Teacher characteristics also impact teacher turnover. Teacher characteristics include gender, age, race, academic achievement, years of experience, and teaching specialty (Ngyuen et al., 2020 (Grissom et al., 2016a). One-third of all teachers leave within the first three years of teaching and at least half leave within the first five years of teaching (Glazerman, 2008). This conclusion is further supported by the fact that teachers under the age of 28 have higher attrition rates (Grissom et al., 2016a; Nguyen et al., 2020b). Furthermore, teachers with higher academic ability measured by college entrance exams (ACT/SAT) are more likely to leave teaching (Grissom et al., 2016a; Nguyen et al., 2020b). Teacher turnover is also high for special education and STEM fields (Boe & Cook, 2006; Carver-Thomas & Darling-Hammond, 2019b; Goldhaber et al., 2015). Highly effective educators often transfer from low-performing schools to high-preforming schools (Cowen et al., 2012b). Not only is teacher attrition high for early career educators but enrollment in traditional and non-traditional teacher preparation

programs is also declining across the United States (U.S. Department of Education; Gracias and Weiss, 2019).

Finally, external factors that impact turnover include things such as policy shifts, salary increases, merit pay, and employment rates. Salary increases, teacher evaluations, and merit pay increases are all associated with lower turnover rates (Grissom et al., 2016a). While Nyugen's et al.'s (2021) comprehensive analysis looks at certain policy changes and examines a host of other issues that are predictive of teacher turnover, the current literature does little to explore how political ideology in a teacher's geographical region impacts teacher turnover.

3.2.2 Teacher Turnover in COVID-19

Teachers faced many challenges during the COVID-19 pandemic. Some of these include a switch from in-person to remote learning, dealing with higher absenteeism from students and staff, concerns about health and safety, PPE requirements or the lack thereof, as well as communicating these requirements with students and parents. The literature surrounding teacher turnover during COVID-19 can be split into two categories: survey data and analysis of statewide administrative data.

Survey results indicate that teachers faced increased difficulties in teaching during the pandemic, experienced lower rates of job satisfaction, reported more mental health concerns, increased the number of hours worked, and had a stronger desire to leave their profession (Carver-Thomas et al., 2021; M. K. Diliberti & Schwartz, 2021; Steiner & Woo, 2021b; Walker, 2022; Baker et al., 2021; Gicheva, 2022; Hilger et al., 2021; Moser & Wei, 2021; Pressley, 2021; Pressley et al., 2021). While studying teachers' intentions

and desire to leave provides useful information about teacher burnout and working conditions, Nguyen et al. (2022) suggest that a teacher's intention to leave is associated with actual turnover and, while an association exists, teacher's intentions are not an effective proxy measure for actual turnover. For example, a RAND study using district survey results found that teacher turnover increased by four percentage points above pre-pandemic levels. This study also found that teacher turnover was higher in urban districts and low-income school districts, while principal turnover was higher in rural districts (Diliberti & Schwartz, 2023).

Newspapers and other media sources have echoed colloquial teacher concerns, reporting that there would be a mass exodus from the teaching profession due to COVID-19 (Kamenetz, 2022; López Restrepo & Chang, 2022; Natanson, 2022; Singer, 2021; Streeter Gray Leslie, 2021). As the first year of teacher turnover data became available (2020-2021 AY), studies found that while there was a modest uptick in teacher turnover, experts did not see a dramatic shift in teacher turnover. However, as additional years of data have become available many states have found significant changes in teacher turnover (Bacher-Hicks et al., 2023; Barnum, 2021, 2022; Bastian & Fuller, 2023; Camp et al., 2023; M. K. Diliberti & Schwartz, 2021; Goldhaber & Theobald, 2021, 2022; Harbatkin et al., 2023).

Analysis of statewide administrative data has been completed in Massachusetts, Washington, North Carolina, and Arkansas and all indicate that teacher attrition rates have increased since the start of the pandemic. During 2021-2022 AY, teachers leaving the Massachusetts teaching force increased by 15 percent compared to the previous school year. (Bacher-Hicks et al., 2023b). Teacher attrition rates in the 2022-2023 AY

were up almost half a percentage point higher than at any other time in Washington's state history (Goldhaber & Theobald, 2023). Similar results are found in North Carolina where teacher attrition moved from 12.1 percent in 2020-2021 AY to 15.6 percent in 2021-2022 AY(Bastian & Fuller, 2023). Finally, in Arkansas, Camp and McGee found a significant increase in teacher turnover during the 2022-2023 AY (Camp et al., 2023).

While these state analyses are robust, these results are not generalizable to other parts of the United States, as teacher labor markets are very individualized by state contextual factors. An article published in *Education Newsweek* showed some states such as New York and Minnesota (typically Democratic states in recent presidential elections) witnessing a decline in teacher retirements while Arizona (typically a Republican state) had a record number of teachers leave the classroom (Madeline Will, 2020). Testing and exploring teacher turnover rates in other states is essential to understanding the full effect of COVID-19 on teacher turnover in the United States as states adopt different COVID-19 safety protocols.

3.3 Theory

A robust literature exists on teacher turnover before and during COVID-19 and how turnover impacts student achievement. However, little is known about how the political ideology of an educator's environment is associated with teacher turnover. This paper fills that gap by positing a theory for why the political ideology of a teacher's county will impact their decision to stay or leave and investigates the association between the political ideology of a county and teacher turnover before and during the COVID-19 pandemic. Differences in some COVID-19 policies were susceptible to political

perspectives, strengthening our ability to investigate the question of county political ideology and teacher turnover.

Limited research explores whether and how politics influence government employee attrition within public administration. Existing research focuses on senior government officials and measures individual political ideology whereas my study looks at teachers, considered to be street-level bureaucrats, whose specific political ideology is unknown (Akhtari et al., 2022; Bolton et al., 2021b; Cameron & de Figueiredo, 2020; Rutherford & Lozano, 2018). Therefore, rather than rely on the public administration literature to predict a community's political ideology's effect on teacher turnover, I draw theories from two different literatures—political economy and sociology. I will (a) define both theories and how they relate to teacher turnover, (b) describe the policy preferences in both Republican and Democratic counties during the pandemic, (c) explain teachers' general political leanings and policy preferences during the pandemic, and (d) outline how teacher turnover during COVID-19 applies to both theories and predicts teaching sorting.

3.3.1 Political Economy—Tiebout

The first theory comes from Tiebout's model in the field of political economy. The model states that an individual's optimal public provision of public goods can be achieved through competition between local jurisdictions. Tiebout and others testing this theory argue that individuals and families "vote with their feet" and move to local communities that maximize their utility (i.e., satisfaction with their community) or match their tastes and preferences (Tiebout, 1956). "Sorting" refers to the movement of individuals to communities that match their preferences. I argue that Tiebout's model

also applies to teacher turnover and the political ideology of the community in which they teach. When events with high political upheaval occur, the political ideology of a community can have a higher impact on a teacher's utility. Events such as school shootings, accountability changes such as No Child Left Behind (NCLB), curriculum changes like Common Core and Critical Race Theory (CTR), or charter schools and voucher programs often create political debates between Republicans and Democrats. Consequently, the political leanings of a county determine the community's majority opinion and stance on such issues and may fail to resonate with all teachers. The community's stance can either increase or decrease a teacher's utility. A teacher can respond to this change in utility in three ways, (1) leave the profession, (2) stay in the profession, or (3) switch to another district or community. I test whether there is an association between teacher turnover and county political ideology. This analysis does not explore if a teacher switches to another district. My findings suggest some evidence of teacher sorting as reflected by teacher turnover.

3.3.2 Sociology—Neighborhood Effects

The second theory—neighborhood effects—comes from Sociology. The theory was first outlined in the 1980s by William Wilson who argued that neighborhood characteristics of high-poverty areas seriously impact individual outcomes (Wilson, 1987). This theory has been confirmed in a variety of settings including long-term economic, health, and well-being outcomes (Hedman et al., 2015; Jivraj et al., 2020; Murray et al., 2016). Researchers have also established impacts on education from neighborhood effects as some communities receive more funding for education thus impacting student achievement (Chetty et al., 2016, 2020; Chetty, Friedman, Hilger, et

al., 2011). Pulling from this concept of neighborhood effects, I argue the county political ideology of a community or neighborhood can affect a teacher's decision to leave the profession. To distinguish between the two models, Tiebout directly predicts the sorting of teachers whereas neighborhood effects predict general individual impacts which may include the turnover of teachers. In this paper, I hypothesize that neighborhood effects will manifest through an association between teacher turnover and a county's political ideology.

3.3.3 National Teacher Perspectives on Politics and COVID-19 Saftey Protocols

While my data do not include observations of individual teachers' political preferences, there is some national data on teacher's political beliefs. Based on three surveys in the last decade, the national average of teacher political ideology suggests teachers lean more Democratic (Greene & Paul, 2021; Luona et al., 2024; Yettick et al., 2017). Before the pandemic, Education Week Research Center, surveyed teachers nationwide and found that 41 percent reported being Democrat, 27 percent reported being Republican, and 30 percent reported being independent (Yettick et al., 2017). Similarly, a survey conducted by the Heritage Foundation in 2021 found that teachers express more Democratic views than the average respondent (Greene & Paul, 2021). In 2024, a Pew Research Poll found that fifty-eight percent of teachers lean Democratic with thirty-five percent of teachers identifying as Republican (Luona et al., 2024). Not only do teachers report leaning more towards the Democratic party they also report voting for Democrats, with fifty percent of educators reporting voting for Hillary Clinton in the 2016 election and 29 percent reporting voting for Trump (Yettick et al., 2017).

The survey results on teachers' political ideology are also consistent with survey results about educators' COVID-19 policy preferences. A majority of teachers and principals believe that states and districts should be able to mandate requirements for masks and other COVID-19 safety measures (Woo et al., 2022). Consistent with research showing that urban areas are more Democratic, educators in urban areas were more likely to voice support for COVID-19 safety measures than educators in rural areas (Woo et al., 2022). One-quarter of rural teachers were in favor of limiting states' and districts' ability to implement COVID-19 safety protocols. While nationally teachers lean more Democratic there is variation in perspectives based on geography, and these tendencies may not reflect the sample of teachers in Kentucky.

Before the pandemic, political parties in the United States had already become more polarized (Heltzel & Laurin, 2020; Iyengar, 2021; Layman et al., 2006). As parties politicize education policies, teachers are left in the crosshairs of these debates which adds stress to an already increasingly stressful job. In 2017, sixty-five percent of teachers reported avoiding political activities due to a conflict of interest with their jobs from a national sample (Yettick et al., 2017). During the pandemic, forty-eight percent of principals and forty percent of teachers indicated that political issues created work-related stress compared to sixteen percent of working adults who reported that political issues created work-related stress (Woo et al., 2022). Responding to COVID-19-related issues was of greater stress for principals and teachers than race-related issues in a nationwide sample. Thirty-seven percent and sixty-one percent of principals reported being harassed about COVID-19 safety measures (Woo et al., 2022). Since the pandemic, eighty-two percent of teachers have reported that education has deteriorated over the last five years

(Luona et al., 2024). Teachers cite the current political climate, the lasting effects of the COVID-19 pandemic, and the lack of funding and resources as reasons for the decline (Luona et al., 2024). These reports all suggest that teachers' "utility" or satisfaction from their profession diminished because of the politicization of COVID-19 policies in schools.

3.3.4 COVID-19 Republican and Democratic Counties

The COVID-19 pandemic created political divisions between Republicans and Democrats (Gramlich, 2022; Helmstetter, 2022). The political debate about what safety measures to use in schools due to the virus was of particular importance and relevance to the environment of teachers. These debates ranged from discussions about in-person vs remote learning and mask mandates. Not only did teachers face the brunt end of debates about COVID-19 protocols, but at the same time debates about how to teach and talk about racism spread across the country in school board meetings as concerns about CRT swept the nation.

Mask-wearing is robustly correlated with partisanship and was the single most important predictor of mask use (Milosh et al., 2021). This suggests that the constituents in Republican regions preferred less restrictive COVID-19 policies (Courtemanche et al., 2021). Research in Michigan shows that heavily Democratic counties were four times more likely to open fully remote in the 2020-2021 AY and Republican counties were one point seven times more likely to open to in-person instruction (Matt Grossmann Sarah Reckhow, 2021; Silver et al., 2022). Polling data indicates how schools should and did address COVID-19 was divided along party lines (Gramlich, 2022; Helmstetter, 2022). Also, other research suggests that rural areas lean more Republican, while urban areas

lean more Democratic (Parker et al., 2018). Thus politics may have driven teacher turnover during the pandemic as educators were forced to address these highly polarized topics (Diliberti & Schwartz, 2022).

Based on research, Table 3.1 outlines the majority perspective constituents in both Republican and Democratic counties had on COVID-19 protocols for K-12 educational practices such as in-person learning, vaccine mandates, mask mandates, and race-related topics (Horowitz, 2020; C. Jackson et al., 2022; Jones, 2022; Silver et al., 2022; Woo et al., 2022). I anticipate county politics to reflect the perspectives of the majority of the county's constituents.

Table 3.1 Republican vs Democratic Counties

Topic	**Republican Counties**	**Democratic Counties**
In person learning	Prefer in-person learning due to concerns about learning loss, parents not being able to work if kids are at home, and students missing out on social interactions.	Prefer online instruction due to risk of teachers and students spreading or getting the virus and the financial costs of school systems following health guidelines.
Vaccines	Prefer not to have vaccine mandates for high school, middle, or elementary school.	Prefer vaccine mandates for high school, middle, or elementary school.
Mask Mandates	Prefer to not have school mask mandates (44% of republicans).	Prefer mask mandates (92% of democrats).
Race-related Topics	Prefer minimal focus on racial inequality in public schools.	Prefer strong emphasis on racial inequality.

In comparing different political policy preferences, I also considered test-to-play policies and the use of standardized test-taking. However, there is a lack of sufficient and robust research supporting differences between political parties on these policies. Democrats likely favored test-to-play policies that required students to take a COVID-19 vaccine to participate in extra-curriculars based on their stance on COVID-19 vacancies and masks. Whether to have students take standardized tests became a hot topic as students participated in remote learning and because underserved populations faced additional barriers in taking standardized tests and concerns about the sample size of the data collected. However, it appears that standardized test-taking might not have been a politically divisive topic during the pandemic. A recent survey suggests that Democrats and Republicans both supported standardized test-taking after the pandemic even though Republicans pushed back on standardized testing that came along with Common Core (Education Next, 2022).

3.3.5 Prediction of Teacher Sorting—Tiebout and Neighborhood Effects

Tiebout's model and the theory about neighborhood effects imply that a community's political ideology can influence a teacher's decision to leave the profession, especially during the pandemic when COVID-19 school safety protocols became contentious and politicized. Based on teacher surveys, the politicization of COVID-19 protocols affected teachers' working environments. In this paper, I hypothesize that there is an associative relationship between a county's political ideology and a teacher's decision to leave. This is not a causal study, however, based on the established theories of Tiebout sorting and neighborhood effects I posit that the association is directional. With teachers being more Democratic in nationwide research, I predict a higher turnover in

more Republican counties because they are no longer comfortable with the policy implications reflected by the political ideology of their community. This paper adds to the body of research by examining a potential relationship between county political ideology and teacher turnover. It is a first foray into this important topic and suggests that highly polarized political ideology may impact the teacher labor force (Education Next, 2022).

3.4 Background on Teacher Turnover and COVID-19 in Kentucky

Analyzing the impact of political ideology on teacher turnover in Kentucky during COVID-19 is important. Teacher turnover is likely to vary in states such as Kentucky and Arkansas compared to Washington and Massachusetts with different levels of funding for education and different responses to the pandemic. Based on rurality indexes from the community and staffing survey, Kentucky is overall a more rural state than Washington and Massachusetts and only slightly less rural than Arkansas. The Appalachia region of Kentucky falls into the lowest category on the national scale of economic conditions—economically distressed (Curl, 2020). As the literature indicates, higher turnover is associated with more rural areas, especially in the South (Carver-Thomas & Darling-Hammond, 2019b). Thus, COVID-19 could exacerbate these issues in a more rural state such as Kentucky. Second, Kentucky provides a unique political environment to examine the interplay between COVID-19, political ideology, and teacher turnover. During the pandemic, Kentucky, a historically Republican state, had a Democratic Governor, Andy Beshear, whereas Washington a historically Democratic state had a Democratic Governor, Jay Inslee.

Two studies have explored teacher attrition and mobility in Kentucky. Cohen et al. (Cowen et al., 2012b) found that between 1985 and 2005 teachers were not only more likely to leave Appalachia but were less likely to transfer to it. However, Curl (2020) found that between 2009 and 2018, teachers in Appalachia were less likely to leave teaching than other areas and had lower attrition rates. Teachers were more likely to live in school districts with more white students, higher ratings on the TELL working conditions survey, and following periods of state education curriculum reform. Curl (2020) finds that between 2009 and 2015—10,757 teachers left the profession. As the literature indicates, twice the number of teachers left during their first year of teaching compared to their second year of teaching. On average between 2008 to 2018, Appalachia teachers (rural areas) made $3,145 less than teachers outside of Appalachia, and Appalachia student achievement in mathematics was lower on average compared to the rest of the state.

The state of Kentucky sets minimum salary requirements for teachers including preschool teachers through a salary schedule based on experience and educational attainment. In addition to the state requirements, school districts have their own incentive programs. Kentucky teachers do not pay into Social Security but are offered a pension. The monetary value of the pension is based on a multiplier determined by the number of years of service and the average salary of the teacher's five highest-paying years. Teachers are required to work at least five years before being vested into the pension program. The requirements for an unreduced retirement benefit are either any age with 27 years of service credit or age 60 with at least five years of service credit.

In March 2020, as the global pandemic hit America, Kentucky Governor Andy Beshear called for all public schools to close for at least two weeks. In April, the Governor announced that schools would not resume in-person instruction for the rest of the 2019-2020 AY. Local education agencies were given discretion at the beginning of the 2020 to 2021 AY on how to reopen schools. However, in August 2020, the Governor requested that schools remain in remote learning until at least Sept. 28th. Some schools opted for a few weeks of remote learning and then moved into in-person instruction, others delayed the start of school, and some schools reopened for in-person instruction. At the same time, the Governor issued a mask mandate inside public and private schools. He rescinded that order at the end of August when the Kentucky Supreme Court ruled in favor of the state legislature's ability to limit the emergency powers of the Governor. However, an order from the Kentucky Board of Education still required masks to be worn inside school buildings.

With COVID-19 cases rising in November of 2020, Governor Beshear closed all schools to in-person instruction again. As of Dec. 7th 2021, elementary schools in non-red-zone areas were permitted to meet in person. Middle schools were reopened in January of 2021 and by February 2021 the Governor announced that schools were required to be open for in-person instruction twice a week by March 1st. By the end of the 2020—2021 AY, most Kentucky schools were holding in-person classes. Then in September 2021, the Kentucky state legislature passed a bill overriding the state's mask requirement policy, the Governor vetoed the bill, but the legislature overrode the veto. The bill requires school masking decisions to be left to local authorities. This political situation poises Kentucky as a unique state to explore.

Due to data limitations, this analysis will only explore the timeframe from March 2020 to the start of the school year in August 2020. Thus, teachers' decision to leave will be reflective of two marked periods in the COVID-19 pandemic in Kentucky—(1) remote learning for all schools (March 2020 to May 2020) and (2) summer debates and planning about how to reopen schools for the 2020 to 2021 school year. In the future, as the data for the 2021-2022 to 2022-2023 AY becomes available, the additional years will be examined.

3.5 Data

Data for this study was obtained from memoranda of understanding (MOU) with the Kentucky Center for Statistics (KYSTATS) and the Kentucky Department of Education (KDE). The data agreement provides access to 186,702 certified and classified employees within Kentucky's public school system from 2009-2010 to 2020-2021 AY. The data set includes yearly observations on each employee which identifies where they worked, salary, birth year, gender, and other demographic information. Employees are observed when they switch schools or districts within the state of Kentucky, therefore if an employee leaves the dataset between academic years, it is assumed they left the teaching profession (Bolton et al., 2021a). The MOU classified employees as certified or classified staff. Certified staff are employees with a teaching certification or credential, including administrators, teachers, and instructional coordinators/coaches. A classified staff is a district employee who does not require a teaching certification for employment and covers a range of job responsibilities including bus drivers, district personnel, custodians, groundskeepers, maintenance, computer programmers, HR specialists, graphic artists, financial clerks, and school secretaries.

County-level data on political ideology was obtained from the MIT Data and Science Lab.[13] Political ideology over time was determined by the county's percentage of Republican voters in the most recent presidential election. For example, data from the 2008 presidential election was used for years 2009 to 2011, data from the 2012 presidential election was used for years 2012 to 2015, and so on. Median income and other county-level data from 2009 to 2020 were obtained from the US Census Bureau.

The Common Core of Data (CCD) from the Department of Education provided detailed school and district-level covariates from the 2009-2010 to the 2019-2020 AY. The Common Core Directory data set provides enrollment numbers, number of students on free and reduced lunch, Title-I status, school degree of urbanicity, and student-to-teacher ratios for each school. Similar covariates from the Common Core Directory for school districts include enrollment, district level of urbanicity, and student-to-teacher ratios.

