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ABSTRACT

The COVID-19 pandemic has been a trying period for teachers. Teachers had to adapt to unexpected conditions, teaching in unprecedented ways. As a result, teachers' levels of stress and burnout have been high throughout the pandemic, raising concerns about a potential increase in teacher turnover and future teacher shortages. We use administrative data for the state of Arkansas to document the effects of the COVID-19 pandemic on teachers' mobility and attrition during the years 2018-19 to 2021-2022. We find stable turnover rates during the first year of the pandemic (2020-2021) but an increase in teacher mobility and attrition in the second year (2021-2022). Teacher mobility and attrition increased by 2 percentage points (10% relative increase) this second year but with heterogeneous effects across regions and depending on the teacher and school characteristics. Our results raise concerns about increased strain in areas already experiencing teacher shortages and a potential reduction in the diversity of the Arkansas teacher labor force.

Keywords: Teacher turnover, teacher retention, COVID-19

JEL Codes: I20, J28, J18

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1. Introduction

The COVID-19 pandemic has been a trying period for teachers. After nationwide school closures during the spring of 2020, schools reopened in the fall using combinations of in-person, hybrid, and remote learning models. Teachers had to adapt to unexpected conditions, teaching in unprecedented ways, using synchronous and asynchronous instruction, while also being challenged to establish connections with students, families, and colleagues. Health concerns added to the mix as some teachers went back to in-person education despite the lack of a vaccine and uncertainty surrounding COVID-19 transmission in schools.

Teachers' levels of stress and burnout have been high throughout these unusual pandemic times, raising concerns about a potential increase in teacher turnover and future teacher shortages (Goldberg, 2021; Lavery, 2020). Kraft et al., (2021) document how teachers' sense of success dramatically declined in the initial months of the pandemic, especially for teachers in schools with less supportive working environments. Diliberti et al., (2021) using nationally representative data from the RAND American Teacher Panel document how most teachers who left the profession after March of 2020, before their scheduled retirement, cited COVID-19 as a major reason why. Similarly, Zamarro et al., (2021) also use data from the RAND American Teacher Panel and document how teachers' considerations of leaving the profession increased during the pandemic. Zamarro et al., find that approaching retirement age (being 55 or older), having to change instructional modes, COVID-19 related health concerns, and high levels of job-related burnout all were significantly associated with a higher probability of considering leaving or retiring. Hybrid teaching was also associated with increased consideration of leaving because of COVID. However, teacher considerations to leave might not necessarily match actual teacher turnover (Nguyen et al., 2022).

As state-level administrative data becomes available, emerging literature has started documenting actual teacher turnover changes during the pandemic. Using administrative data from Massachusetts, Bacher-Hicks et al., (2022) track teacher turnover throughout the pandemic. They find that, overall, turnover did not increase from the spring of 2020 to the fall of 2020-21 academic year, but turnover did increase by about 2.5 percentage points (17% relative increase) entering the 2021-22 academic year. The authors examine turnover rates by subgroups and find that while turnover declined for early-career teachers, it increased for teachers with more than 9

years of experience in the first year of the pandemic. However, turnover did increase above pre-pandemic levels for all groups of experience entering the 2021-22 academic year. Interestingly, they find that there was a decrease in turnover in schools serving a high proportion of non-white students in the first year of the pandemic followed by a sharp increase going into the second year. These results highlight the potential for differing turnover effects over time as the pandemic continues and the economy recovers.

Goldhaber and Theobald (2022) find similar patterns for teacher turnover in Washington state. While there was little evidence of increased turnover between the spring and fall of 2020, there was a 1.6 percentage point increase (20% relative increase) in the proportion of teachers attriting from the labor force or moving to non-teaching positions going into the 2021-22 academic year as compared to the prior year. The authors also document an almost one percentage point increase in the rates of school-to-school mobility. However, the authors caution interpreting these increases as a sign of a mass teacher exodus. They note that levels of turnover in both years of the pandemic were not unprecedented in comparison with past years.

We contribute to this emerging literature by documenting the effects of the COVID-19 pandemic on teachers' mobility and attrition using administrative data for the state of Arkansas for the years 2017-18 through 2021-22. In contrast with the states of Massachusetts and Washington, Arkansas required school districts to offer five days of in-person learning at the beginning of the 2020-21 academic year and, as a result, in-person learning in Arkansas was more prevalent than in most of the United States. Arkansas then offers a different context to evaluate the effects of the pandemic on teachers' turnover.

Overall, our findings document stable turnover rates during the first year of the pandemic (2020-21) but an increase in teacher mobility and attrition in the second year (2021-22). Teacher mobility and attrition increased by about 2 percentage points (a 10% relative increase) in the second year but with heterogeneous effects across regions and depending on the teacher and school characteristics. Teacher retention at the same school was lower for Black teachers, for schools with higher percentages of students receiving Free or Reduced-priced Lunch (FRL), and for schools in the Southeast, Southwest, and Northwest regions. Those approaching retirement age (55 and older) were more likely to leave the profession in the first year of the pandemic

(2020-21) than pre-pandemic. Having to change learning modes during the first year of the pandemic was associated with an increased rate of attrition in the second year.