The CCD data set also provides financial information that allows for calculating dollar spending per pupil adjusted to 2012 dollars. However, this data was only available from 2009-2010 to 2018-2019 AY. District-level spending per pupil in 2019 was obtained from the Kentucky Department of Education (KDE) and adjusted to the 2012 dollar. KDE data was not used for the entire timeframe because KDE public data sets only include district-level funding per pupil starting in 2019.

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[13]MIT Election Data and Science Lab, 2018, "County Presidential Election Returns 2000-2020," https://doi.org/10.7910/DVN/VOQCHQ, Harvard Dataverse, V9, UNF:6:qSwUYo7FKxI6vd/3Xev2Ng== [fileUNF]

Finally, student-level achievement data was gathered from the National Center for Education Statistics (NCES) at both the school and district level from 2009 to 2018. Data for the school year beginning in 2019 is not available via NCES or KDE website due to the COVID-19 pandemic which resulted in limited testing from 2019-2020 AY. NCES achievement data scores were standardized using a z-score and all student and district-level achievement data for 2019-2020 AY were coded as zero.

The employee cohort is restricted to only certified staff employed between 2009-2010 and 2019-2020 AY between the ages of 18 and 99. Depending on the year, certain employees alternate as classified staff and certified staff. Any employee who worked for at least one year as a certified staff is included in the cohort. After applying the certified staff and age restrictions 82,252 employees remained with 572,727 observations.

Prior to restricting the data set to only certified staff, school- and district-level missing values were singly imputed as the average value over the school or district over time. After narrowing the data set to certified staff, for any additional missing school or district covariates the average of the year prior and the year after the missing value by teacher is imputed. Following both imputation procedures there were 582 employees (< 1 percent) still missing one or more covariates and said employees were excluded from the cohort. The final cohort included 81,667 employees with 567,928 observations.

Unfortunately, the data provided by KYSTATS and KDE does not provide a clear indicator of teacher retirement. Additionally, COVID-19 health risks are associated with higher mortality risks for employees over the age of 60 and those health risks increase with age. During COVID-19, employees approaching retirement could be incentivized to retire earlier than anticipated. While there is no clear indicator variable for retirement,

assumptions were made about teacher retirement based on two key factors: years of teaching experience and age. Certified credential teachers (those in this data set) at the earliest, can access their pension when they have 27 years of experience and have reached the age of 60. While the number of years of teaching experience is provided for most certified employees, 925 observations did not disclose data regarding years of experience. An additional outcome variable is created to account for retirement assumptions. In this specification of the employee turnover variable, certified staff over the age of 59 with 26 or more years of experience are coded as zero, instead of 1, if they left the data set the subsequent year

In the final data set, employees are classified as school-level or district-level employees. District-level employees are educators assigned to a district or central-level office. Examples of these positions included teacher coordinators, traveling teachers, or special education educators splitting their time between multiple school locations.

See Table 3.2 for descriptive statistics on all certified educators the first time they are observed in the data set.

Table 3.2 Demographics of Certified Educators (first year observed)

Demographic	**Average, Median, IQR**
Number of Teachers	82667
Academic year (fall semester), median (IQR)	2009.0 (2009.0, 2012.0)
Percent Republican, median (IQR)	59.8 (49.5, 66.6)
Teacher Covariates	
Age, median (IQR)	37.0 (28.0, 47.0)
Gender (Female =1)	62636 (76.7%)

Table 3.3 (continued)

Salary, median (IQR)	37949.7 (32367.8, 44652.6)
Race	
White	77328 (94.7%)
Unknown	361 (0.4%)
Two or More	90 (0.1%)
Other	249 (0.3%)
Hawaiian	39 (<1%)
Black	3203 (3.9%)
Asian	336 (0.4%)
American Indian	61 (0.1%)
County Level Covariates	
Median Household Income, median (IQR)	43498.0 (35785.0, 47959.0)
Population, median (IQR)	50000.0 (24697.0, 133581.0)
School Level Covariates	
Title I Eligible (1,0)	65491 (86.7%)
Title I Eligible (1,0) median (IQR)	330.0 (241.0, 455.0)
Student Enrollment, median (IQR)	565.0 (400.0, 799.0)
Student to Teacher Ratio, median (IQR)	18.0 (15.0, 20.0)
NCES math scores, median (IQR)	54.5 (37.0, 72.0)
NCES math scores , median (IQR)	67.0 (52.0, 77.0)
School level	
Prekindergarten	76 (0.1%)
Primary	36825 (45.1%)

Table 3.2 (continued)

Middle	14992 (18.4%)
High	21383 (26.2%)
Other	2175 (2.7%)
Ungraded	54 (0.1%)
Secondary	6 (<1%)
District	6156 (7.5%)
District Level Covariates	
Per-Pupil Funding adj 2012, median (IQR)	10817.4 (10014.4, 12054.9)
Student Enrollment, median (IQR)	6157.0 (2889.0, 14659.0)
Student to Teacher Ratio, median (IQR)	16.0 (15.0, 17.0)
NCES math scores, median (IQR)	53.0 (44.0, 62.0)
NCES reading scores, median (IQR)	67.0 (60.0, 75.0)
Degree of urbanization (urban-centric locale)	
City, large	14594 (17.9%)
City, small	2797 (3.4%)
Suburb, large	10010 (12.3%)
Suburb, midsize	1451 (1.8%)
Suburb, small	1698 (2.1%)
Town, fringe	1846 (2.3%)
Town, distant	9868 (12.1%)
Town, remote	6830 (8.4%)
Rural, fringe	15050 (18.4%)
Rural, distant	12184 (14.9%)
Rural, remote	5339 (6.5%)

3.6 Methods/Analysis

A hazard model controlling for teacher, school, and district-level covariates is used to analyze the data. The estimation is based on a similar model used in Cowen et al. (2012) which also looked at teacher turnover. This hazard model is a maximum likelihood estimation (MLE) of the probability that an employee will exit. The underlying distribution of time dependence is assumed to be a Weibull distribution and is adequate for this analysis (Cowen et al., 2012b). A hazard model approach is necessary for this study as hazard ratios not only account for the total number of events but also the timing of each event. The event in this model is employee turnover. It is critical in this analysis to determine whether an employee turns over during COVID-19.

The hazard model is estimated as follows:

$$\Pr(Y_{it}) = H(B_0 + B_1 Year_i + B_2 Republican_t + B_3 COVID * Republican_t + B_4 Teacher_{it} + B_5 X_i + B_6 School_t + B_7 District_t)$$

The outcome probability—employee turnover—is identified for teachers/staff/administrators between 2009-2010 AY to 2019-2020 AY as 1 if the employee was not in the data set the subsequent year (i.e. turnover) and 0 if not a turnover. COVID is coded as 1 for the 2019-2020 AY to reflect that COVID was present in the subsequent year when turnover was evaluated for 2019-2020 AY employees. Education policymakers worried that COVID-19 would push teachers close to retirement, to either leave the profession early or retire early. To see if the results are being driven by a group of teachers close to retirement, an additional model is estimated with age and experience assumptions in the outcome probability.

Year is a dummy variable with "1" denoting the first year a teacher can be in the data set in 2009-2010 AY and "11" marking the last year a teacher can be in the data set. Republican is an indicator variable coded as "1" if over fifty percent of the county voted Republican in the last presidential election. The explanatory variable of interest, B_3, interacts with the timing of COVID-19 and the indicator variable for Republican or not. COVID-19 is coded as 1 for the 2019- 2020 AY. Because teacher turnover is determined by the employment status of the subsequent school year. This model estimates the impact COVID-19 had on educators' decision to leave the market due to (a) remote learning from March of 2020 to the end of the school year and (b) debates and decisions made by schools and districts about how to reopen schools in the Fall of 2021 before having an effective vaccine.

Teacher time-invariant characteristics (X_i) include race and gender. Race was classified as Black, Asian, American Indian, Hawaiian, white, two or more races, other, and unknown. Gender was classified as female and male. Teacher time-varying characteristics ($Teacher_{it}$) include salary and age. Age is calculated from the birth year provided. Salary is a continuous variable representing a teacher's base salary as well as any additional stipend for performing extra duties.

School varying time covariates ($School_t$) are included for each teacher classified as a school-level employee. School-level is classified as pre-k, primary, middle, high, and ungraded. Enrollment, the number of students eligible for free and reduced lunch, and student-to-teacher ratio is included as continuous covariates. Title-I status is classified as yes/no for Title-I eligibility.

All employees have district and county time-varying covariates. Due to the structure of the public school system in Kentucky, county boundary lines are the same as district boundary lines. County-level covariates included median income and population. District-level covariates included cost-per-pupil expenditures. Because of Kentucky's stark contrast in its urban to rural make-up, an urban-centric locale measure was included as a scale of eleven different degrees of urbanization including city (large, small); suburb (large, midsize, small), town (fringe, distant, remote), and rural (fringe, distant, remote). To test the robustness of the model due to concerns that there is a strong correlation between urbanicity and the percentage of individuals voting Republican at the county level in Kentucky, urbanicity was also removed from the model.

Finally, math and reading achievement scores from NCES were included at the school- and district-level, with appropriate grades included based on the school level. The level reflects the percentage proficient at the midpoint (standardized to z-score). Enrollment, student-to-teacher ratios, and NCES student district-level covariates were structured and calculated in the same format as the previously noted school-level covariates.

While all certified staff are included in this analysis, the study narrows the data set further to only include those certified employees with a job class code indicating a position where the employee is regularly and directly interacting with students. The study uses the subset teacher data set and tests with and without teacher retirement assumptions.

In summary, the model is estimated for five different specifications—all certified employees *without* retirement assumptions, all certified employees *without* retirement

assumptions and *without* urbanicity controls, all certified employees *with* retirement assumptions, only teachers *without* retirement assumptions, and only teachers *with* retirement assumptions.

3.7 Results

All estimates are reported as a hazard ratio. When a ratio is over one it indicates an increased risk for turnover and when less than one it indicates a decreased risk for turnover. Future iterations of the paper will include margin impact estimations for the interpretation of magnitude. Currently, the direction of the relationship and statistical significance are explored.

In the primary model—adjusting for employee-, school-, and district-level covariates, teacher turnover was associated with a decreased risk in later years (Table 3.3).[14] Due to COVID-19 protocols in the 2019-2020 AY and in the summer of 2020, the risk of turnover among the labor force decreased compared to the 2009 - 2010 AY (HR = 0.6476, 95% CI: 0.599 – 0.7, $p < 0.001$). Similarly, counties identified as Republican per the 2020 Presidential election were associated with a decreased turnover rate (HR = 0.8868, 95% CI: 0.8364 – 0.9402, $p = 0.0001$); and, during COVID a similar pattern is observed, Republican counties are associated with a decreased turnover rate (HR = .8349, 95% CI: .7614 – .9154, $p = 0.0001$). For more detailed estimates refer to Appendix 2: Table 3.6. When making the 2018-2019 AY the reference year, the risk of turnover due to COVID-19 was statistically insignificant (HR=.9846, 95% CI: 0.9015 – 1.07, $p = .73$: Appendix 2: Table 3.11).

[14] No adjustments were made for retirement assumptions.

Table 3.4 Certified Educators (No Retirement Assumptions)

	Hazard Ratio	St.Err.	p-value	[95% Conf	Interval]	Sig
Republican County (0,1)	0.8868	0.0265	0.0001	0.8364	0.9402	***
COVID*Republican	0.8349	0.0392	0.0001	0.7614	0.9154	***
School Year (2009-2010)						
2010-2011	0.803	0.0232	0	0.7587	0.8498	***
2011-2012	0.7092	0.0265	0	0.6591	0.7631	***
2012-2013	0.7081	0.0257	0	0.6596	0.7603	***
2013-2014	0.6969	0.0261	0	0.6476	0.75	***
2014-2015	0.6178	0.0237	0	0.5731	0.6659	***
2015-2016	0.6141	0.0239	0	0.569	0.6628	***
2016-2017	0.5865	0.023	0	0.5431	0.6334	***
2017-2018	0.5938	0.0232	0	0.55	0.641	***
2018-2019	0.6476	0.0257	0	0.599	0.7	***
2019-2020	0.6372	0.0347	0	0.5727	0.709	***
Teacher Covariates						
Age	1.0454	0.0005	0	1.0444	1.0465	***
Gender (Female =1)	1.0049	0.0138	0.7186	0.9784	1.0323	
Salary, (per $10,000)	0.7375	0.0035	0	0.7306	0.7445	***
Race (White)						
Unknown	1.2756	0.093	0.0008	1.1058	1.4714	***
Two or More	3.2547	0.4443	0	2.4906	4.2532	***
Other	2.0663	0.1494	0	1.7933	2.3809	***
Hawaiian	1.0184	0.3072	0.9518	0.5638	1.8395	
Black	1.018	0.0278	0.5144	0.9649	1.074	
Asian	1.4166	0.1159	0	1.2067	1.6631	***
American Indian	1.635	0.2589	0.0019	1.1989	2.2299	***

Table 3.3 (continued)

County Level Covariates						
Median Income, (per $10,000)	1.1068	0.0084	0	1.0904	1.1234	***
Log County Population	1.0683	0.0128	0	1.0434	1.0938	***
School Level Covariates						
Title I Eligible (1,0), , school level	1.1131	0.0243	0	1.0665	1.1618	***
Free and Reduced Lunch, per 200 students	1.0817	0.0133	0	1.0559	1.1081	***
Enrollment, per 200 students, school level	0.9541	0.0064	0	0.9416	0.9667	***
Student to Teacher Ratio, school level	1.0051	0.0016	0.0012	1.002	1.0082	***
NCES math z-score, school level	1.0036	0.0101	0.72	0.984	1.0236	
NCES reading z-score, school level	0.956	0.0101	0	0.9364	0.976	***
**** p<.01, ** p<.05, * p<.1*						

Additionally, higher turnover was associated with educators working in a school with a higher proportion of students eligible for free and reduced lunch (HR = 1.0817, 95% CI: 1.02 – 1.0559, p= 1.1081) and in Title-I schools among low-income schools and districts (HR = 1.1131, 95% CI: 1.0665 – 1.618, p < 0.001). Moreover, higher teacher turnover rates were associated with employees who were Asian (HR = 1.4166, 95% CI: 1.2067 – 1.6631, p < 0.001) and who reported two or more ethnicities (HR = 3.2547, 95% CI: 2.491 – 4.25, p < 0.001) relative to employees who are white. Older classified staff were associated with a higher turnover (HR = 1.0454, 95% CI: 1.044 – 1.0465, p <

0.001). The estimated increased turnover risk during COVID-19 was consistent without controls for urbanicity (see Appendix 2: Table 3.7).

Additionally, the estimated increased turnover risk during COVID-19 was consistent under certified educators' retirement assumptions (Table 3.4). (See Appendix 2: Table 3.8 and Table 3.12 for detailed estimations).

Table 3.5 Certified Staff Retirement Assumptions

	Without Retirement	**With Retirement**
Republican County (0,1)	0.8868	0.8969
	(0.0265)***	(0.0275)***
COVID*Republican	0.8349	0.8305
	(0.0392)***	(0.0399)***
Retirement Assumptions		
age < 59	No	Yes
exp <26	No	Yes
*** *p<.01, ** p<.05, * p<.1*		

When only including teachers in the model, the results are still consistent with only a slight increase in hazard ratio for teacher turnover in Republican counties (Table 3.5). (See Appendix 2: Table 3.9 and Table 3.10 for detailed estimations).

Table 3.6 Teacher Retirement Assumptions

	Without Retirement	**With Retirement**
Republican County (0,1)	0.869	0.8807
	(0.0289)***	(0.03)***

Table 3.5 (continued)

COVID*Republican	0.8557	0.8515
	(0.0439)***	(0.0446)***
Retirement Assumptions		
age < 59	No	Yes
exp <26	No	Yes
*** *p<.01, ** p<.05, * p<.1*		

Finally, one possible explanation for the current findings is that during recessions individuals are unlikely to leave a job to maintain financial stability. This might also explain why higher turnover is associated with higher median household incomes, employees living in more wealthy areas have more opportunities to find jobs that meet their preferences in COVID-19 and feel less of a risk of switching jobs during a recession. To control for this, additional modeling using a control variable for unemployment is added to the model (Grissom et al., 2016a; Nguyen et al., 2020b). The results show no real difference in the main results (Appendix 2: Table 3.12).

Overall, the results indicate that the first year of post-COVID-19 data was not associated with a sizeable impact on the number of employees exiting the profession. This finding is consistent with several sensitivity analyses. The study did reveal that over time Republican counties are associated with a decrease in teacher turnover.

3.8 Limitations/Conclusions

This paper is the first to examine the relationship between county political ideology and teacher turnover and the intersection of COVID-19. In a comprehensive study of Kentucky educators, employed from 2009-2010 AY to 2019-2020 AY, the

results of this study indicate that COVID-19 was not associated with a sizable impact on the number of personnel leaving the workforce. Furthermore, Republican counties were more likely to experience a decrease in teacher turnover, even more so during COVID-19. This research identifies a strong association between lower teacher turnover rates and Republican counties. While this finding does not support the hypothesis that Republican counties will experience higher turnover rates in Kentucky during COVID-19, another study had similar results showing that teacher turnover was higher in urban areas (Woo et al., 2022). Results about the interaction between COVID-19 and teacher turnover should be interpreted with caution as only one year of post-COVID-19 data is included in the analysis currently.

One possible explanation for the current findings is that teachers might already be sorted into teaching in communities that match their tastes and preferences before the pandemic thus teachers in more Republican areas might be less likely to leave the profession because they are already in a community that matches their preferences. While a plausible theory, it is not testable because I don't have information on individual teacher's political preferences. Furthermore, presidential election results might not generate enough variation in the data. Additional analysis will also sort counties based on a dosage effect and look at gubernatorial election results.

These results may also be impacted by unmeasured confounding and our imputation method for missing data. Unmeasured confounding is a common limitation of observational studies such as this. The lack of achievement data during COVID-19 years poses additional challenges that researchers and educators are addressing. Testing the model under different imputation methods can reflect greater robustness of the results.

Additionally, requesting student-level achievement data from KYSTATS and KDE can prevent the need for some data imputation.

Additional iterations of the paper will include more years of post-COVID data, a falsification test, and other subgroup analyses. During subsequent COVID-19 school years, new and changing pressures were put on teachers, as well as more relaxed COVID-19 measures in other areas of Kentucky. Testing the model with an additional year of COVID-19 exposure will provide further insights into the relationship between political ideology, COVID-19, and teacher turnover. Identifying turnover trends by year and performing a falsification test where the 2018- 2019 AY is included as a treatment group will also add clarity to the results. Subgroup analysis could provide further scrutiny and insights into early to mid-level career educators. Especially, when turnover can be so high for early educators (Grissom et al., 2016a; Nguyen et al., 2020b). Subgroup analysis will also be done for administrators, hard-to-fill positions in STEM and special education, and comparisons of classified staff including bus drivers and cafeteria workers. Finally, the current analysis focuses only on teacher turnover as an option for how teachers sort in response to COVID-19. The data does show if a teacher switches between counties or districts. This analysis would allow for greater congruence with Tiebout's model.

The data set has two important limitations. The first is that the data does not identify if a teacher leaves the profession in the middle of the school year making it difficult to test varying COVID-19 policies throughout the year. All COVID-19 impacts are assumed into one school year. The second is that a teacher's political ideology is not measured making it impossible to test the mechanisms behind a county's political ideology and teacher turnover.

While there are limitations to this study, the model does include a large data set of 82,667 employees with 567,928 observations and the results are consistent with several specification tests including limiting the data set to only teachers and removing possible confounding variables such as urbanicity. The hazard model also controls for most factors that could otherwise influence an educator's decision to leave the market such as age, ethnicity, income and other factors such as the county they work in, county size, student performance, student-to-teacher ratios, per-pupil funding, and enrollment. Additional teacher-level covariates such as experience and a teacher's education level can be added to the model (Grissom et al., 2016a; Nguyen et al., 2020b). Title-I status and free and reduced lunch estimates are also consistent with previous literature indicating teacher attrition and turnover are higher among low-income areas (Grissom et al., 2016a; Nguyen et al., 2020b). While the initial model with no retirement assumptions indicates that older teachers are more likely to turnover, when retirement assumptions are included in the model, the findings are still robust and consistent with the original estimation. Most importantly this paper fills a gap in the teacher turnover literature by exploring the relationship between teacher turnover, political ideology, and COVID-19 as educations navigate an increasingly polarized policy environment.

CHAPTER 4. THE IMPACT OF COMMON CORE ON ENROLLMENT AND COMPLETION OF TEACHER PREPARATION PROGRAMS

4.1 Introduction

Teachers are key to a student's educational success (Chetty et al., 2014a, 2014d; Chetty, Friedman, & Rockoff, 2011; Hanushek, 2011b). However, teachers often get caught in the crosshairs of political debates regarding educational reforms. Most recently the teaching profession faced criticism from both sides of the political aisle about how to provide educational services during a global pandemic and curriculum changes surrounding Critical Race Theory (CRT). During the 2010s, Common Core—a curriculum reform in the United States—embroiled the teaching community in a debate about its effectiveness and placed more responsibility and accountability on educators. The highly political debates and the additional responsibilities placed on teachers created a negative work environment for educators and potentially discouraged new teachers from entering the profession. While not the most recent policy debate in education, Common Core serves as an example of how policy changes can impact the teacher labor market, especially the teacher pipeline. Teacher labor markets should be a top priority for policymakers, especially considering the increased number of teacher strikes in the last decade, the decline in enrollment in teacher preparation programs, the increased teacher turnover induced by a global pandemic, and the continued polarized political environment. This paper contributes to the literature on teacher labor markets because it

explores a potential suppressing factor in the teacher labor supply—the implementation of Common Core—through a quasi-experimental research design.

4.2 Background on Common Core

In 2008, the National Governor's Association (NGA) released a dire report noting U.S schools were behind their international peers and suggested states needed to "adopt a common core of international benchmark standards in math and language arts" (NGA, 2008). At the time of this 2008 report, every state had its own unique education standards and different levels of student proficiency. The Common Core curriculum was designed to create consistent standards and improve students' achievement and college and career readiness. The NGA designed and completed the Common Core curriculum by 2010. Current governors supported the curriculum and while not federally mandated, like No Child Left Behind (NCLB), the Obama Administration encouraged its adoption through financial incentives. By 2010, most states had adopted Common Core, but each state had different projections on when the curriculum would be fully implemented. As of the 2014-2015 AY, forty-five states had implemented Common Core. In the same school year, frustrations about Common Core pushed some early adopting states to make changes to already implemented curricula.

While Common Core was a curriculum change for students and teachers, it had vast implications on accountability in a post-NCLB period. As forty-five states implemented Common Core, they faced the issue of also revamping and assessing their accountability systems as state standardized tests changed to reflect the new curriculum. Twenty-four states planned to use the Partnership for Assessment of Readiness for

College and Careers (PARCC) exam, but after much controversy over the high rigor of the exam, many states opted for alternative tests. Effective school accountability systems must be linked to reliable student data, or they are not useful (Sears, 2014). Thus, while Common Core was not directly aimed at increasing accountability, implementation of Common Core required states to reassess and address how accountability would be measured.

4.3 Literature on the Impact of Common Core

A large body of research examines the impact of Common Core (Bleiberg, 2016; EPE Research Center, 2013; Hamilton, 2015; Jochim & Lavery, 2015; Loveless, 2014, 2015, 2016; Polikoff, 2017; Sforza et al., 2016; Song et al., 2022). Prior to 2015, research about the impact of Common Core on student outcomes explored associative relationships because of data limitations due to how recent Common Core was implemented and because of the difficulties of creating a quasi-experimental design. Creating a quasi-experimental design is challenging with nationwide policies because most, if not all, states are affected by the policy, which makes establishing a control group difficult. Researchers exploring Common Core use a similar approach to Jacob and Dee's study on NCLB to overcome the issue of finding a control group by leveraging differences in curriculum rigor at the state level before the policy (Dee & Jacob, 2011a). Since 2015, a handful of studies have used a quasi-experimental design to estimate the impact of Common Core on student outcomes with mixed results (Loveless, 2014b, 2015b, 2016b; Schmidt & Houang, 2012; Sforza et al., 2016b; Song et al., 2022b; Xu & Cepa, 2018).

While these studies explore the effectiveness of Common Core on student achievement, they do not evaluate the impact Common Core has on students via teacher labor markets. Researchers have identified the greatest predictor of student success outside the home is the quality of their teachers (Hanushek, 2011b). Students are likely to have greater access to quality teachers when there is a larger pool of newly trained teachers. However, if there is not a large pool of newly trained teachers, then students' access to highly effective teachers and their ability to learn is diminished. The assumption here is that a large quantity of teachers also increases competition, and the number of highly effective teachers' students can access (Darling-Hammond, 2000a; C. K. Jackson & Bruegmann, 2009; Kraft & Papay, 2014c; Ladd & Sorensen, 2017a; Ronfeldt et al., 2013c; Sorensen & Ladd, 2020c). The quality and condition of the teacher labor market impacts student learning. Knowing how Common Core affected teacher labor markets and if the curriculum changes deterred potential teachers from entering teacher preparation programs is an important next step in understanding the impact of this policy on the education system and how future curriculum changes could impact teacher labor markets.

4.4 Decline in Enrollment and Completion of Teacher Preparation Programs

Since 2010, there has been a national decline in enrollment and completion of teacher preparation programs (see Figure 4.1) (García & Weiss, 2019h, 2019d). In the 2016-2017 academic school year 340,000 fewer students enrolled in teacher preparation programs and students completing teacher preparation programs decreased by 28 percent (U.S. Department of Education).

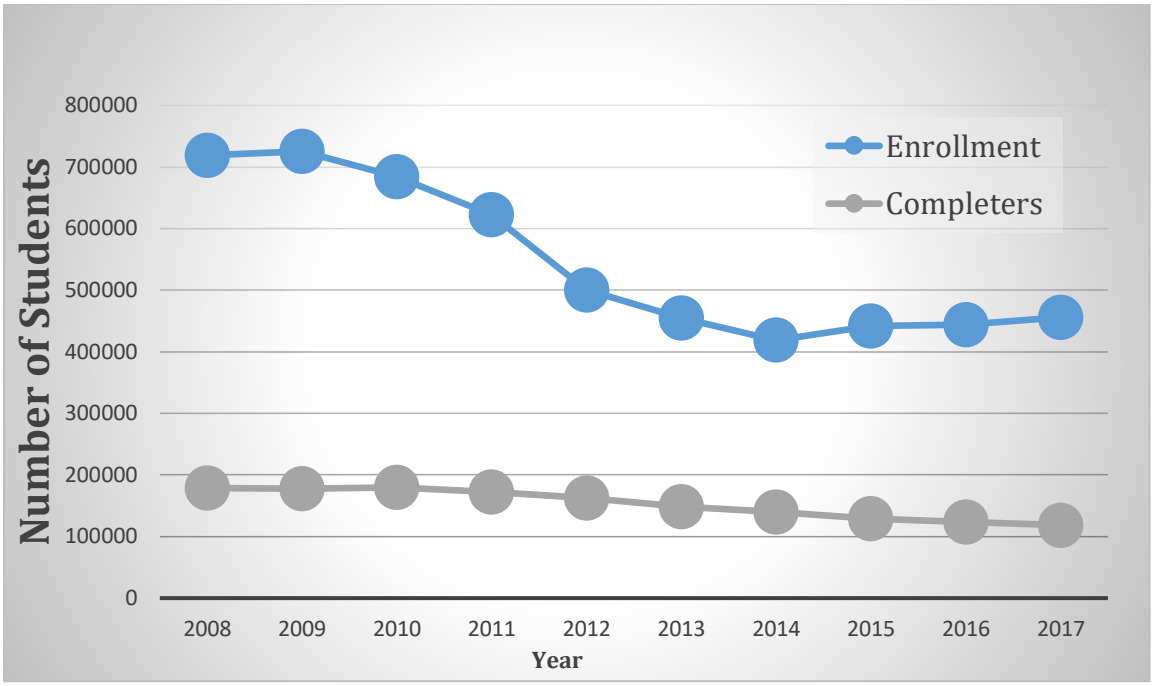

Figure 4.1 Enrollment and Completion Rates in Teacher Preparation Programs[15]

The decline in enrollment occurs most notably in traditional teacher preparation programs where a teaching certificate is earned via a four-year university and the other programs are largely inconsequential (see Figure 4.2).

[15] https://title2.ed.gov/Public/Home.aspx

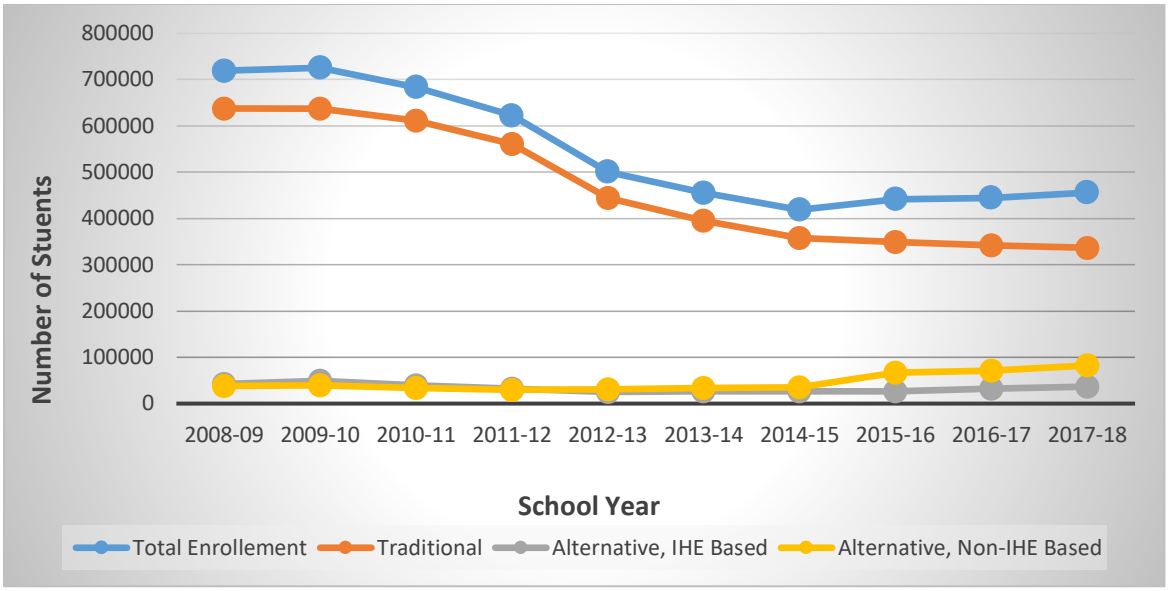

Figure 4.2 Enrollment in Teacher Preparation Programs by Program Type[16]

The decline in enrollment is potentially due to several factors, such as teachers' salaries and compensation, preparation and costs to entry, hiring and personnel management, induction and support for new teachers, and finally working conditions (Boyd et al., 2005b, 2008; Feng, 2009b; Hanushek, Kain, J. F., & Rivkin, 2004; Imazeki, 2005b; Podgursky et al., 2004b; Scafidi et al., 2007b).

Another possible reason for the decline in enrollment is a lack of demand for teachers. Measuring demand for teachers is difficult and national estimates do not exist. One way to estimate demand is to measure the rate at which teachers retire or leave the profession. This approach assumes that for every teacher who retires or leaves, the teacher is replaced by a new teacher. Sources using the Schools and Staffing Survey (SASS) data cite 269,800 teachers left the classroom in the 2008-2009 school year and of that number, only 27.8 percent left due to retirement (Keigher & Cross, 2008). In the

[16] https://title2.ed.gov/Public/Home.aspx

2004-2005 AY, 39.2 percent of teachers who left the profession did so for retirement (Keigher & Cross, 2008). The limited data suggest that the percentage of teachers leaving the market is increasing. In the 2008-2009 AY teacher attrition numbers might be lower because of the impacts of the Great Recession. Additional data is needed to eliminate the potential bias of teacher enrollment rates declining due to a lack of demand for teachers. Furthermore, recent studies suggest the United States is experiencing a teacher shortage (Carver-Thomas & Darling-Hammond, 2017b; García & Weiss, 2019e, 2019i; Sutcher et al., 2016b). However, Dee and Goldhaber argue this evidence doesn't paint a full picture, they suggest that teacher shortages "are not a general phenomenon but rather are highly concentrated by subject (e.g., mathematics, science, and special education) and in schools (e.g., those serving disadvantaged students) where hiring and retaining teachers are chronic problems" (Dee & Goldhaber, 2017b).

While there is evidence to suggest that teacher compensation, training practices, and the teaching environment are associated with declining enrollment, little has been done to explore if increased accountability measures impact the teacher pipeline. Ingersoll argues that teacher shortages occur due to attrition rates caused by job dissatisfaction (Ingersoll, 2003). The literature evaluates the impact of increased teacher accountability at the state level. These studies find that teacher attrition increases at grade levels where accountability measures are in place and in schools with low-performing students (Boyd et al., 2008; Clotfelter et al., 2011b). A study done in Florida found teacher attrition increases in schools that receive a lower rating or grade due to the new accountability measures (Feng et al., 2010). In a 2007 report commissioned by Congress, researchers found states with high and low accountability measures in the 1990s were

likely to report concerns about teacher attrition at the same rate (Loeb & Estrada, 2013). Figilo and Lobe note "that accountability has not dramatically changed the career choices of teachers overall, but that it has likely increased attrition in schools classified as failing relative to other schools" (Figlio & Loeb, 2011). On the other hand, survey results suggest that teacher retention is influenced by accountability policy changes such as NCLB and Common Core. Roughly twenty-five percent of public school teachers who left the profession in 2012 reported dissatisfaction with the influence of school assessment accountability measures on their teaching or curriculum was extremely or very important in their decision to leave and seventeen percent reported dissatisfaction with support preparing students for assessments was extremely or very important in their decision to leave teaching (Podolsky et al., 2016). Despite reports from teachers identifying dissatisfaction with increased accountability measures, the research on the effect of increased accountability policies such as NCLB or Common Core is limited.

While several studies have explored the effectiveness of Common Core on student achievement, none have evaluated the impact on teacher labor markets. Although researchers have identified a decline in enrollment and completion of teacher preparation programs and probable causes, they have not explored the effect of increased accountability policy or highly politicized policy changes on the teacher pipeline. This paper examines if an unintended consequence of Common Core is a reduction in the number of teachers entering the teacher labor market. This limits the number of highly effective teachers in the field and negatively impacts students' ability to learn (Darling-Hammond, 2000b; Kraft & Papay, 2014d; Ladd & Sorensen, 2017b; Ladd & Sorenson, 2016; Ronfeldt et al., 2013d). Without knowing what impact Common Core had on the

teacher pipeline, policymakers are left to guess how to develop and implement policy changes in education curricula that improve the teacher pipeline.

4.5 Theory

While the negative teaching environment surrounding Common Core potentially increased the number of teachers exiting the profession, I explore the potential trickle-down effect the negative perception of Common Core had on the teacher pipeline for several reasons. First, a comprehensive data set of the number of teachers exiting the profession by state over time does not exist. Second, around the same time Common Core was being introduced the number of teachers entering teacher preparation programs started to decline (U.S. Department of Education see Figure 1 & 2). Finally, while the immediate impact of Common Core on teacher labor markets is important, the long-term effects of accountability and curriculum policy changes on the teacher labor market are often overlooked but are equally important.

I argue Common Core had a *trickle-down effect* on the teacher pipeline. Specifically, I predict that the number of students enrolling in teacher preparation programs did decline due to the negative perceptions and working conditions filtered down from teachers to potential teachers exploring or enrolled in a teacher preparation program. The trickle-down theory has been used in management literature to explain manager and employee behaviors. The research suggests, that if you work for an effective high-level manager, you are more likely to be an effective mid-level manager and positively influence your employees (Zenger & Folkman, 2016; Zhang et al., 2022). High-level managers' emotions and behaviors are contagious allowing mid-level

managers to mimic that behavior creating a trickle-down effect on employees (Zhang et al., 2022). I argue that this theory applies to teachers and the teacher pipeline. Teachers' attitudes, perceptions, and intentions or decisions to leave or stay in teaching can serve as signals to potential teachers about the current working environment and conditions of the profession and therefore impact their decision to enter a teacher preparation program. Thus, teachers' behaviors can have a trickle-down effect on the teacher pipeline.

I'll proceed by (a) providing evidence of the negative experience teachers had while implementing Common Core, (b) providing evidence that Common Core also created negative perceptions surrounding the teaching profession, especially from the public and parents, and (c) outlining the different pathways through which this trickle-down effect could deter individuals in the teacher pipeline from entering a teacher preparation program or from completing it.

4.5.1 Teacher Experiences

Teachers faced challenges as their state adopted Common Core including inadequate training and preparation time to adjust to new standards, lack of resources to revamp their classroom content, and negative perceptions from parents (Abraham et al., 2019a; Cassino, 2015a; EPE Research Center, 2013a; Jochim & Lavery, 2015c; Polikoff, 2017a; Roberts, 2015a). Common Core took root when teacher performance-based pay was becoming popular. This approach links teachers' compensation to students' performance (EPE Research Center, 2013a; Jochim & Lavery, 2015c). Performance-based pay added another layer of stress for many teachers because the changing standards and unknown state assessments of the new standards left them uncertain about how students would perform.

Initially, teachers and teacher unions were very supportive of a universal set of standards. However as Common Core took root, these organizations and teachers began to voice concerns about the pace of the rollout suggesting that teachers did not have adequate training and materials to implement the curriculum (Jochim & Lavery, 2015c). Between 2013 and 2014 an EdNext Poll showed a thirty-point drop in teacher's support for the standards from 76 percent to 46 percent (EdNext, 2016a; Silliman & Schleifer, 2018). Additionally, a Gallup poll in 2014, indicated that 65 percent of teachers were worried about the new standards, and 62 percent were frustrated with them (Davis, 2014). The poll also showed that in states that had only partially implemented Common Core, 58 percent of teachers stated they were not receiving enough support (Davis, 2014). Teachers admitted in a survey to intentionally not using the words Common Core with parents, staff members, fellow teachers, and administrators to avoid confrontational conversations (Zubrzycki, 2016). These survey results suggest that the working environment was stressful and difficult to navigate for teachers as Common Core was implemented.

As teachers began to face the difficulties of implementing Common Core, the two largest teachers' unions the National Education Association (NEA) and the American Federation of Teachers (AFT) came out against Common Core in 2014 stating implementation of Common Core was "botched" and called for a freeze on teacher evaluations linked to Common Core until students and teachers were given sufficient time to adjust to the new curriculum (Jochim & Lavery, 2015c). Daine Ravitch, a well-known education historian, came out opposed to the standards in the Washington Post in June of 2013. Newspaper articles espousing the flaws of Common Core and teachers'

frustrations with the initiative appeared in many major news outlets such as the New York Times, the Wall Street Journal, CNN, and the Washington Post (Brody, 2016; Kirp, 2014; Kissel, 2015; Navarrette, 2014; Porter-Magee, 2014; Rich, 2014a, 2014b; Strauss, 2020a, 2020c; Zorn, 2015).

By 2016, only one in five teachers agreed that their textbooks and main curricular materials aligned with Common Core (Zubrzycki, 2016). An article in the Washington Post highlighted a teacher's blog post entitled "The Seven Deadly Sins of Common Core" where the teacher outlined that Common Core doesn't teach students the basics, was rolled out too quickly, and contains too many standards to cover in a single grade (Washington Post, August 18, 2016). In a follow-up survey in 2016, more teachers opposed Common Core than supported it with 51 percent against Common Core. Not only did the number of teachers opposing Common Core increase but the strength of the opposition changed with more teachers stating they strongly opposed Common Core instead of somewhat opposing the standards (J. Bleiberg, 2016; EdNext, 2016b).

While teachers initially supported Common Core, when they were required to implement a curriculum with inadequate resources, support wanned as educators navigated an acronymous environment.

4.5.2 Attitudes and Opinions of the Public and Parents

Initially, the general public's opinion on Common Core was either supportive or naïve. Based on a 2013 Gallup poll, 63 percent of the public was unaware of the new curriculum, however, a year later 80 percent of the public reported being familiar with Common Core (Jochim & Lavery, 2015c). As the public became more aware of Common

Core, opposition to the new standards grew. One poll found that between 2013 and 2014 support for Common Core dropped from 65 percent to 53 percent (Petrilli, 2014). In 2015 a poll by Fairleigh Dickson University found that 40 percent of respondents disapproved of the standards with 17 percent approving them (Cassino, 2015b). On average over time, more people googled "Common Core is bad" than "good" between 2010 and 2016 with the peak hitting in 2016 ("Common Core Is Good vs Common Core Is Bad," 2024). According to the EdNext Survey, public support for Common Core declined from 65 percent to 42 percent from 2013 to 2016 (EdNext, 2016a; Jochim & Lavery, 2015c; Silliman & Schleifer, 2018).

Overall, these statistics show a growing disapproval of the Common Core standards. Interestingly, when the public was asked about national standards without the label Common Core, 67 percent were in favor of national standards (Silliman & Schleifer, 2018). This highlights the growing animosity and negative association many people had with the Common Core standards (Silliman & Schleifer, 2018).

The opposition to Common Core arose not only from public opinion but also among public school parents and eventually led some parents to start grass-roots movements protesting Common Core. In April 2014, only 38 percent of parents noted knowing a lot about the new standards but after five months nearly 49 percent of public-school parents stated knowing a lot about the new standards (McCarthy, 2014; Ogisi & Saad, 2014). The follow-up survey also found that 29 percent of public school parents supported using the Common Core standards and that 57 percent were opposed to using the standards (McCarthy, 2014; Ogisi & Saad, 2014). Also, 48 percent of teachers reported having heard a concern or general dislike of Common Core from parents with

only 7 percent of teachers saying they received positive feedback from a parent about Common Core (Zubrzycki, 2016).

Small grass-roots movements emerged as the opposition grew through social media groups (Jochim & Lavery, 2015a; Roberts, 2015b).[17] Parents in these groups voiced concerns when unable to help their children with homework due to the new curriculum (Rich, 2014c). One parent stated:

> The very randomness of the math I am supposed to teach my daughters and son, is crazy! They are supposed to skip genuinely useful & important skills, to tell us some random math thing that will not help them with life, in any way! This is so pointless. It makes me feel frustrated and helpless (Utahns Against Common Core, 2012).

Parents also became concerned about the accountability measures and tests associated with Common Core (Jochim & Lavery, 2015b; Sears, 2014). Grassroots movements among parents to stop Common Core culminated in parent and student "opt-out" movements from the standardized tests in states such as New York, New Jersey, and Louisiana (Abraham et al., 2019b). One parent who participated in the opt-out movement in New Jersey noted Common Core as the primary reason for not allowing their child to be tested: "I am adamantly opposed to Common Core because it is not developmentally appropriate, it's tied to federal funds and undermines education. This was one way to make a statement about that" (Abraham et al., 2019b).