2. The Arkansas Context

Located in the South-Central United States and with a population of just over 3 million, Arkansas is a mid-size state in the country. From 2017-18 through 2021-22, there have been approximately 32,500 teachers and 490,000 students in the state's public school system each year¹. As shown in Table 1, and like national trends, most teachers in the state are female (77%) and white (87%). The proportion of teachers using some form of licensure waiver² has increased from 6% in 2017-18 to 8% during the 2021-22 academic year. Teacher turnover averaged 20% from 2018-19 through 2020-21 academic years but increased to 22% during the 2021-22 academic year. The Arkansas Department of Education identifies teacher shortage areas based on the number of uncertified teachers³ filling true vacancies. According to this classification, most geographical teacher shortage areas in the state are in the Lower Delta region (Southeast), followed by the Southwest and Upper Delta regions (Northeast)⁴.

There are large regional differences in terms of both teachers and students within the state. Teachers in the Northwest and Northeast regions tend to be whiter, less likely to be on a waiver, and better retained than teachers in the Southeast, Southwest, or Central regions. The Northwest and Northeast regions also tend to be less diverse than other regions, though Northwest Arkansas does have a higher proportion of Hispanic and Pacific Islander students than other regions. The region with the highest level of student economic disadvantage (as measured by the percentage of FRL students) is the Southeast (85%) while the region with the lowest level is the Northwest (64%). More detailed summary statistics describing regional differences can be found in Appendix A.

¹ Own calculations based on Arkansas administrative data provided to us.

² Licensure waivers include emergency teaching permits, long-term substitute waivers, alternative licensure plans, and waivers for charter schools and schools of innovation under Arkansas Act 1240.

³ Uncertified teacher is defined as a teacher employed under an Act 1240 waiver, a teacher employed under an emergency teaching permit, or a long-term substitute filling a true vacancy for a full year.

⁴ https://static.ark.org/eeuploads/adhe-financial/Shortage_Areas_for_ADHE_8.26.2020.pdf

As in most other states across the United States, in March 2020 schools in Arkansas closed for in-person attendance, and students moved to remote learning for the rest of the academic year with the hope of containing the pandemic. Schools started to reopen in the fall of 2020 using different combinations of in-person, remote learning, and hybrid models. In contrast with many other states in the country, Arkansas' secretary of education issued guidance on August 5th, 2020, requiring all school districts in the state to offer in-person learning instruction five days a week when classes resumed later in August. Decisions about whether a school could close for in-person learning and pivot to remote learning options had to be made in collaboration with the Arkansas Department of Health and Education⁵. As a result, most districts in Arkansas (74.6%) offered fully in-person learning for all students in mid-September of 2020. No districts were fully remote at that time⁶. However, changes in teaching modality were frequent with 45% of Arkansas teachers teaching in a district that changed modalities at least once during the 2020-21 academic year.⁷

3. Data and Methods

To examine teachers' mobility and attrition in Arkansas we use administrative data maintained by the Office of Education Policy and the Department of Education Reform at the University of Arkansas. These data cover the universe of traditional public and charter schoolteachers for 2017-18 through the 2021-22 academic years and allow us to track individual teachers throughout their time in the Arkansas teacher workforce.

We build individual teacher turnover measures exploiting the longitudinal nature of our data. We define an individual as a teacher in an Arkansas school if they are both assigned classes at that school and recorded as having received a salary from the same district in the same year. Within each district and year, we classify teachers as working in only one school⁸. From these

⁵ See [https://ballotpedia.org/School_responses_in_Arkansas_to_the_coronavirus_\(COVID-19\)_pandemic#cite_note-AR8241-14](https://ballotpedia.org/School_responses_in_Arkansas_to_the_coronavirus_(COVID-19)_pandemic#cite_note-AR8241-14)

⁶ Data provided by the American Enterprise Institute's Return 2 Learn tracker.

⁷ Own calculations based on Arkansas administrative data and information from https://www.returntolearntacker.net/instructional_status/

⁸ For teachers who are shown as teaching in multiple buildings, we first assign them to whichever building they have the most classes in and, if there is a tie, to whichever building they have taught at in previous years. For the small number of teachers we are still unable to match to a single school at this point, we randomly assign them to one of the schools they have taught at. Our results presented later are robust to excluding these teachers.

longitudinal observations, we construct a categorical variable representing labor transitions for each teacher entering a given academic year as compared with the prior academic year. We differentiate three possible labor transitions. If a teacher remains in an instructional role at their current school and district, we consider them a “Stayer.” If a teacher moves to another school within the same district or across districts but remains in the Arkansas teacher labor force we categorize the teacher as a “Mover,” while if the teacher exits the Arkansas teacher workforce entirely she/he is considered an “Exiter.” Teacher turnover is measured by aggregating moves of teachers with exits from the Arkansas teacher labor force.

These administrative data also include the teacher’s date of birth, race, and gender as recorded by district personnel. We merge our data with information from the National Center for Education Statistic’s Common Core of Data (CCD) to create variables representing the demographic composition of each school’s student body, grade levels served, and urbanicity. Finally, we use data from the American Enterprise Institute’s Return to Learn tracker⁹ to build district-level measures of instructional mode (in-person, hybrid, or remote) for the 2020-21 academic year¹⁰. We use this information to create a variable for each teacher indicating if a school in their district changed instructional mode at least once¹¹. We match 141 districts to data in AEI’s database which represents over 80% of statewide student enrollment. Table 1 presents the summary statistics of our sample.