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[17] E.g., www.utahnsagainstcommoncore.com, www.flcommoncore.net; www.facebook.com/pages/Stop-Common-Core-inCalifornia/436128033134967.

While not all public-school parents opposed to Common Core participated in these grassroots movements, the polling data indicates that most public-school parents had a negative perception of Common Core. Additionally, an important 2018 poll found that parents did not encourage their children to pursue teaching professions due to low salaries and difficult working situations. This is the first time more parents did not want their children to become teachers since the poll began 50 years ago (Stringer, 2018). Over time the public, not just parents, were unsupportive of Common Core. The opinions and attitudes of parents and the public create a negative perception surrounding schools and the teaching profession which, I argue, can impact the teacher pipeline.

4.5.3 Pathways from Teachers to the Teacher Pipeline

Common Core required teachers to revamp their curriculum with limited support and resources while limiting teachers' autonomy and authority creating a more stressful work environment. These factors make entry into a low-wage job less appealing. The trickle-down effect from teachers to the teacher pipeline happens through many pathways. I will distinguish different pathways through which (a) potential teachers do not enroll in teacher preparation programs and (b) potential teachers enrolled in teacher preparation programs do not complete the program.

In the first situation, potential teachers do not enroll in teacher preparation programs. Common Core could be driving this through one of two ways—their parents and high school teachers. Two major influences on college freshmen's thoughts and opinions before they enter college are their family and teachers (Graber, 1995; Hattie, 2003; Nihal Lindberg et al., 2019). As noted previously, at this same time survey reports show an alarming trend that parents prefer their children not to enter the teaching

profession (Stringer, 2018b). Additionally, surveys show that parents became frustrated and confused about the curriculum being used in schools and how to help their children with homework (Roberts, 2015a). College freshmen interested in teaching could be persuaded directly or indirectly through this trickle-down effect from their parent's attitudes and perceptions of Common Core to declare a major other than education.

High school teachers also influence students. Students and teachers have a similar management hierarchy to managers and employees like parents and children. Students likely felt the stress and change in their classrooms from teachers as pressures mounted to learn a new curriculum and create resources for it with limited additional prep time or resources (Cassino, 2015a; Davis, 2014; EPE Research Center, 2013b; Jochim & Lavery, 2015c; Silliman & Schleifer, 2018; Zubrzycki, 2016). Some high school teachers might have explicitly encouraged their students to choose a different profession. Whether directly or indirectly, the experience and attitudes high school teachers had with their students about Common Core in the classroom likely impacted students potentially interested in teaching.

In the second case, potential teachers enrolled in a preparation program do not complete the program. Students enrolled in teacher preparation programs participate in classroom observations, teaching practicums, and student teaching. As most teachers had a negative perception of Common Core, it is unlikely that potential teachers did not observe these negative attitudes and perceptions of Common Core in some way (EdNext, 2016a; McCarthy, 2014; Ogisi & Saad, 2014). During these observations and hands-on teacher experiences, current educators' attitudes and observed stress levels from implementing a new curriculum, can dissuade potential teachers from completing their

degree. Finally, as young college students do informational interviews with teachers as they search for career options, they might be dissuaded by teachers in the interview process to become teachers.

4.6 Data

To examine what impact Common Core had on the teacher pipeline, I use data from the United States Department of Education Title II Reports, the Common Core Data (CCD), and the United States Census Bureau from the 2008-2009 AY to the 2017-2018 AY.

4.6.1 Dependent Variables

The dependent variables are proxy measures for the number of newly trained teachers entering the labor market. While Common Core Data (CCD) reports the number of newly hired teachers at the school district level, it does not indicate if a new hire is moving from another district or just entering the profession. Therefore, I used enrollment in teacher preparation programs and completion of teacher preparation programs as a proxy for the number of newly trained teachers entering the labor market. This variable is an overestimate of the number of teachers entering the field because not every individual who enters a teacher preparation program will complete the program and even fewer will enter the profession. Information on enrollment and completion is broken down by type of teacher preparation program.[18] The data set includes—total enrollment, enrollment in traditional teacher preparation programs, enrollment in an alternative Institution of

[18] https://title2.ed.gov/Public/Home.aspx

Higher Education (IHE) or alternative non-IHE. Additionally, the number of individuals completing a program is reported for the traditional program, an alternative IHE, and an alternative non-IHE. For this analysis, I will use total enrollment, traditional enrollment, and traditional completion for the outcome variables. Furthermore, to create a standard measure across states, I divide each state-level outcome variable—total enrollment, traditional enrollment, and traditional completion—by the state's population. Thus, the outcome variables are measured per 1,000 state residents. State population data was collected from the U.S. Census Bureau.[19]

4.6.2 Independent Variables

Individual state websites were consulted, as well as the Common Core State Standards Initiative website, to identify when states adopted and implemented Common Core.[20] The final assignment of treatment year was used previously by Song, Yang, and Garet and can be seen in Appendix 3: Tables 4.2 and 4.3 (Song et al., 2022b). Song, Yang, and Garet use three different scales to measure the academic standards of each state—an ELA Prior Rigor Index, Math Prior Rigor Index, and Prior CCSS-Similarity. They use these scales, like I do, to sort states into treatment and control groups. It is important to note that there are variations in the timing of treatment for this analysis.

Because Common Core was adopted by most states, identifying a counterfactual is difficult. I exploit the timing of implementation to create a counterfactual by comparing a state's academic standards before and after Common Core was

[19] https://data.census.gov/cedsci/

[20] http://www.corestandards.org/standards-in-your-state/

implemented, which is akin to the approach of Dee and Jacob in examining the impact of NCLB on student performance (Dee & Jacob, 2011b).

States were classified as having rigorous versus non-rigorous content standards before Common Core was implemented. Teachers in states with academic standards comparable to the new Common Core curriculum had less of a burden to change lesson plans and prepare for the new curriculum. In theory, a reduction in teachers entering the labor force was more likely to occur in states with standards that were significantly less rigorous than the new Common Core curriculum. Educators in states with lower standards likely had increased preparation time and more pressure to adjust their classroom materials. Each state's standards were evaluated using three indexes ELA Prior Rigor Index, Math Prior Rigor Index, and Prior CCSS-Similarity index (Song et al., 2022b). This follows the same approach and ranking of Song, Yang, Garet (2019). Rankings for each state are in the Appendix 3 Table 4.3. Because the state standards are assessed with three different indexes there are three separate classifications of states into treatment and control groups.

The Prior Rigor Index measures the state's 2010 standards on a scale of 1 to 7. States with a score between 4-7 are assigned to the control group; states with a score between 1-3 are assigned to the treatment. The Prior CCSS-Similarity only uses math standards (Schmidt & Houang, 2012). The scale ranges from most like Common Core to least like Common Core. Like Song, Yang, and Garet, CCSS is placed on a five-point scale, with 5 being the most like Common Core and 1 being the least like Common Core (Song et al., 2022b). States with a 4 or higher are assigned to the control group and states with a 3 or lower are assigned to the treatment group.

4.6.3 Control Variables

Four control variables are used in the main specification of the paper: (1) teacher strikes, (2) per-pupil expenditures, (3) student-teacher ratios, and (4) average teacher salary.

The data for the number of teacher strikes in a state for each year was collected by looking at newspaper sources and state Department of Education websites. In the late 2010s, there was a noticeable increase in teacher strikes in some cases directed at increasing salaries, thus, teacher wages could also vary over time and are included as a control variable.[21]

Per-pupil-expenditures and student-teacher ratios are obtained from the Common Core Data from the 2007-2008 AY to 2017-2018 AY. The amount of funding per student and the number of students in a classroom can impact student learning and is likely correlated to the level of resources teachers receive when implementing Common Core (Chingos, 2010; Hill et al., 2008; Hoxby, 2000; C. K. Jackson & Mackevicius, 2024; Sims, 2009).

Data on average teacher salaries at the state level from 2007—2008 AY to 2017—2018 AY are obtained from the National Education Association Rankings and Estimates. Low compensation is a top reason why college students decide not to enter teaching (Podolsky, Kini, Bishop, & Darling-Hammond, 2016; Tran & Smith, 2019). Thus, areas with higher teacher salaries might attract more individuals to the profession.

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[21] https://ncses.nsf.gov/indicators/states/indicator/public-school-teacher-salaries/table

4.7 Method

In order to identify a causal relationship between Common Core and total enrollment in teacher preparation, traditional enrollment in teacher preparation, and completion of teacher preparation programs, a difference-in-differences (DID) analysis is used to estimate the impact on the teacher pipeline. As noted previously, states fully implement ELA and Math standards at different times. As documented recently in the DID literature, using a basic DID estimator when you have variation in the timing of treatment and homogeneity in the treatment effect cannot be assumed, and a biased result is potentially created (Callaway & Sant'Anna, 2021; Gardner, 2022; Goodman-Bacon, 2021). Bias results happen because the effect among early adopters could be different than the effect among late adopters and the overall effect could be driven by early or late adopters. To address this issue, I use Callaway and Sant'Anna's approach, which essentially estimates treatment for the groups of observations that are adopted at the same time (Callaway & Sant'Anna, 2021). Each of these sub-groups is unbiased assuming unmeasured confounders are accounted for. To provide overall results, each of these sub-groups is then aggregated together. I use only never-treated observations for the control group and the outcome regression estimator.

The DID model is estimated for the three different outcomes—total enrollment in teacher preparation programs, enrollment in traditional teacher preparation programs, and completion of a teacher preparation program. Each outcome is estimated three times based on the three different assignments for treatment and control groups constructed on the Prior Rigor Index for Math and ELA standards and the Prior CCSS-Similarity Index.

The main DID equation is estimated as follows:

$$y_{st} = \beta_0 + \beta_1 Treat_{st} + \beta_2 Post_{st} + \beta_3 Treat * Post_{st} + \theta X_{st} + \alpha_s + \gamma_t + \varepsilon_{st} \quad (1)$$

where y_{st} is the outcome scaled to 1,000 state residents where *s* denotes state; *t* denotes school year. $Treat_{st}$ indicates if a state has been assigned to the treatment or control group based on the scale proposed by the Prior Rigor Index for ELA, Math, and the Prior CCSS-Similarity Index. $Post_{st}$ is an indicator variable for the time-varying implementation of Common Core. $Treat * Post_{st}$ is the main variable of interest and β_3 estimates the impact of Common Core upon the outcome in the years after Common Core rollout. θ includes the four-time varying control variables. State-fixed effects and year-fixed effects are denoted by $\alpha\ \gamma$. Year-fixed effects will capture things such as the Great Recession and state-fixed effects will control for issues related to unemployment. The standard errors are also clustered by state because the observations from one year to the next within a state are highly correlated. The parallel trends assumption is assessed, and sensitivity analyses are performed.

4.8 Results/Discussion

For all nine outcomes, an event study was performed, which allows for an assessment of the parallel trends, a critical assumption for a DID model (Appendix 3: Figures 4.3 through 4.11). The parallel trends assumption states that trends in the outcome variable before treatment are parallel and would continue to be parallel without the treatment effect. In this case, the event study estimates before Common Core starts should be near zero and statistically insignificant. The event studies for each outcome and treatment specification are in Figures 4.3—4.11of Appendix 3. As seen in the figures, the parallel trend assumption is generally not met across all outcomes which reduces the

ability to draw causal conclusions. Therefore, the results should be interpreted with caution.

Table 4.1 Impact of CC on Teacher Prep. Programs Enrollment/Completion (number of students per 1K state residents)

	Total Enrollment	**Traditional Enrollment**	**Traditional Completers**
ELA Index	-0.12 (0.18)	-.22 (.19)	-.04 (.03)
Math Index	-.018 (.15)	.02 (.15)	-.03 (.03)
CCSS Index	-.09 (.31)	-.15 (.32)	-.02 (.04)

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.1 displays the results of the impact of Common Core on teacher preparation programs, analyzed using ELA, Math, and CCSS indices. The columns in Table 4.1 indicate the three outcome variables and the rows indicate the treatment assignments. The standard errors are noted in parenthesis below each coefficient. For each outcome of interest, and across each classification of treatment and control states, there is no evidence that Common Core had a statistically significant impact on the number of students enrolling or completing a teacher preparation program. While these results produce many coefficients aligned with the theory proposed, the results are not statistically significant and lack evidence to support a causal relationship.

Sensitivity analyses were performed to test the cut-offs for the treatment and control groups. For the ELA and Math Index, states with a curriculum ranked as 4 were initially assigned to the control group, in the sensitivity analysis these states were

assigned to the treatment group. With the CCSS Index, states with a curriculum ranked at 3 were originally assigned to the treatment group, but in the sensitivity analysis were assigned to the control group. The results were not changed by testing these cut-offs and no causal relationship was observed.

4.9 Conclusions/Limitations

Overall, there is no evidence to identify a causal relationship between the reduction in enrollment and completion of teacher preparation programs and Common Core. Despite these null findings, this paper still adds to the discussion about the impact of Common Core on the teacher pipeline. Understanding if and how accountability measures like Common Core or other policy changes and debates like CRT affect the teacher pipeline is critical for policymakers to understand especially considering the documented reduction of individuals enrolling in teacher preparation programs.

This study has several limitations. First, the limited evidence of parallel trends and lack of significance in this study could be due to the difficulty in identifying a clear counterfactual. The rigor of a state's curriculum to identify a counterfactual group could be inaccurate. Due to the lack of time variation in states adopting Common Core, this study uses prior-rigor measures of states' curricula to identify a counterfactual group. This classification system might misidentify states into a treatment or a control group. The classification systems were tested to see if moving states with a ranking of 4 on the Prior Rigor Index and states with 3 on the CCSS index between the treatment and control group changed the results only two of the outcomes had evidence to support parallel trends and the results were not statistically significant.

A second issue could be with the number of pre-treatment years. States that adopted Common Core in the 2010-2011 AY only have one year of pre-treatment data. A majority of states in the analysis adopted in the 2010-2011 AY. Only having one year of data for the outcome variable before treatment makes it difficult to evaluate and establish parallel trends between the treatment and control groups. Sensitivity analyses were performed to include states that had three years of pre-trend data, this narrowed the data set to 50 observations which dramatically limits both the power and variation within the study.

Third, the outcome variables of total enrollment, traditional enrollment, and traditional completion are proxy measures for the number of new educators entering the profession. These variables are used instead of data that precisely measures the number of individuals entering the teaching profession for each state. While this analysis is intended to explore how Common Core impacts the teacher pipeline, the impact of Common Core on the teacher labor market could be more apparent in teacher retention rates looking at a specific state instead of across the United States. While this paper investigates the impact, Common Core has on the teacher pipeline, future research could also explore how Common Core impacts teacher retention.

Moving forward there are several areas of research worth exploring. Other potential reasons for the decline in teacher preparation programs could be due to the compounding nature of accountability measures from No Child Left Behind (NCLB), Common Core, increased focus on student test performance, changes in teacher evaluations, and most recently the increased stress and preparation needed due to COVID-19. Pinpointing the causes for the decline in enrollment in teacher preparation programs is essential because

as fewer teachers enter the profession competition decreases, thus limiting the number of highly effective teachers' students can interact with potentially affecting student achievement.

APPENDICES

APPENDIX 1. CHAPTER 2

Table 2.6 Baseline Covariates for Kentucky Schools in Treatment vs Control Group

	(1)	(2)
VARIABLES	Treatment	Control
Total # of Job Postings	6.20	5.70
	(3.70)	(3.63)
# of Free/Reduced Lunch	337.70	323.76
	(139.48)	(139.92)
Student Enrollment	572.11	542.45
	(260.12)	(247.12)
Number of Full-Time Teachers	34.57	33.12
	(14.37)	(13.25)
Student Test Scores	0.39	0.39
	(0.46)	(0.53)
Average Teacher Salary	49,023.90	49,631.37
	(1,850.94)	(2,209.53)
Median Household Income	45,267.28	44,313.32
	(5,824.33)	(6,413.50)
Observations	149	149

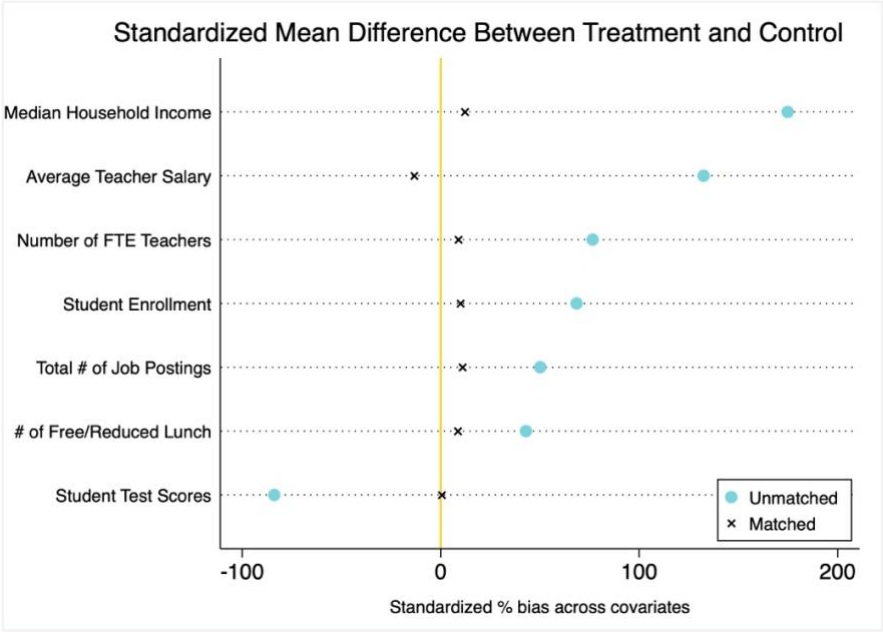

Figure 2.11 Standardized Mean Difference Before and After Matching

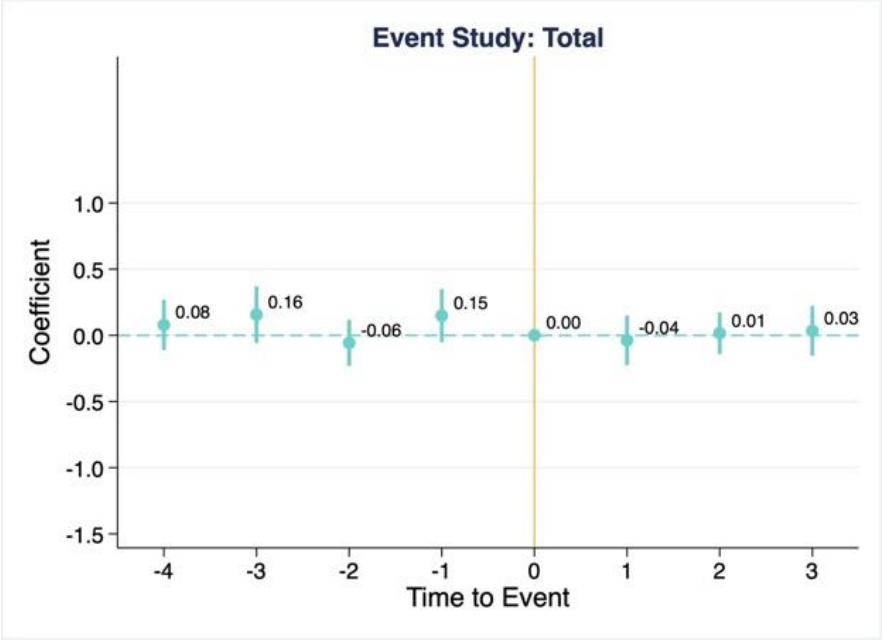

Figure 2.12 Event Study: Total # of Job Postings

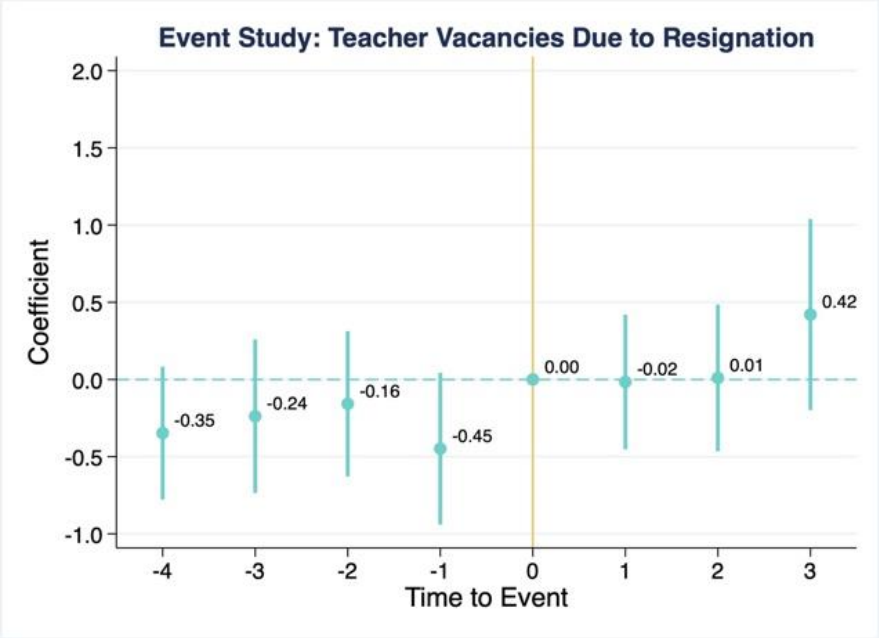

Figure 2.13 Event Study: Job Postings due to Resignation

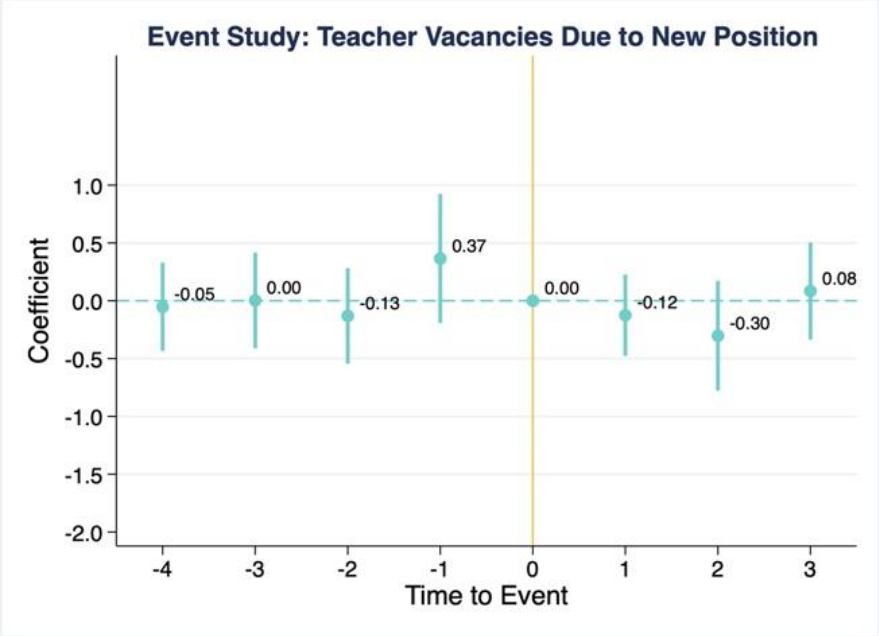

Figure 2.14 Event Study: Job Postings due to New Position

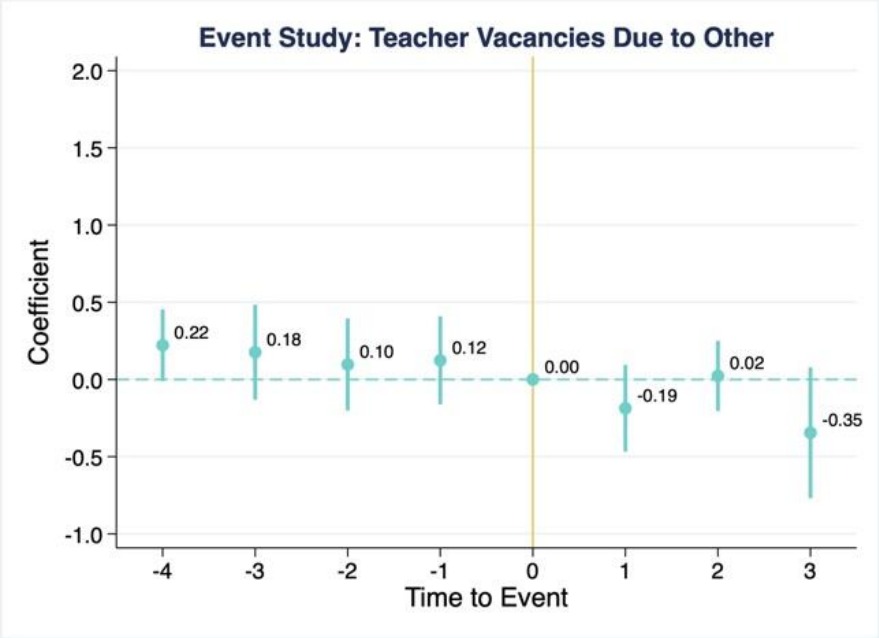

Figure 2.15 Event Study: Job Postings due to Other

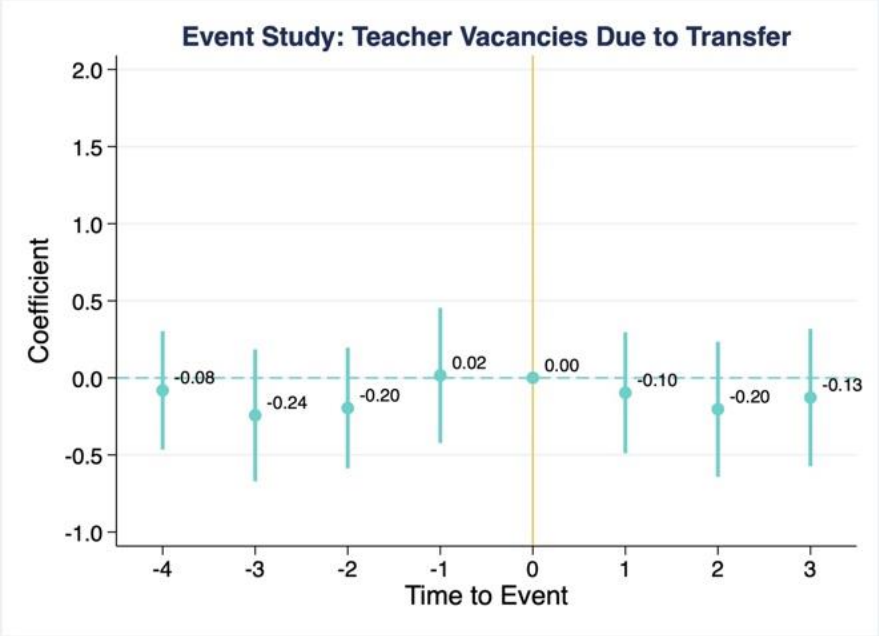

Figure 2.16 Event Study: Job Postings due to Transfer

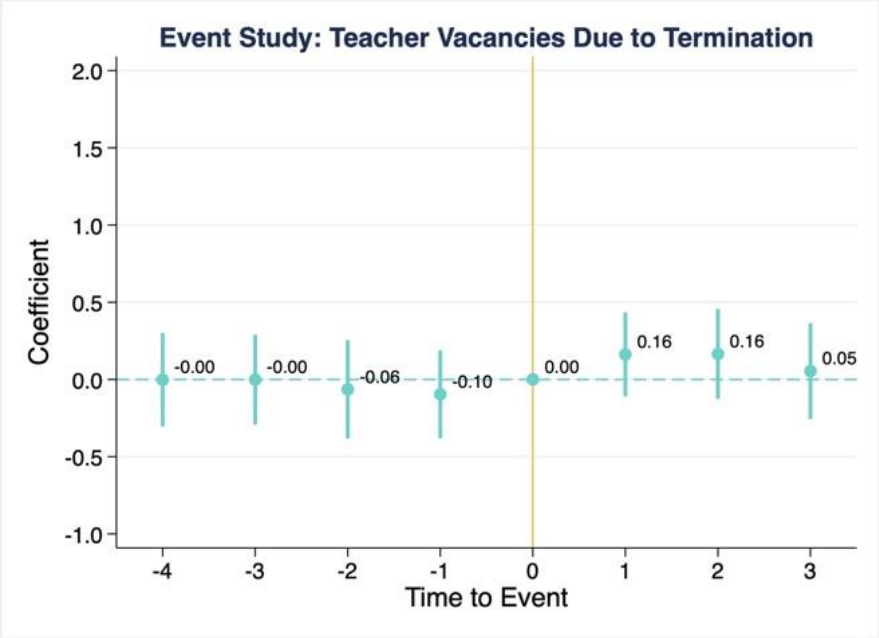

Figure 2.17 Event Study: Job Postings due to Termination

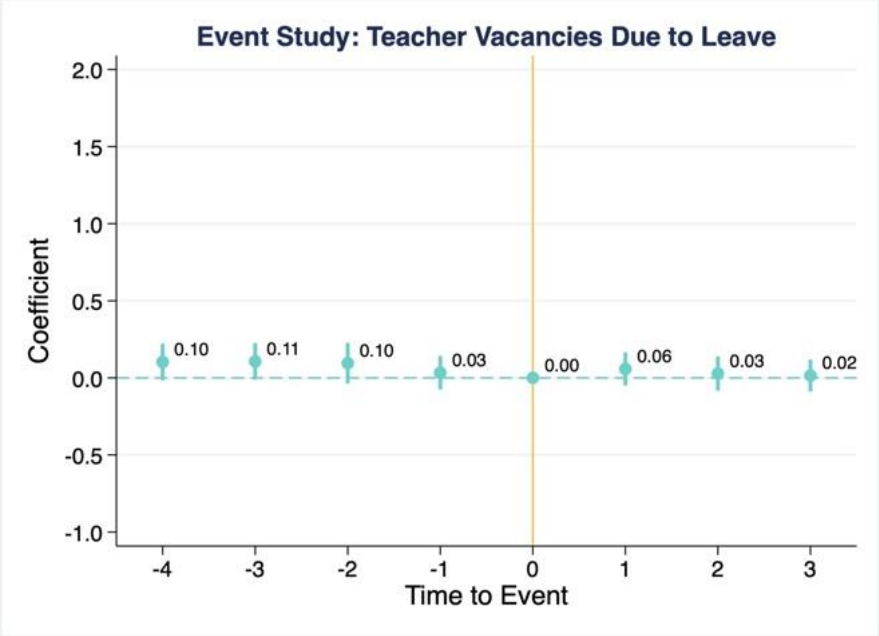

Figure 2.18 Event Study: Job Postings due to Leave

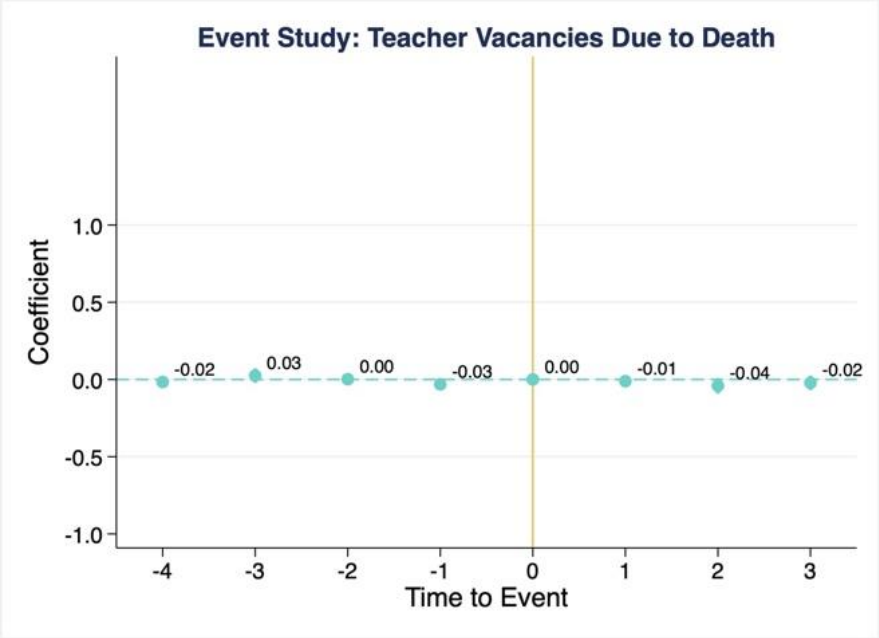

Figure 2.19 Event Study: Job Postings due to Death

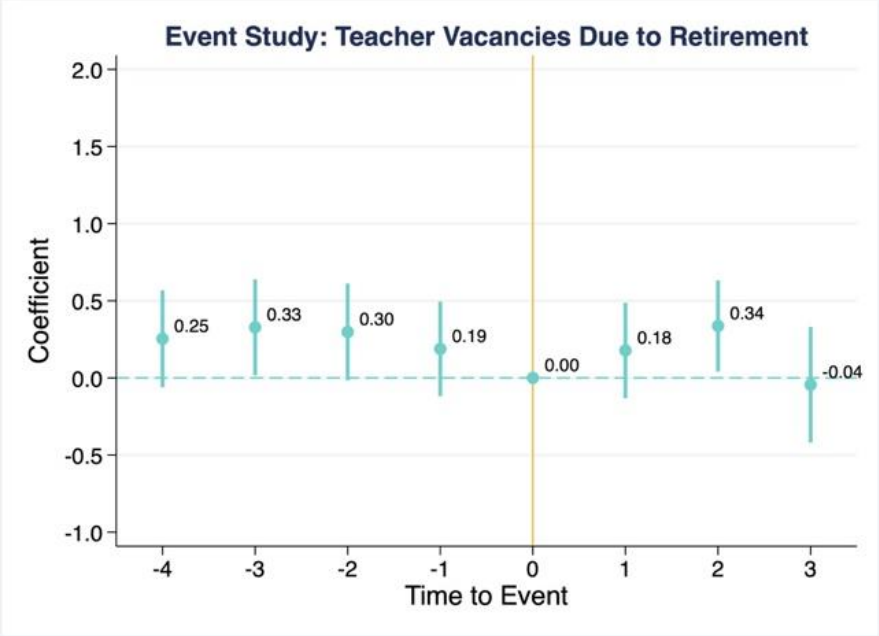

Figure 2.20 Event Study: Job Postings due to Retirement

Table 2.7 Estimation of Matching DID COVID-19 Impact on Teacher Job Postings and Reasonings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Total	Death	Leave	New Position	Other	Resign	Retire	Fired	Transfer
COVID* Post	-0.07	-0.02	-0.03	-0.16	-0.29***	0.36**	-0.05	0.16**	-0.04
	(0.04)	(0.02)	(0.02)	(0.11)	(0.10)	(0.15)	(0.10)	(0.08)	(0.11)
Year (2014)									
2015	-0.01	0.00	-0.02	-0.06	-0.31	0.42**	-0.31***	0.09	0.18*
	(0.06)	(0.02)	(0.03)	(0.11)	(0.23)	(0.19)	(0.11)	(0.12)	(0.11)
2016	-0.01	0.00	0.02	-0.08	-0.42	0.55***	-0.32***	-0.00	0.24**
	(0.07)	(0.01)	(0.03)	(0.12)	(0.26)	(0.21)	(0.12)	(0.13)	(0.11)
2017	0.12	0.01	-0.01	0.03	-0.52*	0.68***	-0.34**	-0.00	0.27*
	(0.08)	(0.02)	(0.04)	(0.17)	(0.31)	(0.25)	(0.14)	(0.14)	(0.14)
2018	0.07	-0.00	0.02	-0.03	-0.72*	0.79**	-0.72***	0.18	0.53***
	(0.11)	(0.02)	(0.05)	(0.21)	(0.39)	(0.31)	(0.18)	(0.18)	(0.20)
2019	0.02	0.01	0.01	-0.05	-0.58	0.94**	-0.80***	-0.04	0.53**
	(0.12)	(0.03)	(0.05)	(0.23)	(0.44)	(0.38)	(0.22)	(0.20)	(0.22)
2020	0.07	0.04	-0.05	0.85***	-0.19	-0.21	-0.69***	-0.12	0.44**
	(0.09)	(0.04)	(0.05)	(0.24)	(0.19)	(0.32)	(0.20)	(0.19)	(0.22)
2021	0.06	0.03	-0.05	0.09	-0.47	0.68	-0.81***	0.01	0.58**
	(0.11)	(0.04)	(0.06)	(0.27)	(0.43)	(0.42)	(0.24)	(0.22)	(0.25)
School Type (Elementary)									
Middle School	-0.21***	-0.03**	-0.03	0.02	-0.31*	-0.16	0.20	-0.02	0.11
	(0.08)	(0.02)	(0.02)	(0.31)	(0.18)	(0.24)	(0.16)	(0.16)	(0.23)
High School	-0.06	-0.05**	-0.05*	0.84	-0.64*	-0.29	-0.11	0.24	0.01
	(0.15)	(0.02)	(0.03)	(0.68)	(0.36)	(0.48)	(0.21)	(0.19)	(0.34)
K-12	-0.03	0.00	-0.03	0.72	0.04	0.07	-0.37*	-0.16	-0.29
	(0.07)	(0.03)	(0.04)	(0.66)	(0.14)	(0.37)	(0.19)	(0.12)	(0.30)
Other	0.11	-0.03	-0.01	0.57	-0.42	0.38	-0.25	0.15	-0.27
	(0.14)	(0.02)	(0.02)	(0.75)	(0.27)	(0.50)	(0.21)	(0.38)	(0.35)
Job Posting Characteristics									

Table 2.7 (continued)

Full-time	1.00***	0.00	0.01***	0.18***	0.07***	0.36***	0.10***	0.10***	0.18***
	(0.00)	(0.00)	(0.00)	(0.02)	(0.02)	(0.03)	(0.01)	(0.01)	(0.02)
Support Staff	0.19	-0.11*	0.17	-0.62	0.60	0.35	-1.21*	3.86	-1.06
	(1.07)	(0.06)	(0.37)	(0.67)	(0.75)	(0.26)	(0.73)	(3.27)	(0.87)
Teacher	-0.14	-0.10	0.15	-0.65	0.56	0.58***	-1.50**	4.05	-1.44*
	(1.06)	(0.06)	(0.36)	(0.62)	(0.74)	(0.22)	(0.71)	(3.27)	(0.85)
Principal	-0.22	-0.01	0.11	-0.99	0.71		-1.51**	3.77	-0.49
	(1.07)	(0.06)	(0.36)	(0.65)	(0.75)		(0.72)	(3.28)	(0.86)
Subject									
Art and Music	0.23	0.07	-0.17	0.03	-0.76	0.10	1.83**	-3.82	1.19
	(1.07)	(0.06)	(0.36)	(0.64)	(0.73)	(0.34)	(0.74)	(3.29)	(0.87)
CTE	0.46	0.19**	-0.06	1.36*	-0.86	-0.50	1.68**	-4.25	1.13
	(1.09)	(0.09)	(0.38)	(0.75)	(0.77)	(0.56)	(0.80)	(3.28)	(0.91)
English	0.42	0.09	0.01	0.82	-0.24	-0.83*	1.62**	-4.02	1.20
	(1.08)	(0.06)	(0.39)	(0.70)	(0.81)	(0.44)	(0.69)	(3.29)	(0.90)
General	0.17	0.09	-0.11	0.52	-0.70	-0.61***	1.99***	-4.18	1.38
	(1.06)	(0.06)	(0.36)	(0.64)	(0.74)	(0.22)	(0.71)	(3.27)	(0.86)
PE	0.28	0.12*	-0.11	-0.15	-0.90	0.85	1.88**	-4.30	1.13
	(1.07)	(0.06)	(0.37)	(0.70)	(0.75)	(0.73)	(0.73)	(3.27)	(0.88)
STEM	0.34	0.08	-0.13	0.55	-0.58	-0.62	1.82***	-3.82	1.28
	(1.06)	(0.06)	(0.36)	(0.65)	(0.73)	(0.40)	(0.70)	(3.28)	(0.88)
Social Studies	0.19	0.10	-0.11	-0.13	-0.74	0.07	1.63**	-3.66	1.27
	(1.07)	(0.08)	(0.34)	(0.72)	(0.75)	(0.61)	(0.74)	(3.25)	(0.91)
Special Education	0.20	0.08	-0.09	0.56	-0.74	-0.68**	1.74**	-4.21	1.76**
	(1.06)	(0.06)	(0.36)	(0.62)	(0.75)	(0.27)	(0.71)	(3.27)	(0.85)
Tutor	3.22**	0.26*	-0.07	1.61	1.72	-1.91**	2.52***	-4.59	1.91*
	(1.60)	(0.13)	(0.37)	(1.29)	(1.72)	(0.83)	(0.96)	(3.31)	(1.09)
World Languages	0.17	0.14	-0.19	0.15	-0.36	-0.35	1.79**	-4.10	1.33
	(1.06)	(0.12)	(0.37)	(0.81)	(0.85)	(0.68)	(0.82)	(3.28)	(0.95)
School Characteristics									
Title I Status	-0.06	-0.02*	-0.01	0.04	-0.06**	-0.03	0.00	0.02	0.00
	(0.05)	(0.01)	(0.02)	(0.08)	(0.03)	(0.08)	(0.05)	(0.06)	(0.07)

Table 2.7 (continued)

# of full-time equivalent teachers	-0.01	-0.00	-0.00	-0.06***	-0.03**	0.00	0.02	0.06**	0.00
	(0.01)	(0.00)	(0.00)	(0.02)	(0.01)	(0.02)	(0.01)	(0.03)	(0.02)
# of students eligible for free or reduced-price lunch	0.00	-0.00	-0.00	0.00	0.00	0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Student enrollment	-0.00	0.00	0.00	0.00	0.00	-0.00	0.00	-0.00***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
District Level Characteristics									
Student Reading Test Scores	0.02	0.00	-0.01	-0.00	0.06	-0.04	-0.02	0.03	0.01
	(0.02)	(0.01)	(0.01)	(0.05)	(0.04)	(0.06)	(0.04)	(0.03)	(0.04)
ESSER	-0.00	-0.00	0.00	-0.00	-0.00	0.00**	0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Average Teacher Salary	0.00	0.00	0.00	0.00	0.00	-0.00***	0.00***	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
County Level Characteristics									
Median Household Income	-0.00	-0.00	-0.00	-0.00	0.00**	0.00	0.00	-0.00*	-0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Unemployment Rate	-0.02	0.00	0.01	-0.03	-0.22	0.18*	-0.08	0.00	0.11**
	(0.03)	(0.01)	(0.01)	(0.05)	(0.16)	(0.10)	(0.05)	(0.05)	(0.05)
Observations	2,325	2,325	2,325	2,325	2,325	2,325	2,325	2,325	2,325
Number of Schools	298	298	298	298	298	298	298	298	298
Robust standard errors in parentheses									
*** p<0.01, ** p<0.05, * p<0.1									