Using the data described above we first study patterns of teacher turnover during 2018-19 to 2021-22 academic years to see how teachers’ mobility and attrition might have changed during the pandemic, overall in the state, as well as across different geographic areas and teacher characteristics. To gain further insight, we use statistical logit models to study factors associated with the probability of a teacher being a “Stayer” and remaining in their current school and district as a function of teachers’ race, gender, age as measured at the start of each academic year, whether the teacher was a first-year teacher the prior academic year, and school characteristics such as region and urbanicity of the school the teacher taught the prior academic year. We estimate this model separately for pooled pre-pandemic years (2018-2019 and 2019-

⁹ <https://www.returntolearntracker.net/>

¹⁰ For more detail on the construction of these and other variables, see Appendix A.

¹¹ As schools in Arkansas were required to offer five days of in-person learning, these changes in modality would most often represent changes from in-person learning to hybrid or fully remote modalities due to increased COVID cases and related teacher shortages.

2020) and during-COVID periods, 2020-21, and the 2021-22 academic years. We additionally estimate a separate model for the 2021-22 academic year using the previous year's changes in learning modality information as those experiences could have shaped teachers' decisions about whether to remain teaching in the same school or not. Finally, we use multinomial logit models to study factors associated with the separate probabilities of staying in their current school, leaving for another position, or exiting the Arkansas teacher labor force. A detailed description of the variables and methods used in this analysis can be found in Appendixes B and C.

4. Results

4.1 Descriptive teacher turnover patterns pre-and during the first two academic years of the pandemic

Figure 1 shows the overall attrition, movement, and retention of Arkansas teachers as measured in the fall of the academic years from 2018-19 to 2021-22. The proportion of teachers who stayed in their current school was about 80% for the pre-pandemic years 2018-19 and 2019-20 and remained constant during the first year of the pandemic, the 2020-21 academic year. However, we observe a decrease of about 2 percentage points during the second academic year of the pandemic (2021-22). Teacher mobility remained at about 10% during the pre-pandemic years and first year of the pandemic but increased to almost 11% during the second year of the pandemic. Similarly, the percentage of teachers exiting the Arkansas teacher labor force also increased from about 10% to 11.5% in the 2021-22 academic year.

Figures 2 and 4 present turnover rates, including moves and exits together, across regions in the state and academic years. Figure 3 presents separately only teacher exits from the Arkansas teacher labor force. As we can see in these figures, Southeast, Southwest, and Central are the regions in the state that traditionally presented higher rates of teacher turnover and exits pre-covid while Northwest Arkansas experienced the lowest turnover rates. Overall, we observe that turnover and teacher exits increased for all regions in the state during the second academic year of the pandemic. Interestingly, Northwest Arkansas also experienced higher levels of turnover, but not exits, during the first year of the pandemic, whereas the Southeast region has experienced a continuous increase in turnover during the past four years. Southeast, Southwest, and Northwest Arkansas are the regions in the state that experienced the highest increases in

teacher turnover and exits during the second year of the pandemic. This is especially worrisome for those school districts in the Southeast and Southwest as these are regions identified by the Arkansas Department of Education as containing a higher number of districts experiencing teacher shortages as described above in Section 2.

Figures 5 and 6 present patterns of mobility for veteran teachers approaching retirement age (age 55 or older) as well as teachers after their very first year in the profession. In line with findings from Zamarro et al. (2021), we observe an increase in teacher exits among those teachers approaching retirement age of about 2 percentage points starting in the first year of the pandemic. In contrast, we do not observe an increase in exits for new teachers after their very first year in the profession but an increase of almost 5 percentage points in movements across schools in the second pandemic year.

The increase of diversity of the Arkansas teacher labor force is of great concern. Figure 7 presents patterns of teacher mobility for Black teachers. We observe that during the pandemic retention of Black teachers in the same school from year to year decreased from about 75% in the years pre-pandemic academic years to 71% in the first pandemic year and 68% in the second pandemic year. This is in contrast with overall retention rates (Figure 1) of 80% pre-pandemic and during the first pandemic academic year and 78% during the second year of the pandemic. That represents a difference in retention rates of teachers in the same school of 10 percentage points in the second year of the pandemic.

4.2 Factors associated with teacher turnover pre-and during the first two academic years of the pandemic

Tables 2 and 3 present our results of logit models for studying factors associated with the probability of a teacher staying in the same school from spring to fall of a given year, and multinomial models for separate probabilities of a teacher staying in the same school, moving schools within or across districts but staying teaching, or leaving the Arkansas teacher labor force, respectively. Results are presented as average marginal effect for ease of interpretation. Estimates are presented for pooled pre-pandemic years (2018-19 and 2019-20) and each pandemic year (2020-21 and 2021-22) separately. Bold numbers in Table 2 represent statistically significant differences in estimated coefficients when compared with pre-pandemic years.

As it was described in Figure 7, our results in Table 2 indicate a decrease in retention of Black teachers in the same school during the pandemic. Interestingly, keeping other factors constant, we do not observe statistically significant differences in the probability of Black teachers staying in the same school as compared to white teachers in the pre-pandemic years. However, Black teachers are 3 percentage points less likely to remain in the same school than white teachers in the first pandemic year and 4 percentage points less likely in the second year. Looking at the multinomial results in Table 3, we observe that this change is associated with an increase of about 2 percentage points in the probability of Black teachers exiting the profession in the first year of the pandemic and an increase of 4 percentage points in the second year as compared with white teachers. These results raise concerns about a potential reduction in the diversity of the Arkansas teacher labor force.

Female teachers are overall better retained than male teachers, but the difference decreased during the pandemic by about one percentage point. Looking at the multinomial results presented in Table 3, we observe that this change is due to an increase in the probability of female teachers exiting the profession. Similarly, teachers aged 45 to 54 years old were better retained in the same school than teachers younger than 35 in the pre-pandemic years, but this difference diminishes during the pandemic.

Teachers approaching retirement age (55 and older) had probabilities of staying in the same school that were comparable to teachers younger than 35 years old in the pre-pandemic years. However, during the first year of the pandemic, teachers approaching retirement age were about 2 percentage points less likely to stay in the same school. Looking at Table 3, we observe that this decrease in retention corresponds with an increase in the probability of teachers approaching retirement exiting the profession. In contrast, first-year teachers are, on average, between 5 and 7 percentage points less likely to be retained in the same school but we do not observe statistically significant changes in this pattern during the pandemic years.

Teachers in the suburbs were about 5 percentage points less likely to remain in the same school year after year during the pre-pandemic years than teachers in urban schools in the state. This difference decreased to about 2 percentage points during the first year of the pandemic but increased again to 4 percentage points during the second pandemic year.

Teachers are less retained in more disadvantaged schools in the state and retention worsened during the pandemic years. Before the pandemic, teachers in a school where 50 percent of the students qualify for FRL were about one percentage point more likely to leave that school than similar teachers in a school where 0 percent of students qualify for FRL. During the pandemic years, this negative effect increased to almost 3 percentage points less likely to stay in the first pandemic year and about 2.5 percentage points less likely in the second year. Looking at Table 3, we observe that these decreases in retention correspond with increases in the school-to-school mobility of teachers during the pandemic years.

As it was discussed in Figures 2 and 3, Northwest Arkansas enjoyed the lowest turnover rates and highest retention rates of teachers in the same school during the pre-pandemic years. Keeping all other teacher and school characteristics constant, teachers in Central, Northeast, and Southwest Arkansas were about 3 percentage points less likely to remain in the same school year after year, and 2 percentage points less likely in the Southeast. During the pandemic years, however, due to an increase in turnover rates in Northwest Arkansas, these regional differences diminished and became statistically insignificant for Central and Southeast Arkansas. For Northeast Arkansas, the difference with Northwest Arkansas remained statistically significant but was reduced to 2 percentage points in the first year of the pandemic and became insignificant in the second pandemic year. Finally, differences with Southwest Arkansas became statistically insignificant during the first year of the pandemic but returned to levels like those observed pre-pandemic during the second pandemic year.

Finally, having to change learning modes during the year is associated with higher levels of teacher job burnout and higher considerations to leave the profession (Zamarro et al., 2021). Our results in the last column of Table 2 show that teaching in a district that ever had to change learning models during the 2020-21 academic year was associated with a reduction in retention of teachers in the same school of about 4 percentage points. Looking at the multinomial results in Table 3 we observe that this decrease in retention is associated with increases in both teacher mobility across schools as well as exits from the Arkansas teacher labor force.

5. Discussion and Conclusions

The COVID-19 pandemic has been a challenging time for many but especially for teachers who had to adapt to new ways of instruction, different working conditions, and health concerns when returning to in-person learning. Early research documented high levels of teachers' stress and burnout and an increase in reported intentions to leave their positions (Zamarro et al., 2021), raising concerns about a potential increase in teacher turnover and future teacher shortages.

In this paper, we use administrative data for the state of Arkansas to document the effects of the COVID-19 pandemic on teachers' patterns of mobility and attrition in the fall of two pre-pandemic years (2018-19 and 2019-20) and two academic years of the pandemic (2020-21 and 2021-22). Arkansas is an interesting case to study as it required school districts to offer five days of in-person learning at the beginning of the 2020-21 academic year and, as a result, in-person learning was more prevalent than in other states.

Similarly to the patterns documented for Massachusetts (Bacher-Hicks et al., 2022) and Washington state (Goldhaber & Theobald, 2022) we find relatively stable turnover rates during the first year of the pandemic (2020-21) but a comparable increase in teacher mobility and attrition in the second year (2021-22). Teacher mobility and attrition increased by 2 percentage points (10% relative increase) this second year but with heterogeneous effects across regions and depending on the teacher and school characteristics.

While not qualifying to the level of the mass exodus of teachers that some warned about in popular media, this 2 percentage points increase in teacher turnover raises concerns about potential instability in the Arkansas teacher labor force, given the relatively high pre-pandemic turnover rates in the state and documented shortages in school districts in the Lower Delta region (Southeast), Southwest, and Upper Delta regions (Northeast).

Our results show that teacher retention at the same school during the pandemic especially decreased for schools in the Southeast and Southwest, as well as for schools with higher levels of students who qualify for FRL, which could put a strain on those schools already experiencing teacher shortages. In future research, we will further study the challenges facing these schools and the use of uncertified teachers and emergency teacher licenses to cover vacancies in these areas.