Table 2.8 Estimation of CITS: COVID-19 Impact on Teacher Job Postings and Reasonings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Total	Death	Leave	New Position	Other	Resign	Retire	Fired	Transfer
Treatment	-0.16**	-0.02**	-0.05***	0.92***	-0.39***	-0.13	-0.24***	-0.03	-0.22**
	(0.07)	(0.01)	(0.02)	(0.13)	(0.08)	(0.11)	(0.07)	(0.07)	(0.10)
Year (-4 to 3 relative to 2019-2020 AY)	0.04**	0.00	0.00	-0.12***	0.05**	0.01	0.06***	-0.00	0.04**
	(0.02)	(0.00)	(0.00)	(0.03)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
Treatment by Year	-0.06***	-0.01*	-0.02**	0.36***	-0.09***	-0.03	-0.11***	-0.09***	-0.08***
	(0.02)	(0.00)	(0.01)	(0.05)	(0.02)	(0.04)	(0.02)	(0.02)	(0.03)
Time (0=pre-covid,1=covid)	-0.09	-0.00	-0.03	0.05	-0.03	0.07	-0.15*	-0.07	0.08
	(0.06)	(0.01)	(0.02)	(0.10)	(0.06)	(0.10)	(0.08)	(0.06)	(0.08)
Treatment * Time	**0.11**	**0.02**	**0.05***	**-2.08*****	**0.32*****	**0.52*****	**0.50*****	**0.27*****	**0.51*****
	(0.09)	**(0.02)**	**(0.03)**	**(0.22)**	**(0.09)**	**(0.16)**	**(0.10)**	**(0.09)**	**(0.15)**
Resignations in 2018	0.01	-0.00	0.00	-0.23***	-0.01	0.29***	-0.00	0.07***	-0.10***
	(0.01)	(0.00)	(0.00)	(0.03)	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)
School Type (Elementary)									
Middle School	-0.26**	-0.00	-0.02	0.11	-0.18*	-0.09	0.00	-0.14**	0.06
	(0.10)	(0.01)	(0.02)	(0.13)	(0.10)	(0.10)	(0.06)	(0.07)	(0.09)
High School	-0.27***	0.01	-0.02	0.35**	-0.02	0.07	-0.24***	-0.19**	-0.23**
	(0.10)	(0.01)	(0.02)	(0.17)	(0.09)	(0.13)	(0.07)	(0.08)	(0.09)
K-12	-0.26***	0.02	-0.06***	0.03	0.07	0.09	-0.16	-0.29***	0.04
	(0.07)	(0.02)	(0.02)	(0.29)	(0.16)	(0.21)	(0.11)	(0.10)	(0.22)
Other	-0.10	-0.01	-0.03***	-0.31	-0.03	0.49***	-0.17	0.06	-0.11
	(0.09)	(0.00)	(0.01)	(0.26)	(0.10)	(0.14)	(0.10)	(0.09)	(0.11)
Job Posting Characteristics									
Full-time	1.03***	0.00**	0.00***	0.34***	0.07***	0.24***	0.06***	0.10***	0.20***
	(0.01)	(0.00)	(0.00)	(0.03)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
Support Staff	1.40**	-0.06	0.09	0.22	-0.41	0.21	0.15	2.47*	-1.28

Table 2.8 (continued)

	(0.70)	(0.04)	(0.25)	(1.20)	(0.80)	(2.62)	(0.69)	(1.39)	(1.18)
Teacher	0.70	-0.07*	0.08	0.27	-0.68	0.24	-0.25	2.58*	-1.47
	(0.69)	(0.04)	(0.25)	(1.18)	(0.80)	(2.61)	(0.69)	(1.39)	(1.18)
Principal	0.74	-0.05	0.04	-0.59	-0.55	0.36	-0.21	2.46*	-0.73
	(0.69)	(0.04)	(0.24)	(1.19)	(0.80)	(2.61)	(0.69)	(1.39)	(1.18)
Subject									
Art and Music	-0.17	0.06*	-0.09	-0.18	0.69	-0.20	0.67	-2.61*	1.48
	(0.72)	(0.04)	(0.25)	(1.20)	(0.80)	(2.61)	(0.70)	(1.40)	(1.18)
CTE	-0.38	0.08*	-0.08	0.60	0.21	-0.58	0.88	-2.65*	1.16
	(0.70)	(0.05)	(0.25)	(1.23)	(0.79)	(2.61)	(0.70)	(1.40)	(1.19)
English	-0.10	0.07*	-0.05	0.35	0.94	-0.71	0.47	-2.55*	1.39
	(0.71)	(0.04)	(0.25)	(1.17)	(0.82)	(2.60)	(0.69)	(1.39)	(1.17)
General	-0.77	0.07*	-0.03	0.16	0.45	-0.72	0.60	-2.77**	1.47
	(0.69)	(0.04)	(0.25)	(1.16)	(0.79)	(2.60)	(0.68)	(1.38)	(1.17)
PE	-0.56	0.09**	-0.05	-0.48	0.19	0.39	0.70	-2.87**	1.47
	(0.70)	(0.04)	(0.25)	(1.20)	(0.78)	(2.64)	(0.70)	(1.39)	(1.18)
STEM	-0.54	0.07*	-0.06	-0.15	0.67	-0.54	0.77	-2.55*	1.24
	(0.69)	(0.04)	(0.25)	(1.16)	(0.79)	(2.60)	(0.68)	(1.39)	(1.16)
Social Studies	-0.70	0.08*	0.01	-0.62	0.43	-0.43	0.90	-2.49*	1.43
	(0.69)	(0.04)	(0.24)	(1.20)	(0.78)	(2.63)	(0.70)	(1.39)	(1.18)
Special Education	-0.69	0.06	-0.02	0.07	0.43	-0.57	0.51	-2.76**	1.59
	(0.69)	(0.04)	(0.25)	(1.16)	(0.79)	(2.60)	(0.68)	(1.38)	(1.18)
Tutor	0.61	0.07*	-0.07	0.06	1.88*	-0.14	0.38	-2.70*	1.13
	(0.94)	(0.04)	(0.25)	(1.20)	(1.00)	(2.61)	(0.71)	(1.39)	(1.17)
Word Languages	-0.32	0.17**	-0.05	-1.20	0.92	-0.00	0.62	-2.21	1.44
	(0.74)	(0.08)	(0.25)	(1.26)	(0.81)	(2.62)	(0.71)	(1.42)	(1.21)
District Level Characteristics									
Average Teacher Salary	-0.00	-0.00	-0.00***	0.00***	-0.00*	-0.00***	-0.00***	-0.00***	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Student Reading Test Scores	0.08***	-0.00	0.00	-0.17***	0.02	-0.01	0.05**	0.06***	0.13***

Table 2.8 (continued)

	(0.03)	(0.00)	(0.01)	(0.04)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
ESSER	-0.00	0.00	0.00	-0.00***	0.00***	0.00**	-0.00	-0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
School Level Characteristics									
Title I status	-0.00	0.00	0.00	0.16***	-0.02	-0.06*	-0.05**	-0.01	-0.02
	(0.03)	(0.00)	(0.00)	(0.05)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)
Number of full-time equivalent teachers	0.02***	-0.00	-0.00	-0.02*	0.00	-0.02*	0.01**	0.02***	0.03***
	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)
Number of students eligible for free or reduced-price lunch	-0.00***	0.00	-0.00	0.00***	-0.00	-0.00*	-0.00***	-0.00***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Student enrollment	-0.00	0.00	0.00**	-0.00	-0.00	0.00**	0.00***	-0.00	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
County Level Characteristics									
Median Household Income	-0.00	-0.00	0.00***	-0.00	-0.00	0.00**	-0.00***	0.00*	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Unemployment Rate	-0.01	0.00	0.01***	-0.02	-0.01	-0.06***	0.04***	0.02*	0.01
	(0.01)	(0.00)	(0.00)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923	5,923
Robust standard errors in parentheses									
*** p<0.01, ** p<0.05, * p<0.1									

Table 2.9 Estimation of DID COVID-19's Impact on Teacher Job Postings due to Resignation without Matching

	(1)
VARIABLES	Resignation w/o Matching
COVID*POST	**0.46*** **
	(0.11)
Year (2014)	
2015	0.32***
	(0.09)
2016	0.30***
	(0.10)
2017	0.42***
	(0.14)
2018	0.58***
	(0.17)
2019	0.80***
	(0.21)
2020	0.58***
	(0.19)
2021	1.11***
	(0.22)
School Type (Elementary)	
Middle School	-0.21
	(0.15)
High School	0.07
	(0.22)
K-12	0.16
	(0.20)
Other	0.34**

Table 2.9 (continued)

	(0.17)
Job Posting Characteristics	
Full-time	0.24***
	(0.02)
Support Staff	-0.79
	(3.25)
Teacher	-0.79
	(3.24)
Principal	-0.85
	(3.24)
Subject	
Art and Music	1.04
	(3.24)
CTE	0.88
	(3.24)
English	0.39
	(3.23)
General	0.51
	(3.24)
PE	1.66
	(3.27)
STEM	0.50
	(3.24)
Social Studies	0.40
	(3.26)
Special Education	0.43
	(3.24)
Tutor	0.77
	(3.24)
World Languages	1.11

Table 2.9 (continued)

	(3.24)
School Characteristics	
Title I Status	-0.04
	(0.04)
# of full-time equivalent teachers	0.00
	(0.01)
# of students eligible for free or reduced-price lunch	0.00**
	(0.00)
Student enrollment	0.00
	(0.00)
District Level Characteristics	
Student Reading Test Scores	0.02
	(0.04)
ESSER	-0.00
	(0.00)
Average Teacher Salary	-0.00***
	(0.00)
Median Household Income	0.00
	(0.00)
County Level Characteristics	
Median Household Income	0.09**
	(0.03)
Unemployment Rate	10.56***
	(1.57)
Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 2.10 Falsification Test: Estimation of Matching DID Impact of COVID-19 on Teacher Job Postings and Reasonings (Treatment Year = 2020-2021 AY)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Total	Death	Leave	New Position	Other	Resign	Retire	Fired	Transfer
COVID* Post	-0.03	-0.03	-0.04*	-0.13	-0.22*	0.41**	-0.05	0.11	-0.07
	(0.04)	(0.02)	(0.02)	(0.13)	(0.13)	(0.18)	(0.12)	(0.09)	(0.12)
Year (2014)									
2015	-0.01	0.00	-0.02	-0.06	-0.31	0.42**	-0.31***	0.09	0.18*
	(0.06)	(0.02)	(0.03)	(0.11)	(0.23)	(0.19)	(0.11)	(0.12)	(0.11)
2016	-0.01	0.00	0.02	-0.08	-0.42	0.54**	-0.32***	-0.00	0.25**
	(0.07)	(0.01)	(0.03)	(0.12)	(0.27)	(0.21)	(0.12)	(0.13)	(0.11)
2017	0.12	0.01	-0.01	0.04	-0.52	0.67***	-0.33**	-0.01	0.27*
	(0.08)	(0.02)	(0.04)	(0.17)	(0.31)	(0.25)	(0.14)	(0.14)	(0.14)
2018	0.07	-0.00	0.02	-0.02	-0.71*	0.77**	-0.71***	0.18	0.54***
	(0.11)	(0.02)	(0.05)	(0.21)	(0.39)	(0.31)	(0.18)	(0.18)	(0.20)
2019	-0.02	0.00	0.00	-0.12	-0.71	1.09***	-0.82***	0.03	0.51**
	(0.12)	(0.03)	(0.05)	(0.22)	(0.45)	(0.37)	(0.22)	(0.21)	(0.22)
2020	0.05	0.04	-0.05	0.85***	-0.20	-0.25	-0.69***	-0.11	0.45**
	(0.09)	(0.04)	(0.05)	(0.25)	(0.20)	(0.33)	(0.20)	(0.20)	(0.23)
2021	0.04	0.04	-0.04	0.08	-0.49	0.65	-0.81***	0.02	0.59**
	(0.11)	(0.04)	(0.06)	(0.28)	(0.44)	(0.43)	(0.25)	(0.22)	(0.25)
School Type (Elementary)									
Middle School	-0.20**	-0.03**	-0.03	0.02	-0.31*	-0.15	0.20	-0.03	0.11
	(0.08)	(0.02)	(0.02)	(0.31)	(0.18)	(0.24)	(0.16)	(0.16)	(0.23)
High School	-0.05	-0.05**	-0.05*	0.84	-0.63*	-0.29	-0.11	0.23	0.01
	(0.15)	(0.02)	(0.03)	(0.68)	(0.36)	(0.48)	(0.21)	(0.19)	(0.34)
K-12	-0.02	0.00	-0.03	0.72	0.04	0.08	-0.37**	-0.16	-0.29
	(0.07)	(0.03)	(0.04)	(0.66)	(0.14)	(0.37)	(0.19)	(0.12)	(0.30)
Other	0.11	-0.03	-0.01	0.56	-0.43	0.38	-0.25	0.15	-0.27
	(0.14)	(0.02)	(0.02)	(0.75)	(0.26)	(0.50)	(0.21)	(0.38)	(0.35)
Job Posting Characteristics									
Full-time	1.00***	0.00	0.01***	0.18***	0.07***	0.36***	0.10***	0.10***	0.18***

Table 2.10 (continued)

	(0.00)	(0.00)	(0.00)	(0.02)	(0.02)	(0.03)	(0.01)	(0.01)	(0.02)
Support Staff	0.21	-0.11*	0.18	-0.57	0.69	0.30	-1.20*	3.80	-1.05
	(1.05)	(0.06)	(0.37)	(0.65)	(0.73)	(0.26)	(0.73)	(3.30)	(0.87)
Teacher	-0.11	-0.09	0.15	-0.60	0.64	0.55**	-1.49**	3.99	-1.44*
	(1.05)	(0.06)	(0.36)	(0.60)	(0.72)	(0.22)	(0.71)	(3.30)	(0.85)
Principal	-0.20	-0.01	0.11	-0.96	0.77		-1.50**	3.73	-0.49
	(1.05)	(0.06)	(0.36)	(0.63)	(0.73)		(0.72)	(3.30)	(0.86)
Subject									
Art and Music	0.21	0.07	-0.18	-0.02	-0.86	0.15	1.82**	-3.77	1.18
	(1.05)	(0.06)	(0.37)	(0.62)	(0.71)	(0.34)	(0.74)	(3.31)	(0.87)
CTE	0.43	0.18**	-0.06	1.30*	-0.98	-0.44	1.67**	-4.18	1.13
	(1.07)	(0.09)	(0.38)	(0.72)	(0.75)	(0.56)	(0.79)	(3.30)	(0.91)
English	0.39	0.09	0.00	0.77	-0.32	-0.80*	1.61**	-3.97	1.19
	(1.07)	(0.06)	(0.39)	(0.68)	(0.79)	(0.44)	(0.69)	(3.31)	(0.91)
General	0.14	0.09	-0.11	0.48	-0.79	-0.58**	1.98***	-4.13	1.37
	(1.05)	(0.06)	(0.36)	(0.63)	(0.72)	(0.23)	(0.71)	(3.29)	(0.86)
PE	0.26	0.11*	-0.12	-0.19	-0.97	0.87	1.87**	-4.26	1.13
	(1.06)	(0.06)	(0.37)	(0.69)	(0.73)	(0.73)	(0.72)	(3.29)	(0.88)
STEM	0.32	0.08	-0.13	0.50	-0.67	-0.59	1.81***	-3.77	1.27
	(1.04)	(0.06)	(0.36)	(0.64)	(0.71)	(0.40)	(0.69)	(3.30)	(0.88)
Social Studies	0.17	0.10	-0.12	-0.17	-0.81	0.09	1.62**	-3.62	1.26
	(1.05)	(0.08)	(0.34)	(0.71)	(0.73)	(0.61)	(0.74)	(3.28)	(0.91)
Special Education	0.17	0.07	-0.09	0.51	-0.83	-0.64**	1.73**	-4.15	1.75**
	(1.05)	(0.06)	(0.36)	(0.60)	(0.72)	(0.27)	(0.71)	(3.29)	(0.84)
Tutor	3.19**	0.26*	-0.07	1.55	1.61	-1.86**	2.51***	-4.52	1.90*
	(1.58)	(0.13)	(0.37)	(1.27)	(1.69)	(0.82)	(0.95)	(3.34)	(1.09)
World Languages	0.13	0.14	-0.19	0.09	-0.47	-0.29	1.77**	-4.03	1.32
	(1.05)	(0.11)	(0.37)	(0.79)	(0.84)	(0.68)	(0.81)	(3.31)	(0.95)
School Characteristics									
Title I Status	-0.06	-0.02*	-0.01	0.05	-0.05**	-0.04	0.00	0.02	0.00
	(0.05)	(0.01)	(0.02)	(0.07)	(0.03)	(0.08)	(0.05)	(0.06)	(0.07)
# of full-time equivalent teachers	-0.01	-0.00	-0.00	-0.06***	-0.03**	0.00	0.02	0.06**	0.00

Table 2.10 (continued)

	(0.01)	(0.00)	(0.00)	(0.02)	(0.01)	(0.02)	(0.01)	(0.03)	(0.02)
# of students eligible for free or reduced-price lunch	0.00	-0.00	-0.00	0.00	0.00	0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Student enrollment	-0.00	0.00	0.00	0.00	0.00	-0.00	0.00	-0.00***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
District Level Characteristics									
Student Reading Test Scores	0.02	0.00	-0.01	-0.00	0.06	-0.04	-0.02	0.03	0.00
	(0.02)	(0.01)	(0.01)	(0.05)	(0.04)	(0.06)	(0.04)	(0.03)	(0.05)
ESSER	-0.00	-0.00	0.00	-0.00	-0.00	0.00**	0.00	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Average Teacher Salary	0.00	0.00	0.00	0.00	0.00	-0.00***	0.00***	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Median Household Income									
	-0.00	-0.00	-0.00	-0.00	0.00**	0.00	0.00	-0.00*	-0.00**
County Level Characteristics	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Median Household Income	-0.02	0.00	0.01	-0.03	-0.22	0.18*	-0.08	0.00	0.11**
	(0.03)	(0.01)	(0.01)	(0.05)	(0.16)	(0.10)	(0.05)	(0.05)	(0.05)
Unemployment Rate	0.77	0.11	0.19	-0.06	-1.27	8.14***	-6.13***	0.34	-0.50
	(0.65)	(0.24)	(0.45)	(1.80)	(1.72)	(2.35)	(1.63)	(1.64)	(1.64)
Robust standard errors in parentheses									
*** p<0.01, ** p<0.05, * p<0.1									

APPENDIX 2. CHAPTER 3

Table 3.6 Certified Educators (No Retirement Assumptions)

	Hazard Ratio	St.Err.	p-value	[95% Conf	Interval]	Sig
Republican County (0,1)	0.8868	0.0265	0.0001	0.8364	0.9402	***
COVID*Republican	0.8349	0.0392	0.0001	0.7614	0.9154	***
School Year (2009-2010)						
2010-2011	0.803	0.0232	0	0.7587	0.8498	***
2011-2012	0.7092	0.0265	0	0.6591	0.7631	***
2012-2013	0.7081	0.0257	0	0.6596	0.7603	***
2013-2014	0.6969	0.0261	0	0.6476	0.75	***
2014-2015	0.6178	0.0237	0	0.5731	0.6659	***
2015-2016	0.6141	0.0239	0	0.569	0.6628	***
2026-2017	0.5865	0.023	0	0.5431	0.6334	***
2017-2018	0.5938	0.0232	0	0.55	0.641	***
2018-2019	0.6476	0.0257	0	0.599	0.7	***
2019-2020	0.6372	0.0347	0	0.5727	0.709	***
Teacher Covariates						
Age	1.0454	0.0005	0	1.0444	1.0465	***
Gender (Female =1)	1.0049	0.0138	0.7186	0.9784	1.0323	
Salary, (per $10,000)	0.7375	0.0035	0	0.7306	0.7445	***
Race (White)						
Unknown	1.2756	0.093	0.0008	1.1058	1.4714	***
Two or More	3.2547	0.4443	0	2.4906	4.2532	***
Other	2.0663	0.1494	0	1.7933	2.3809	***
Hawaiian	1.0184	0.3072	0.9518	0.5638	1.8395	
Black	1.018	0.0278	0.5144	0.9649	1.074	
Asian	1.4166	0.1159	0	1.2067	1.6631	***

Table 3.6 (continued)