Our results also bring concerns about a potential reduction in the diversity of the Arkansas teacher labor force as we observe a decline in retention of Black teachers during the pandemic. Although there were no statistically significant differences in the probability of Black teachers staying in the same school as compared to white teachers in the pre-pandemic years, Black teachers became 3 percentage points less likely to remain in the same school than white teachers in the first pandemic year and 4 percentage points less likely the second year. This is in contrast to results presented by Bacher-Hicks et al., (2022) who documented a small increase in the ethnic and racial diversity of the Massachusetts teacher labor force during the pandemic. The authors attribute this effect to the creation of new emergency licenses in Massachusetts during the pandemic. Arkansas, in contrast, has a long history of use of emergency licenses and other waivers which could help explain the different results.

Those approaching retirement age (55 and older) were about 2 percentage points less likely to remain in the same school in the first year of the pandemic (2020-2021) than pre-pandemic, as compared to teachers younger than 35 years old. This increased turnover of most experienced teachers could have important consequences for the teacher quality composition of the Arkansas teacher labor force which may in turn impact student academic outcomes in the pandemic recovery.

Finally, having to change learning modes during the pandemic is associated with higher levels of teacher job burnout and higher considerations to leave the profession (Zamarro et al., 2021) and our results show that teachers who worked in a district that ever had to change learning models during the 2020-2021 academic year were 4 percentage points less likely to be retained at the same school the next academic year. Finding ways to facilitate a supportive work environment and adopting mitigation measures when needed could help reduce changes in learning modes and help retain teachers during this pandemic. In this respect, Kraft et al., (2021) showed that schools with strong communication, targeted training, meaningful collaboration, fair expectations, and authentic recognition for their teachers were more successful at maintaining teachers' sense of success at the beginning of this pandemic.

Moving forward, it will be important to continue monitoring the effects of the pandemic in the Arkansas teacher labor force to help inform policymakers and stakeholders and find ways

to better support teachers and schools in the state, especially in those areas most affected by teacher shortages.

Appendix A: Summary Statistics by Region

Table A1: Summary Statistics by Region for the 2020-21 Academic Year

	Central	Northeast	Northwest	Southeast	Southwest
<i>Teacher Characteristic</i>					
N	9,160	6,536	11,870	1,752	3,186
White	0.79	0.91	0.94	0.74	0.88
Black	0.19	0.08	0.01	0.24	0.10
Hispanic	0.01	0.01	0.02	0.01	0.02
Asian	0.01	0.00	0.01	0.00	0.00
Native American/Alaskan Native	0.00	0.00	0.01	0.00	0.00
Two or More Races	0.00	0.00	0.01	0.00	0.00
Native Hawaiian/Pacific Islander	0.00	0.00	0.00	0.01	0.00
Female	0.78	0.77	0.76	0.78	0.79
Age	41.83	41.93	41.84	42.51	43.32
Experience	10.93	11.19	10.36	10.34	10.87
Advanced Degree	0.48	0.47	0.50	0.47	0.47
Licensure/Certification Waiver	0.11	0.09	0.06	0.21	0.11
Stayers	0.78	0.82	0.81	0.76	0.79
Movers	0.11	0.08	0.10	0.10	0.10
Exiters	0.11	0.09	0.09	0.14	0.11
<i>School/Student Characteristics</i>					
Region Enrollment	143,838	95,194	175,931	23,735	44,180
Average School Enrollment	519	445	496	344	365
Free- or Reduced Lunch	0.68	0.77	0.64	0.85	0.77
White	0.49	0.72	0.70	0.44	0.59
Black	0.36	0.19	0.03	0.46	0.26
Hispanic	0.10	0.05	0.18	0.08	0.11
Asian	0.01	0.00	0.02	0.00	0.01
Native American/Alaskan Native	0.00	0.00	0.01	0.00	0.01
Two or More Races	0.03	0.02	0.04	0.02	0.03
Native Hawaiian/Pacific Islander	0.00	0.00	0.02	0.00	0.00
Stayers	0.76	0.81	0.80	0.75	0.78
Movers	0.10	0.08	0.09	0.10	0.09
Exiters	0.13	0.11	0.10	0.15	0.13

Appendix B: Variables Definition

Teacher Race & Gender

The state administrative data we use contain a teacher race/ethnicity variable with seven possible response options: Asian, Black/African American, Hispanic, Native American/Alaskan Native, Native Hawaiian/Pacific Islander, two or more races, or white. District personnel is responsible for selecting one option from this list for each teacher. The Arkansas teacher workforce is, on average, approximately 88% white, 9% Black, and 1% Hispanic with all other options for the race/ethnicity variable comprising less than 2% of the population. In our logistic and multinomial logistic analyses, we combine these other races into a single “Other Race” group due to sample size limitations. We also estimated models disaggregating all race categories and none of the groups included in “Other Race” led to statistically significant results. Disaggregated results available upon request. Similarly, the state data system allows district personnel to report teacher gender as either male or female. We code an indicator variable for observations listed as female.

Teacher Age & Experience

Our data contain each teacher’s date of birth. We calculate the teacher’s age as of September 1st of each academic year and subsequently categorize each teacher-year observation into one of four bins: under 35 years old, 35-44 years old, 45-54 years old, and aged over 55. Teachers over the age of 55 are more likely eligible for full or partially reduced retirement under Arkansas Teacher Retirement System eligibility guidelines¹².