American Indian	1.635	0.2589	0.0019	1.1989	2.2299	***
County Level Covariates						
Median Income, (per $10,000)	1.1068	0.0084	0	1.0904	1.1234	***
Log County Population	1.0683	0.0128	0	1.0434	1.0938	***
School Level Covariates						
Title I Eligible (1,0), , school level	1.1131	0.0243	0	1.0665	1.1618	***
Free and Reduced Lunch, per 200 students	1.0817	0.0133	0	1.0559	1.1081	***
Enrollment, per 200 students, school level	0.9541	0.0064	0	0.9416	0.9667	***
Student to Teacher Ratio, school level	1.0051	0.0016	0.0012	1.002	1.0082	***
NCES math z-score, school level	1.0036	0.0101	0.72	0.984	1.0236	
NCES reading z-score, school level	0.956	0.0101	0	0.9364	0.976	***
School Level Pre-K (0)						
Primary	0.7505	0.104	0.0384	0.572	0.9847	**
Middle	0.8792	0.1222	0.3543	0.6695	1.1545	
High	0.9157	0.1278	0.5281	0.6966	1.2038	
Other	0.9403	0.1332	0.6638	0.7123	1.2412	
Ungraded	0.9766	0.2133	0.9135	0.6364	1.4984	
District Level Covariates						
Per-Pupil Funding, (per $1000), district level	1.0201	0.0042	0	1.0119	1.0284	***
Enrollment, per 5000 students, **district** level	0.9834	0.0022	0	0.9792	0.9877	***
Student to Teacher Ratio, district level	1.0031	0.0043	0.4815	0.9946	1.0116	

Table 3.6 (continued)

NCES math z-score, district level	1.0013	0.01	0.8932	0.9819	1.0211	
NCES reading z-score, district level	0.9517	0.012	0.0001	0.9285	0.9755	***
Urban Centric Local *City, Large*						
City, small	0.7517	0.0309	0	0.6934	0.8149	***
Suburb, large	0.9385	0.0252	0.018	0.8904	0.9892	**
Suburb, midsize	0.9395	0.0445	0.188	0.8562	1.0309	
Suburb, small	0.9188	0.0443	0.079	0.8359	1.0099	*
Town, fringe	0.9309	0.0427	0.1187	0.8508	1.0185	
Town, distant	0.894	0.0315	0.0015	0.8343	0.958	***
Town, remote	0.8262	0.0326	0	0.7648	0.8926	***
Rural, fringe	0.8593	0.029	0	0.8043	0.9181	***
Rural, distant	0.8735	0.0336	0.0004	0.8102	0.9418	***
Rural, remote	0.879	0.0402	0.0048	0.8037	0.9614	***
*** *p<.01*, ** *p<.05*, * *p<.1*						

Table 3.7 Teacher Turnover (No Retirement Assumptions without Urbanity)

	Hazarad Ratio	St.Err.	p-value	[95% Conf	Interval]	Sig
Republican County (0,1)	0.8342	0.0221	0	0.792	0.8786	***
COVID*Republican	0.8257	0.0397	0.0001	0.7515	0.9073	***
School Year (2009-2010)						
2010-2011	0.7967	0.0231	0	0.7527	0.8434	***
2011-2012	0.638	0.0241	0	0.5923	0.6871	***
2012-2013	0.6467	0.0237	0	0.6019	0.6948	***
2013-2014	0.6331	0.0239	0	0.5879	0.6817	***
2014-2015	0.5604	0.0217	0	0.5195	0.6046	***
2015-2016	0.5582	0.0219	0	0.5169	0.6028	***

Table 3.7 (continued)

2026-2017	0.541	0.0213	0	0.5008	0.5845	***
2017-2018	0.5529	0.0216	0	0.5121	0.5969	***
2018-2019	0.6074	0.0241	0	0.562	0.6565	***
2019-2020	0.611	0.0334	0	0.549	0.6801	***
Teacher Covariates						
Age	1.0373	0.0005	0	1.0362	1.0383	***
Gender (Female =1)	0.9986	0.014	0.9214	0.9715	1.0265	
Salary, (per $10,000)	0.7137	0.0035	0	0.7068	0.7206	***
Race (White)						
Unknown	1.3289	0.0984	0.0001	1.1493	1.5364	***
Two or More	3.2113	0.4384	0	2.4574	4.1964	***
Other	2.1225	0.1576	0	1.8351	2.4551	***
Hawaiian	1.0195	0.3075	0.9491	0.5644	1.8414	
Black	1.0053	0.0285	0.8524	0.951	1.0626	
Asian	1.4645	0.1202	0	1.2469	1.7202	***
American Indian	1.5969	0.2664	0.005	1.1515	2.2146	***
County Level Covariates						
Median Income, (per $10,000)	1.1234	0.0074	0	1.109	1.138	***
Log County Population	1.0574	0.0101	0	1.0379	1.0774	***
School Level Covariates						
Title I Eligible (1,0), , school level	1.1096	0.025	0	1.0617	1.1597	***
Free and Reduced Lunch, per 200 students	1.0865	0.0137	0	1.06	1.1136	***
Enrollment, per 200 students, school level	0.9535	0.0066	0	0.9406	0.9666	***
Student to Teacher Ratio, school level	1.0045	0.0017	0.0076	1.0012	1.0078	***

Table 3.7 (continued)

NCES math z-score, school level	1.0018	0.0104	0.8657	0.9816	1.0223	
NCES reading z-score, school level	0.9518	0.0104	0	0.9316	0.9723	***
School Level Pre-K (0)						
Primary	0.7474	0.1055	0.0391	0.5668	0.9855	**
Middle	0.8838	0.1251	0.3831	0.6697	1.1665	
High	0.9158	0.1302	0.536	0.6931	1.21	
Other	0.9257	0.1337	0.5928	0.6975	1.2285	
Ungraded	0.9822	0.2181	0.9354	0.6356	1.5178	
District Level Covariates						
Per-Pupil Funding, (per $1000), district level	1.023	0.0042	0	1.0147	1.0313	***
Enrollment, per 5000 students, district level	0.989	0.0021	0	0.9848	0.9932	***
Student to Teacher Ratio, district level	1.0022	0.0044	0.6148	0.9936	1.011	
NCES math z-score, district level	0.9979	0.0101	0.8397	0.9783	1.018	
NCES reading z-score, district level	0.951	0.0121	0.0001	0.9276	0.9751	***
*** p<.01, ** p<.05, * p<.1						

Table 3.8 Certified Educators (Retirement age < 59 & experience < 26)

	Hazard Ratio	St.Err.	p-value	[95% Conf	Interval]	Sig
Republican County (0,1)	0.8969	0.0275	0.0004	0.8447	0.9524	***
COVID*Republican	0.8305	0.0399	0.0001	0.7558	0.9126	***
School Year (2009-2010)						
2010-2011	0.7959	0.0231	0	0.7519	0.8424	***

Table 3.8 (continued)

2011-2012	0.642	0.0245	0	0.5958	0.6919	***
2012-2013	0.6478	0.0239	0	0.6027	0.6962	***
2013-2014	0.6348	0.0241	0	0.5893	0.6839	***
2014-2015	0.5635	0.0219	0	0.5222	0.608	***
2015-2016	0.5626	0.0221	0	0.5208	0.6077	***
2026-2017	0.5443	0.0216	0	0.5037	0.5883	***
2017-2018	0.5594	0.022	0	0.518	0.6042	***
2018-2019	0.6162	0.0246	0	0.5698	0.6663	***
2019-2020	0.6197	0.0342	0	0.5563	0.6904	***
Teacher Covariates						
Age	1.0373	0.0005	0	1.0362	1.0383	***
Gender (Female =1)	0.999	0.0141	0.9444	0.9719	1.0269	
Salary, (per $10,000)	0.7139	0.0035	0	0.707	0.7208	***
Race (White)						
Unknown	1.3278	0.0983	0.0001	1.1484	1.5352	***
Two or More	3.2212	0.4399	0	2.4648	4.2097	***
Other	2.1084	0.1566	0	1.8228	2.4387	***
Hawaiian	1.0157	0.3064	0.9588	0.5623	1.8347	
Black	1.0062	0.0285	0.8275	0.9518	1.0637	
Asian	1.4644	0.1202	0	1.2467	1.7201	***
American Indian	1.5917	0.2656	0.0053	1.1477	2.2075	***
County Level Covariates						
Median Income, (per $10,000)	1.1058	0.0087	0	1.0889	1.123	***
Log County Population	1.0654	0.0132	0	1.0399	1.0916	***
School Level Covariates						

Table 3.8 (continued)

Title I Eligible (1,0), , school level	1.1157	0.0253	0	1.0672	1.1665	***
Free and Reduced Lunch, per 200 students	1.0857	0.0138	0	1.059	1.1131	***
Enrollment, per 200 students, school level	0.952	0.0066	0	0.9392	0.9651	***
Student to Teacher Ratio, school level	1.0047	0.0017	0.0045	1.0015	1.008	***
NCES math z-score, school level	1.0014	0.0104	0.8897	0.9813	1.022	
NCES reading z-score, school level	0.9535	0.0104	0	0.9333	0.9742	***
School Level Pre-K (0)						
Primary	0.7434	0.105	0.0359	0.5636	0.9806	**
Middle	0.8811	0.1249	0.3718	0.6673	1.1633	
High	0.9197	0.1309	0.5563	0.6958	1.2156	
Other	0.9271	0.1341	0.6007	0.6983	1.2309	
Ungraded	1.0164	0.2258	0.9416	0.6575	1.5711	
District Level Covariates						
Per-Pupil Funding, (per $1000), district level	1.0214	0.0043	0	1.013	1.03	***
Enrollment, per 5000 students, district level	0.9865	0.0022	0	0.9821	0.9909	***
Student to Teacher Ratio, district level	1.0035	0.0045	0.44	0.9947	1.0124	
NCES math z-score, district level	1.0025	0.0103	0.8096	0.9825	1.0229	
NCES reading z-score, district level	0.9502	0.0123	0.0001	0.9264	0.9747	***
Urban Centric Local *City, Large*						
City, small	0.7449	0.0318	0	0.6851	0.8099	***

Table 3.8 (continued)

Suburb, large	0.935	0.026	0.0155	0.8855	0.9873	**
Suburb, midsize	0.9482	0.0464	0.2771	0.8614	1.0437	
Suburb, small	0.9302	0.0463	0.1459	0.8438	1.0255	
Town, fringe	0.9438	0.0446	0.2211	0.8602	1.0354	
Town, distant	0.9044	0.0329	0.0058	0.8421	0.9712	***
Town, remote	0.8395	0.0342	0	0.7752	0.9092	***
Rural, fringe	0.8665	0.0302	0	0.8093	0.9278	***
Rural, distant	0.8859	0.0351	0.0022	0.8196	0.9575	***
Rural, remote	0.8853	0.0417	0.0098	0.8072	0.971	***
*** *p<.01*, ** *p<.05*, * *p<.1*						

Table 3.9 Teacher Turnover (No Retirement Assumptions)

	Hazard Ratio	St.Err.	p-value	[95% Conf	Interval]	Sig
Republican County (0,1)	0.869	0.0289	0	0.8142	0.9276	***
COVID*Republican	0.8557	0.0439	0.0024	0.7739	0.9461	***
School Year (2009-2010)						
2010-2011	0.8198	0.0264	0	0.7696	0.8732	***
2011-2012	0.7222	0.0302	0	0.6654	0.7838	***
2012-2013	0.735	0.0296	0	0.6792	0.7955	***
2013-2014	0.7323	0.0304	0	0.6751	0.7943	***
2014-2015	0.635	0.027	0	0.5843	0.6902	***
2015-2016	0.6466	0.0278	0	0.5943	0.7034	***
2026-2017	0.6246	0.0269	0	0.5739	0.6796	***
2017-2018	0.6225	0.0267	0	0.5723	0.677	***
2018-2019	0.6901	0.03	0	0.6338	0.7515	***
2019-2020	0.6701	0.0395	0	0.5969	0.7523	***
Teacher Covariates						

Table 3.9 (continued)

Age	1.0439	0.0006	0	1.0427	1.045	***
Gender (Female =1)	1.0207	0.0159	0.19	0.9899	1.0524	
Salary, (per $10,000)	0.699	0.0044	0	0.6904	0.7077	***
Race (White)						
Unknown	1.3638	0.1051	0.0001	1.1726	1.5861	***
Two or More	2.9797	0.4361	0	2.2366	3.9696	***
Other	2.0409	0.1621	0	1.7467	2.3848	***
Hawaiian	0.9549	0.3185	0.8901	0.4967	1.836	
Black	1.036	0.0315	0.2452	0.976	1.0996	
Asian	1.4427	0.1235	0	1.2198	1.7063	***
American Indian	1.6702	0.2912	0.0033	1.1868	2.3505	***
County Level Covariates						
Median Income, (per $10,000)	1.117	0.0095	0	1.0985	1.1357	***
Log County Population	1.0973	0.0149	0	1.0685	1.1269	***
School Level Covariates						
Title I Eligible (1,0), , school level	1.1323	0.0279	0	1.079	1.1883	***
Free and Reduced Lunch, per 200 students	1.0788	0.0147	0	1.0504	1.1079	***
Enrollment, per 200 students, school level	0.9532	0.0071	0	0.9393	0.9673	***
Student to Teacher Ratio, school level	1.0072	0.0019	0.0001	1.0035	1.011	***
NCES math z-score, school level	1.0025	0.0113	0.8274	0.9806	1.0248	
NCES reading z-score, school level	0.9533	0.0112	0	0.9315	0.9756	***
School Level Pre-K (0)						

Table 3.9 (continued)

Primary	0.6838	0.1039	0.0124	0.5076	0.921	**
Middle	0.838	0.1278	0.2465	0.6216	1.1299	
High	0.8821	0.1351	0.4128	0.6534	1.191	
Other	0.8796	0.1369	0.4099	0.6484	1.1934	
Ungraded	0.91	0.2205	0.6971	0.566	1.4631	
District Level Covariates						
Per-Pupil Funding, (per $1000), district level	1.0241	0.0047	0	1.0149	1.0333	***
Enrollment, per 5000 students, district level	0.9792	0.0024	0	0.9745	0.9839	***
Student to Teacher Ratio, district level	1.0007	0.0049	0.8858	0.9912	1.0103	
NCES math z-score, district level	0.9997	0.0113	0.976	0.9777	1.0221	
NCES reading z-score, district level	0.9482	0.0135	0.0002	0.9221	0.9751	***
Urban Centric Local *City, Large*						
City, small	0.7471	0.0346	0	0.6823	0.8181	***
Suburb, large	0.9337	0.0271	0.018	0.882	0.9883	**
Suburb, midsize	0.9495	0.051	0.3344	0.8547	1.0548	
Suburb, small	0.9739	0.0523	0.6221	0.8766	1.082	
Town, fringe	0.9277	0.0479	0.1458	0.8384	1.0264	
Town, distant	0.91	0.0356	0.016	0.8428	0.9826	**
Town, remote	0.8306	0.0364	0	0.7622	0.9052	***
Rural, fringe	0.8716	0.0325	0.0002	0.8101	0.9377	***
Rural, distant	0.8792	0.0375	0.0025	0.8088	0.9558	***
Rural, remote	0.8833	0.0449	0.0146	0.7996	0.9758	**
*** *p<.01*, ** *p<.05*, * *p<.1*						

Table 3.10 Teacher Turnover (Retirement age < 59 & experience < 26)

	Hazard Ratio	St.Err.	p-value	[95% Conf	Interval]	Sig
Republican County (0,1)	0.8807	0.03	0.0002	0.8238	0.9415	***
COVID*Republican	0.8515	0.0446	0.0021	0.7685	0.9435	***
School Year (2009-2010)						
2010-2011	0.8144	0.0263	0	0.7645	0.8677	***
2011-2012	0.6653	0.0283	0	0.612	0.7232	***
2012-2013	0.6809	0.0279	0	0.6284	0.7378	***
2013-2014	0.6764	0.0285	0	0.6229	0.7345	***
2014-2015	0.5885	0.0253	0	0.5409	0.6403	***
2015-2016	0.6021	0.0262	0	0.5529	0.6556	***
2026-2017	0.5872	0.0256	0	0.5392	0.6395	***
2017-2018	0.5912	0.0255	0	0.5433	0.6433	***
2018-2019	0.6632	0.029	0	0.6087	0.7224	***
2019-2020	0.6586	0.0393	0	0.5859	0.7402	***
Teacher Covariates						
Age	1.0366	0.0006	0	1.0354	1.0377	***
Gender (Female =1)	1.0154	0.0163	0.3398	0.984	1.0478	
Salary, (per $10,000)	0.6722	0.0044	0	0.6637	0.6808	***
Race (White)						
Unknown	1.4316	0.112	0	1.2281	1.6688	***
Two or More	2.96	0.4333	0	2.2217	3.9437	***
Other	2.0761	0.1692	0	1.7696	2.4358	***
Hawaiian	0.9712	0.3239	0.9301	0.5051	1.8671	
Black	1.0279	0.0323	0.3813	0.9665	1.0932	
Asian	1.4962	0.1286	0	1.2642	1.7708	***
American Indian	1.6303	0.2981	0.0075	1.1394	2.3329	***

Table 3.10 (continued)

County Level Covariates						
Median Income, (per $10,000)	1.1162	0.0098	0	1.0972	1.1354	***
Log County Population	1.0929	0.0152	0	1.0635	1.1232	***
School Level Covariates						
Title I Eligible (1,0), , school level	1.1315	0.0288	0	1.0764	1.1895	***
Free and Reduced Lunch, per 200 students	1.0813	0.0151	0	1.052	1.1113	***
Enrollment, per 200 students, school level	0.9516	0.0074	0	0.9373	0.9661	***
Student to Teacher Ratio, school level	1.0068	0.002	0.0005	1.003	1.0107	***
NCES math z-score, school level	1.0003	0.0116	0.9825	0.9778	1.0232	
NCES reading z-score, school level	0.9506	0.0115	0	0.9282	0.9735	***
School Level Pre-K (0)						
Primary	0.6901	0.1073	0.0171	0.5088	0.9361	**
Middle	0.856	0.1336	0.3189	0.6304	1.1622	
High	0.9004	0.1411	0.5034	0.6622	1.2243	
Other	0.8951	0.1426	0.4869	0.6551	1.2232	
Ungraded	0.9734	0.2382	0.9124	0.6026	1.5726	
District Level Covariates						
Per-Pupil Funding, (per $1000), district level	1.0257	0.0048	0	1.0162	1.0352	***
Enrollment, per 5000 students, district level	0.9822	0.0025	0	0.9773	0.987	***
Student to Teacher Ratio, district level	1.0017	0.005	0.7405	0.9918	1.0116	
NCES math z-score, district level	0.9972	0.0116	0.8092	0.9746	1.0203	

Table 3.10 (continued)

NCES reading z-score, district level	0.952	0.014	0.0008	0.9251	0.9798	***
Urban Centric Local *City, Large*						
City, small	0.7353	0.0353	0	0.6692	0.8078	***
Suburb, large	0.9251	0.0278	0.0095	0.8723	0.9812	***
Suburb, midsize	0.9585	0.0529	0.4428	0.8602	1.0681	
Suburb, small	0.9853	0.0544	0.7884	0.8843	1.0979	
Town, fringe	0.9331	0.0495	0.1913	0.841	1.0352	
Town, distant	0.9127	0.0368	0.0235	0.8434	0.9878	**
Town, remote	0.8377	0.0378	0.0001	0.7668	0.9152	***
Rural, fringe	0.8724	0.0335	0.0004	0.8092	0.9406	***
Rural, distant	0.8809	0.0387	0.0039	0.8083	0.96	***
Rural, remote	0.8793	0.046	0.014	0.7936	0.9743	**
*** *p<.01, ** p<.05, * p<.1*						

Table 3.11 Teacher Turnover (Reference year 2018-2019 AY)

	Hazard Ratio	St.Err.	p-value	[95% Conf	Interval]	Sig
Republican County (0,1)	0.8864	0.0264	0.0001	0.8361	0.9397	***
COVID*Republican	0.8348	0.0392	0.0001	0.7613	0.9154	***
School Year (2018-2019)						
2009-2010	1.5466	0.0614	0	1.4307	1.6718	***
2010-2011	1.2422	0.0406	0	1.1651	1.3244	***
2011-2012	1.0959	0.035	0.0041	1.0294	1.1666	***
2012-2013	1.0941	0.032	0.0021	1.0332	1.1587	***
2013-2014	1.077	0.0311	0.0102	1.0177	1.1397	**
2014-2015	0.955	0.0269	0.1027	0.9037	1.0093	
2015-2016	0.9492	0.0265	0.0617	0.8986	1.0026	*

Table 3.11 (continued)

2026-2017	0.9062	0.0248	0.0003	0.8588	0.9562	***
2017-2018	0.9173	0.0237	0.0008	0.872	0.9649	***
2019-2020	0.9846	0.0443	0.7295	0.9015	1.0753	
Teacher Covariates						
Age	1.0454	0.0005	0	1.0444	1.0465	***
Gender (Female =1)	1.0047	0.0137	0.7309	0.9781	1.032	
Salary, (per $10,000)	0.7375	0.0035	0	0.7306	0.7444	***
Race (White)						
Unknown	1.2754	0.0929	0.0008	1.1057	1.4712	***
Two or More	3.2529	0.4441	0	2.4892	4.2509	***
Other	2.0653	0.1493	0	1.7924	2.3797	***
Hawaiian	1.0179	0.3071	0.9532	0.5635	1.8386	
Black	1.0179	0.0278	0.5154	0.9649	1.0739	
Asian	1.4163	0.1159	0	1.2065	1.6627	***
American Indian	1.6349	0.2588	0.0019	1.1987	2.2297	***
County Level Covariates						
Median Income, (per $10,000)	1.1069	0.0084	0	1.0905	1.1235	***
Log County Population	1.0682	0.0128	0	1.0433	1.0937	***
School Level Covariates						
Title I Eligible (1,0), , school level	1.1126	0.0243	0	1.066	1.1613	***
Free and Reduced Lunch, per 200 students	1.0819	0.0133	0	1.0561	1.1083	***
Enrollment, per 200 students, school level	0.9539	0.0064	0	0.9414	0.9665	***
Student to Teacher Ratio, school level	1.0053	0.0016	0.0007	1.0022	1.0084	***

Table 3.11 (continued)

NCES math z-score, school level	1.002	0.0101	0.8449	0.9824	1.0219	
NCES reading z-score, school level	0.9565	0.0101	0	0.9369	0.9765	***
School Level Pre-K (0)						
Primary	0.7378	0.1022	0.0282	0.5623	0.968	**
Middle	0.8636	0.1201	0.2914	0.6576	1.134	
High	0.8991	0.1255	0.4458	0.6839	1.1819	
Other	0.9242	0.1309	0.578	0.7001	1.22	
Ungraded	0.9578	0.2091	0.8436	0.6243	1.4694	
District Level Covariates						
Per-Pupil Funding, (per $1000), district level	1.0201	0.0042	0	1.0119	1.0284	***
Enrollment, per 5000 students, district level	0.9834	0.0022	0	0.9792	0.9876	***
Student to Teacher Ratio, district level	1.0029	0.0043	0.4973	0.9945	1.0115	
NCES math z-score, district level	1.0016	0.01	0.8707	0.9822	1.0214	
NCES reading z-score, district level	0.9517	0.012	0.0001	0.9285	0.9754	***
Urban Centric Local *City, Large*						
City, small	0.7521	0.031	0	0.6938	0.8153	***
Suburb, large	0.9383	0.0252	0.0175	0.8902	0.9889	**
Suburb, midsize	0.9387	0.0445	0.1821	0.8555	1.0301	
Suburb, small	0.9184	0.0443	0.0777	0.8356	1.0095	*
Town, fringe	0.9303	0.0427	0.1156	0.8503	1.0179	
Town, distant	0.894	0.0315	0.0015	0.8343	0.958	***
Town, remote	0.8259	0.0326	0	0.7645	0.8922	***
Rural, fringe	0.8592	0.029	0	0.8042	0.918	***

Table 3.11 (continued)

Rural, distant	0.872	0.0335	0.0004	0.8088	0.9402	***
Rural, remote	0.878	0.0401	0.0044	0.8028	0.9603	***
*** *p<.01, ** p<.05, * p<.1*						

Table 3.12 Certified Educators with Unemployment Control

	Hazard Ratio	St.Err.	p-value	[95% Conf	Interval]	Sig
Republican County (0,1)	0.8864	0.0264	0.0001	0.8361	0.9397	***
COVID*Republican	0.8348	0.0392	0.0001	0.7613	0.9154	***
School Year (2009-2010)						
2010-2011	0.8032	0.0232	0	0.759	0.85	***
2011-2012	0.7086	0.0265	0	0.6586	0.7624	***
2012-2013	0.7075	0.0256	0	0.6589	0.7595	***
2013-2014	0.6964	0.0261	0	0.6471	0.7494	***
2014-2015	0.6175	0.0236	0	0.5729	0.6656	***
2015-2016	0.6137	0.0239	0	0.5687	0.6624	***
2026-2017	0.5859	0.023	0	0.5426	0.6328	***
2017-2018	0.5931	0.0232	0	0.5494	0.6403	***
2018-2019	0.6466	0.0257	0	0.5982	0.699	***
2019-2020	0.6366	0.0347	0	0.5721	0.7084	***
Teacher Covariates						
Age	1.0454	0.0005	0	1.0444	1.0465	***
Gender (Female =1)	1.0047	0.0137	0.7309	0.9781	1.032	
Salary, (per $10,000)	0.7375	0.0035	0	0.7306	0.7444	***
Race (White)						
Unknown	1.2754	0.0929	0.0008	1.1057	1.4712	***
Two or More	3.2529	0.4441	0	2.4892	4.2509	***

Table 3.12 (continued)

Other	2.0653	0.1493	0	1.7924	2.3797	***
Hawaiian	1.0179	0.3071	0.9532	0.5635	1.8386	
Black	1.0179	0.0278	0.5154	0.9649	1.0739	
Asian	1.4163	0.1159	0	1.2065	1.6627	***
American Indian	1.6349	0.2588	0.0019	1.1987	2.2297	***
County Level Covariates						
Median Income, (per $10,000)	1.1069	0.0084	0	1.0905	1.1235	***
Log County Population	1.0682	0.0128	0	1.0433	1.0937	***
School Level Covariates						
Title I Eligible (1,0), , school level	1.1126	0.0243	0	1.066	1.1613	***
Free and Reduced Lunch, per 200 students	1.0819	0.0133	0	1.0561	1.1083	***
Enrollment, per 200 students, school level	0.9539	0.0064	0	0.9414	0.9665	***
Student to Teacher Ratio, school level	1.0053	0.0016	0.0007	1.0022	1.0084	***
NCES math z-score, school level	1.002	0.0101	0.8449	0.9824	1.0219	
NCES reading z-score, school level	0.9565	0.0101	0	0.9369	0.9765	***
*** $p<.01$, ** $p<.05$, * $p<.1$						

APPENDIX 3. Chapter 4

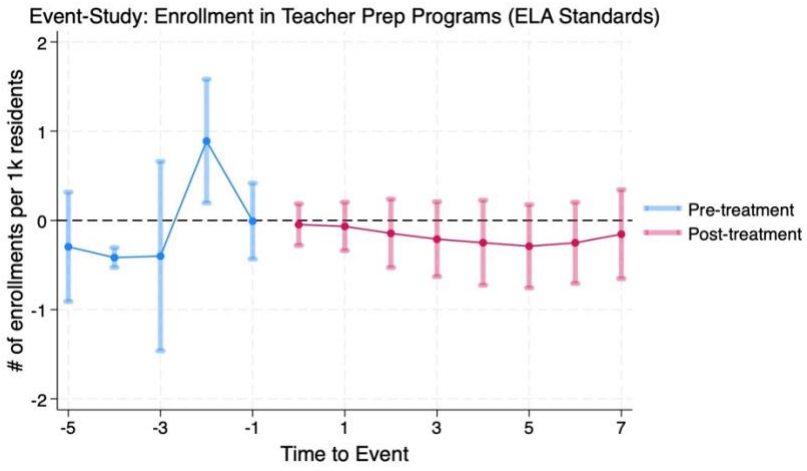

Figure 4.3 Event Study: Enrollment in Teacher Pre Programs (ELA Standards)

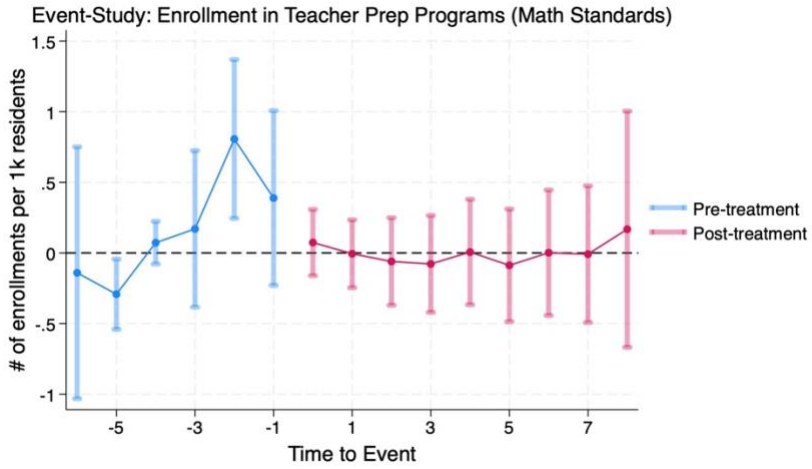

Figure 4.4 Event Study: Enrollment in Teacher Pre Programs (Math Standards)

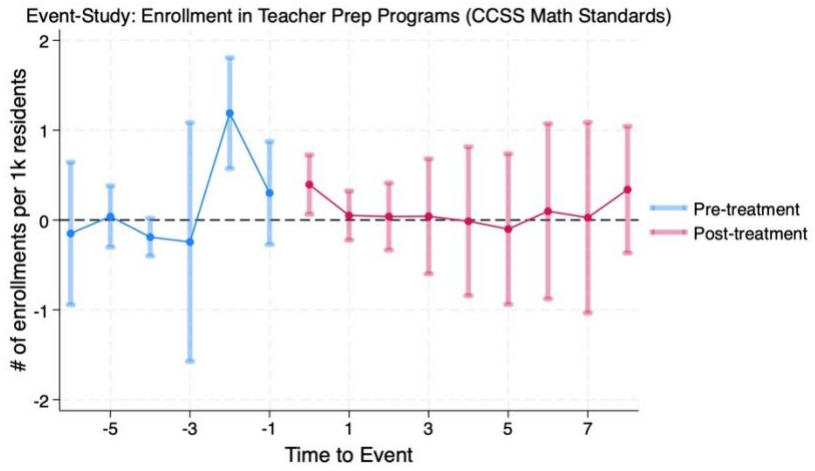

Figure 4.5 Event Study: Enrollment in Teacher Pre Programs (CCSS Math Standards)

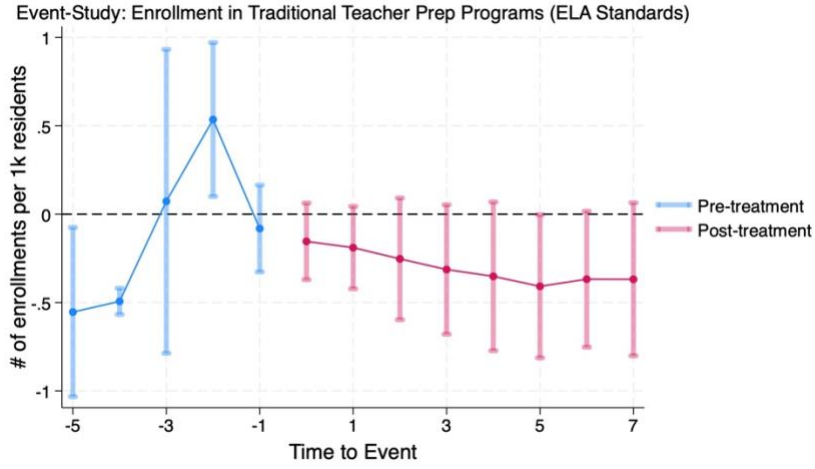

Figure 4.6 Event Study: Enrollment in Traditional Teacher Pre Programs (ELA Standards)

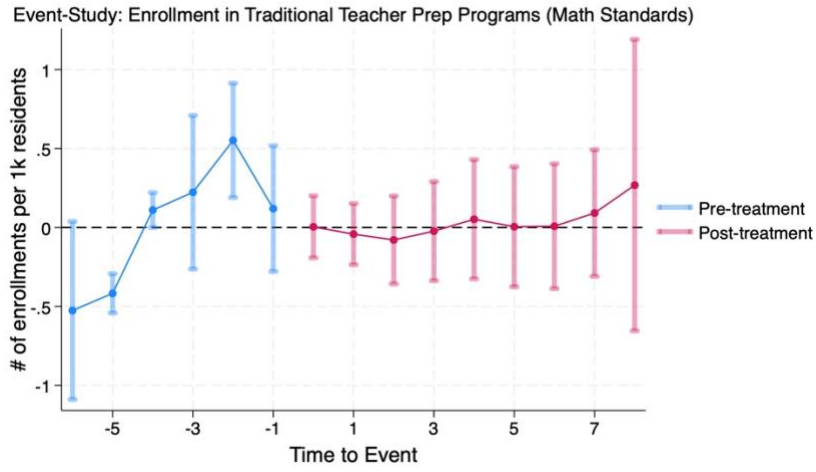

Figure 4.7 Event Study: Enrollment in Traditional Teacher Pre Programs (Math Standards)

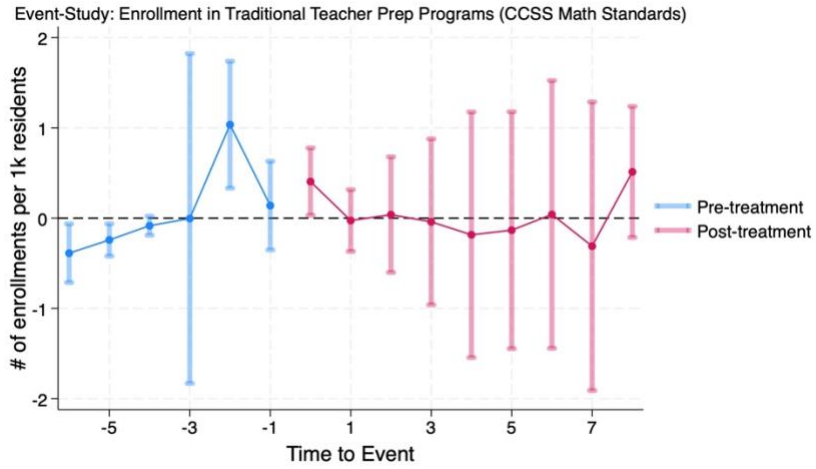

Figure 4.8 Event Study: Enrollment in Traditional Teacher Pre Programs (CCSS Math Standards)

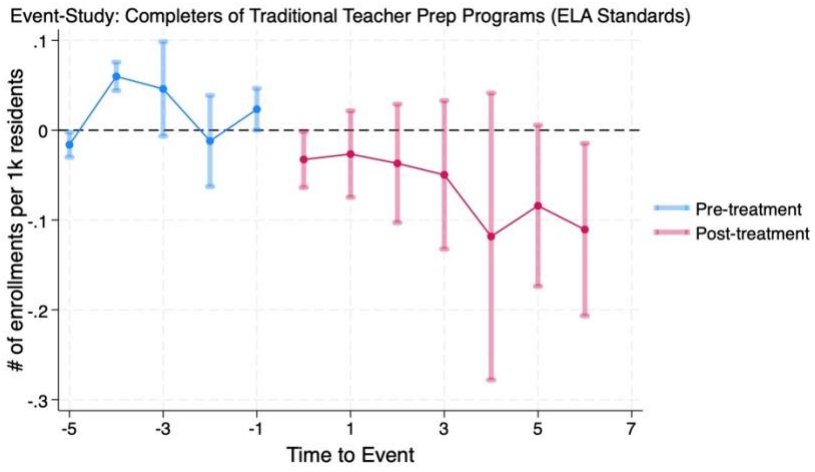

Figure 4.9 Event Study: Completers in Traditional Teacher Pre Programs (ELA Standards)

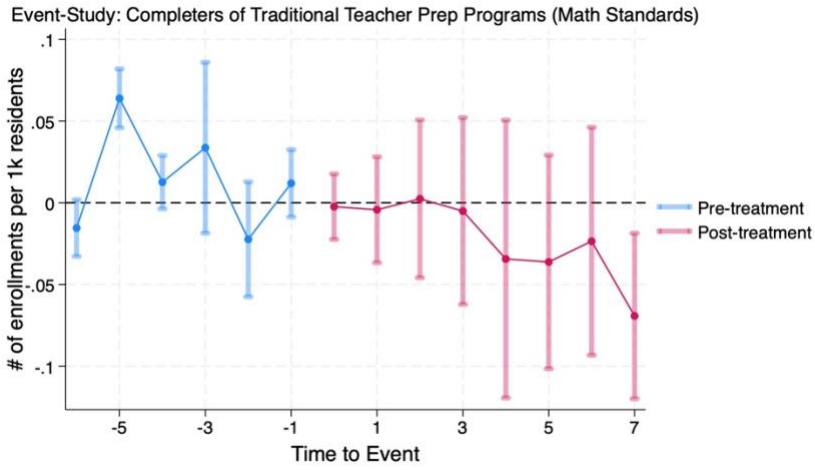

Figure 4.10 Event Study: Completers in Traditional Teacher Pre Programs (Math Standards)

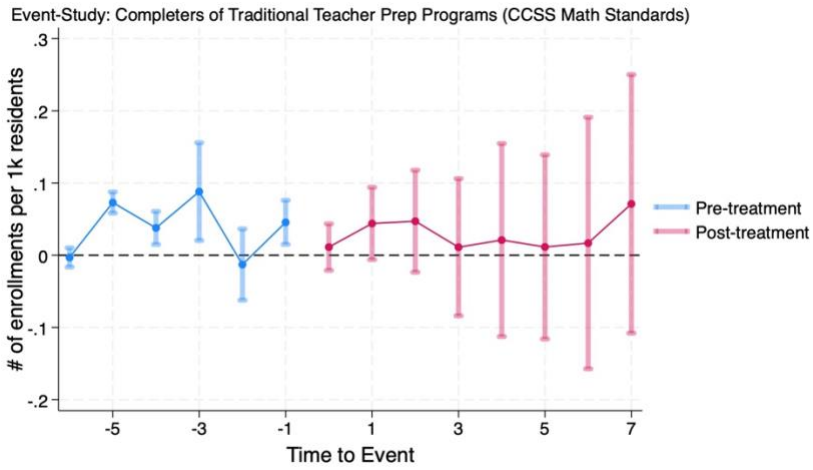

Figure 4.11 Event Study: Completers in Traditional Teacher Pre Programs (CCSS Math Standards)

Table 4.2 Year Each State Adopted Common Core

State	**Year Adopted**	**State**	**Year Adopted**
Idaho	2013-2014	Delaware	2012-2013
Nevada	2013-2014	D.C	2012-2013
Arizona	2013-2014	Maine	2012-2013
Utah	2013-2014	North Carolina	2012-2013
New Mexico	2013-2014	Iowa	2012-2013
Colorado	2013-2014	Michigan	2012-2013
Kansas	2013-2014	Kentucky	2011-2012
Montana	2013-2014	Oklahoma	Never Adopted
North Dakota	2013-2014	Texas	Never Adopted
Arkansas	2013-2014	Nebraska	Never Adopted
Louisiana	2013-2014	Indiana	Never Adopted
Mississippi	2013-2014	South Carolina	Never Adopted
Alabama	2013-2014	Virginia	Never Adopted
Tennessee	2013-2014	Alaska	Never Adopted
Illinois	2013-2014	Florida	Never Adopted
Indiana	2013-2014	California	2014-2015
Ohio	2013-2014	Oregon	2014-2015
Pennsylvania	2013-2014	Washington	2014-2015
Maryland	2013-2014	Wyoming	2014-2015
New Jersey	2013-2014	South Dakota	2014-2015
New York	2013-2014	Missouri	2014-2015
Connecticut	2013-2014	Georgia	2014-2015
Rhode Island	2013-2014	West Virginia	2014-2015
Vermont	2013-2014	New Hampshire	2014-2015

Table 4.2 (continued)

Massachusetts	2013-2014		
Hawaii	2013-2014		

*Year Adopted Common Core based off http://www.corestandards.org/standards-in-your-state/

Table 4.3 Prior Rigor Index Measure for Each States

State	**Year CCR standards in ELA adopted**	**Year CCR standards in math adopted**	**Prior Rigor Index for prior ELA standards**	**Prior Rigor Index for prior math standards**	**Prior CCSS-Similarity Index for prior math standards**
Alabama	2010	2010	6	5	5
Alaska*	2012	2012	1	3	3
Arizona	2010	2010	5	4	1
Arkansas	2010	2010	3	3	3
California	2010	2010	7	7	5
Colorado	2009	2009	6	3	3
Connecticut	2010	2010	2	3	2
Delaware	2010	2010	2	5	3
DC	2010	2010	7	7	NA
Florida	2010	2010	5	7	5
Georgia	2010	2010	6	6	5
Hawaii	2010	2010	4	3	3
Idaho	2011	2011	4	5	4
Illinois	2010	2010	3	1	2
Indiana	2010	2010	7	7	5
Iowa	2010	2010	1	3	1
Kansas	2010	2010	4	1	1
Kentucky	2010	2010	3	2	1

Table 4.3 (continued)

Louisiana	2010	2010	6	3	1
Maine	2011	2011	4	3	2
Maryland	2010	2010	4	3	2
Massachusetts	2010	2010	7	6	3
Michigan	2010	2010	2	6	5
Minnesota*	2010	2007	4	5	5
Mississippi	2010	2010	3	4	5
Missouri	2010	2010	3	2	2
Montana	2011	2011	2	0	2
Nebraska*	2014	2015	1	3	2
Nevada	2010	2010	4	4	1
New Hampshire	2010	2010	4	3	2
New Jersey	2010	2010	4	4	1
New Mexico	2010	2010	4	4	3
New York	2010	2010	3	5	3
North Carolina	2010	2010	3	3	3
North Dakota	2011	2011	2	4	4
Ohio	2010	2010	4	3	3
Oklahoma	2010	2010	5	5	5
Oregon	2010	2010	4	5	4
Pennsylvania	2010	2010	3	1	3
Rhode Island	2010	2010	3	3	1
South Carolina	2010	2010	3	3	3
South Dakota	2010	2010	4	3	4
Tennessee	2010	2010	6	3	4
Texas*	2008	2008	6	4	3

Table 4.3 (continued)

Utah	2010	2010	4	6	4
Vermont	2010	2010	2	1	3
Virginia*	2010	2009	6	4	2
Washington	2011	2011	4	7	5
West Virginia	2010	2010	3	5	3
Wisconsin	2010	2010	3	1	1
Wyoming	2012	2012	3	1	2

*Adopted from Song, Yang, Garet (2019)

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CONFERENCE PRESENTATIONS

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