Similarly, we calculate teachers’ years of experience using a date of hire variable. We thus define an indicator variable for first-year teachers as we theorized that teachers who began teaching during the pandemic may have behaved differently than teachers who had experience in the pre-pandemic education system.

Grade Levels Served

We match schools in our panel to data from the Common Core of Data (CCD) from the National Center for Education Statistics (NCES) using the Urban Institute’s Education Data Portal API¹³. We then construct indicator variables for each teacher-year observation based on the grade levels

¹² <https://www.artss.gov/considering-retirement/retirement-eligibility>

¹³ <https://educationdata.urban.org/documentation/>

served. Teachers in schools offering pre-kindergarten through 4th grade are classified as teaching in an elementary school. Those in schools offering 5-8th grade are classified as teaching in a middle school. Those in schools offering 9-12th grade are classified as teaching in a high school. For teachers in the 18 schools in the state that offer multiple grade bands, we classify teachers based on the lowest grade level served. For example, a school serving kindergarten through 6th grade would be classified as an elementary school.

Urbanity

We use the NCES's locale classifications¹⁴ to construct urbanity indicator variables for each school. Urban schools are defined as those located within both an urbanized area (e.g., a population greater than 50,000 people) and the principal city of a core-based statistical area (CBSA). Suburban schools are those located within an urbanized area, but outside of a CBSA principal city. Town schools are located inside an urban cluster (e.g., a population between 2,500 and 50,000 people). Rural schools are those schools located outside of urban clusters and urbanized areas.

Student Demographics

We use CCD student demographic data to construct two measures of each school's student population. Firstly, we divide the proportion of students qualifying for FRL by the school's enrollment to construct a measure of student-body economic disadvantage. While FRL measures have received criticism due to increasingly permissive program definitions (Domina et al., 2018; Fazlul et al., 2021), we find that our results are similar when economic disadvantage is defined using census bureau small-area income poverty estimates¹⁵ (SAIPE) instead. We prefer the FRL-based measure, however, as the SAIPE measure is only available at the district, not school, level. Results using the SAIPE measure are available upon request. Secondly, we construct a measure of the racial and ethnic diversity of each school's student body by dividing the number of non-white students in an academic year by the school's enrollment for that same year.

Regions

¹⁴ https://nces.ed.gov/programs/edge/docs/LOCALE_CLASSIFICATIONS.pdf

¹⁵ <https://www.census.gov/programs-surveys/saipe.html>

Arkansas is a state with considerable regional differences in terms of local economies, demographics, and the impact of the COVID-19 pandemic. We use classifications from the Office for Education Policy at the University of Arkansas¹⁶ to classify districts as either belonging to the Northwest, Northeast, Central, Southwest, or Southeast regions. We then include indicator variables for four of these regions (using Northwest as the reference) to study and account for some of these regional differences.

Mode of Instruction & Changes in Mode of Instruction

We use district-level longitudinal data from the American Enterprise Institute's Return 2 Learn Tracker¹⁷ to construct measures related to instructional mode during the 2020-21 academic year. These data contain weekly instructional status for 141 districts representing 81.6% of statewide student enrollment from August 10th, 2020, through June 7th, 2021. Districts were classified as fully in-person if all grade levels were offered in-person learning five days per week and remote if all grades above first grade participated only in remote learning. Districts were classified as hybrid if all students in any grade above first grade were unable to attend school in-person five days per week. Districts that offered in-person learning only for particular student subgroups (e.g., students receiving special education services) were classified as fully remote. We then construct an indicator variable representing if a district changed its mode of instruction during the school year to capture disruptions and changes to normal working conditions that may impact teacher retention. As schools in Arkansas were required to offer five days of in-person learning starting in the fall of the 2020-2021 school year, these changes in modality would most often represent changes from in-person learning to hybrid or fully remote modalities due to increased COVID cases and related teacher shortages.

¹⁶ <http://www.officeforeducationpolicy.org/>

¹⁷ https://www.returntolearntracker.net/instructional_status/

Appendix C: Empirical Strategy

Logistic Regression Analysis

To examine factors associated with the probability that a teacher remains in their current school and district, we use a logit model as specified below:

$$\begin{aligned} \Pr(\text{Stayer}_{ist}) = \Lambda(\beta_1 \text{Race}_i + \beta_2 \text{Female}_i + \beta_3 \text{AgeBin}_{it} & \quad (1) \\ + \beta_4 \text{FirstYearTeacher}_{it-1} + \beta_5 \text{GradeLevel}_{ist-1} & \\ + \beta_6 \text{Urbanity}_{ist-1} + \beta_7 \text{PercentFRL}_{ist-1} & \\ + \beta_8 \text{PercentNonWhite}_{ist-1} + \beta_9 \text{Region}_{ist-1}) & \end{aligned}$$

Estimates returned from equation 1 represent the association between the probability that teacher i in school s remains in the same school entering year t and various teacher and school characteristics. Teachers' age is measured as of the start of each academic year as this timing is most salient for retirement eligibility. For all other time-varying factors, we use lagged values to represent the exposure that each teacher had during the academic year before making their labor market decision. For example, we use values for a teacher's school during the 2019-20 academic year to explain their choice of remaining in that school for the 2020-21 academic year. We estimate this model separately for pooled pre-COVID periods, 2020-21, and the 2021-22 academic years. We additionally estimate a separate model for the 2021-22 academic year using the previous year's modality changes information as those experiences would have shaped teachers' decisions about whether to return or not:

$$\begin{aligned} \Pr(\text{Stayer}_{ist}) = \Lambda(\alpha_1 \text{Race}_i + \alpha_2 \text{Female}_i + \alpha_3 \text{AgeBin}_{it} & \quad (2) \\ + \alpha_4 \text{FirstYearTeacher}_{it-1} + \alpha_5 \text{GradeLevel}_{ist-1} & \\ + \alpha_6 \text{Urbanity}_{ist-1} + \alpha_7 \text{PercentFRL}_{ist-1} & \\ + \alpha_8 \text{PercentNonWhite}_{ist-1} + \alpha_9 \text{Region}_{ist-1} + \alpha_{10} \text{EverHyb} & \\ + \alpha_{11} \text{EverChangeModes}_{ist-1}) & \end{aligned}$$

To determine if differences between point estimates between the pre-COVID and post-COVID periods are statistically significant we use fully interacted models as described by equation 3 below. Here, D_t is an indicator variable that takes a value of 1 for observations during

a pandemic period (either 2020-21 or 2021-22), θ_{ist} is a vector of the same explanatory variables as in equation 1, and $D_t \times \theta_{ist}$ represents the change in the association between each explanatory variable and teacher retention during the pandemic. Significant point estimates on these interacted terms indicate that the relationship between the factor and teacher retention is statistically significantly different during COVID as compared to pre-pandemic. While we do not directly report the results of these fully interacted models, we indicate statistically significant differences in point estimates at the 5% significance level in table 2 by bolding those results.

$$\Pr(\text{Stayer}_{ist}) = \Lambda(D_t + \theta_{ist} + D_t \times \theta_{ist}) \quad (3)$$

Multinomial Logistic Regression Analysis

To explore how teacher- and school characteristics are associated with the relative probabilities of teachers staying in their current school, leaving for another position, or exiting the Arkansas teacher labor force separately we use a multinomial logit model:

$$\Pr(Y_i = j | \theta_{ist}) = \frac{\exp(\gamma_j' \theta_{ist})}{\sum_{l=1}^3 \exp(\gamma_l' \theta_{ist})} \quad \text{where } j = \begin{cases} 1 & \text{for STAYER} \\ 2 & \text{for MOVER} \\ 3 & \text{for EXITER} \end{cases} \quad (4)$$

Here, θ_{ist} is a vector of the same explanatory variables as in equations (1) above. We separately estimate coefficients for a pooled pre-pandemic period (2018-19 through 2019-20) as well as for entering the first and second full pandemic academic years (2020-21 and 2021-22). For the second pandemic academic year, we include the additional controls for changes in school learning modality in the prior year modality introduced in equation (2). For ease of interpretation, we report all estimates from the logit and multinomial logit analyses as average marginal effects.

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Figure 1 – Attrition, Movement, and Retention of Arkansas Teachers

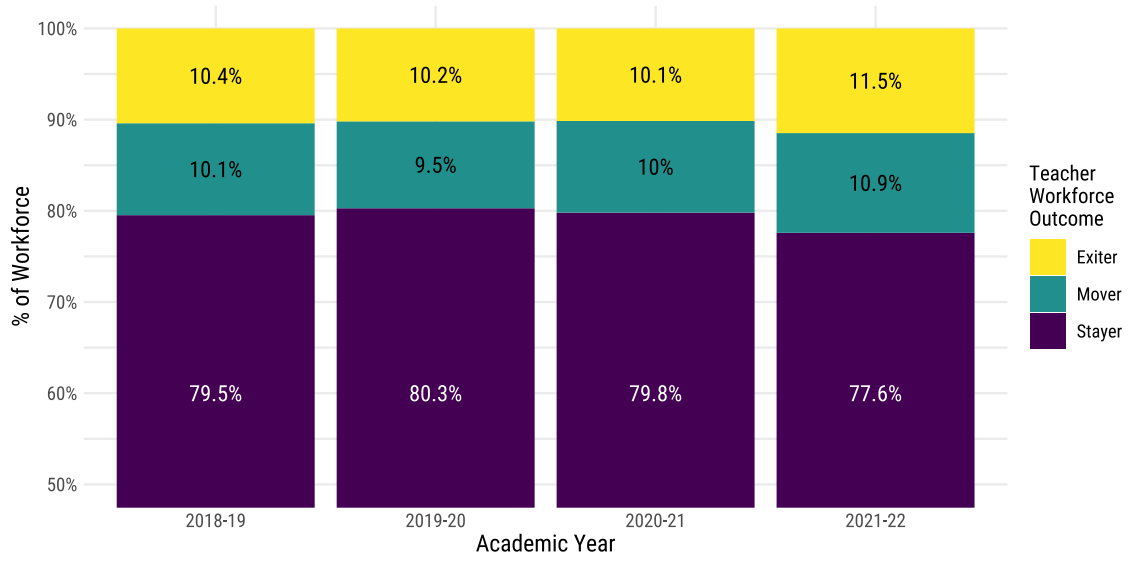


Figure 2 – Teacher Turnover (Exiters & Movers) by Region and Academic Year

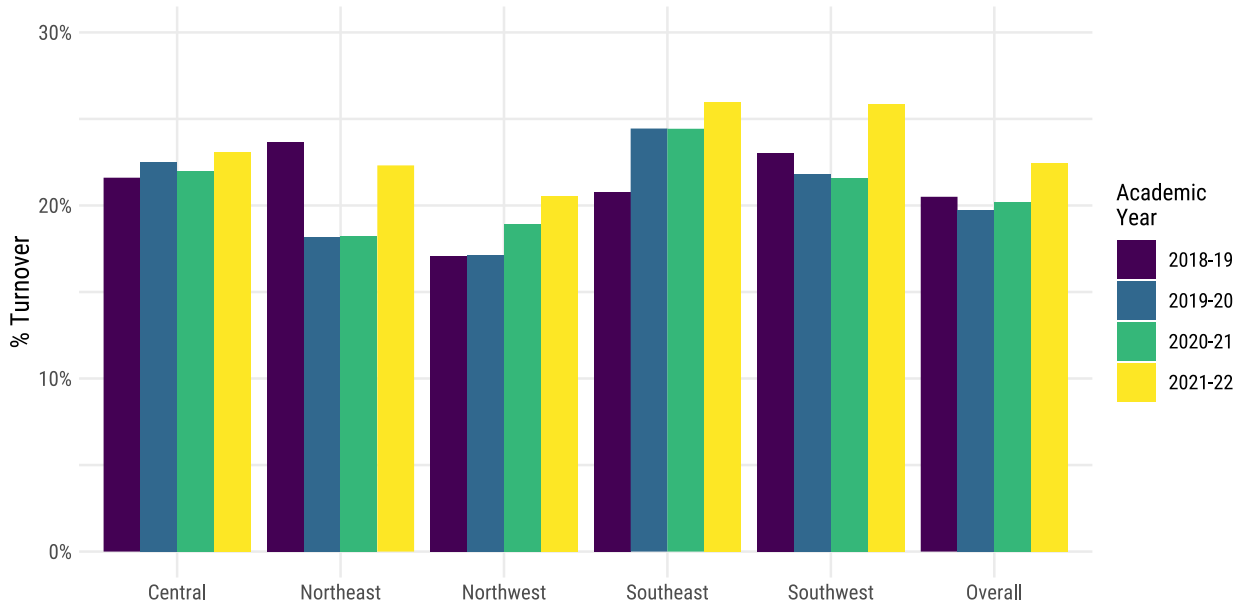


Figure 3 – Teacher Exits by Region and Academic Year

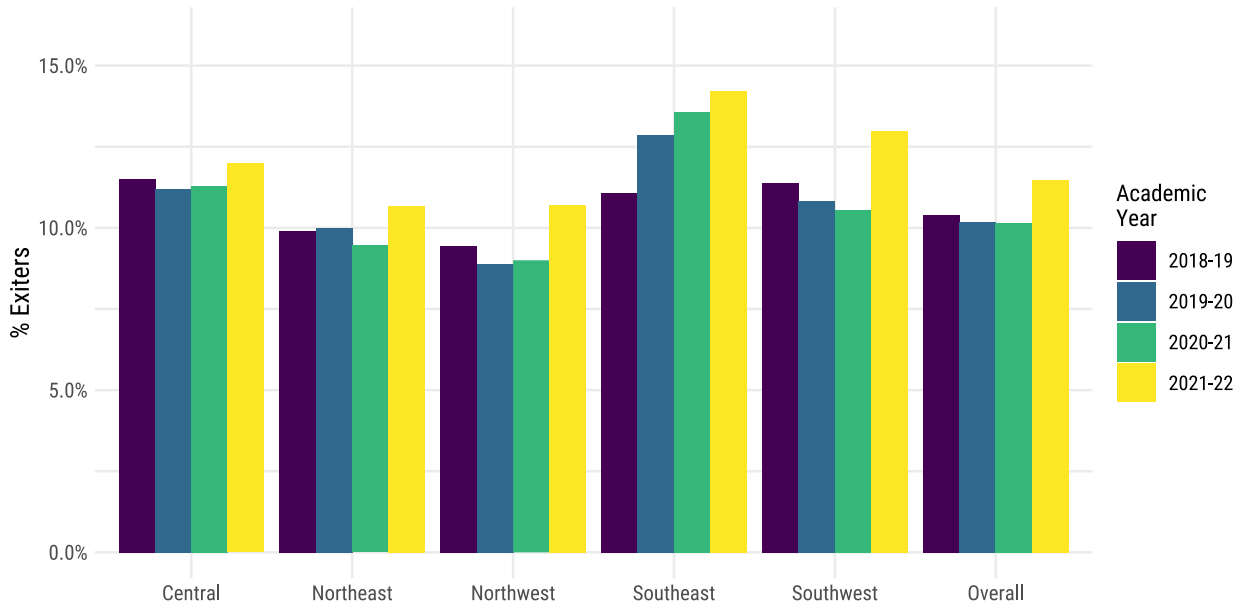


Figure 4 – Geographical Trends in Arkansas Teacher Turnover (Exiters & Movers)

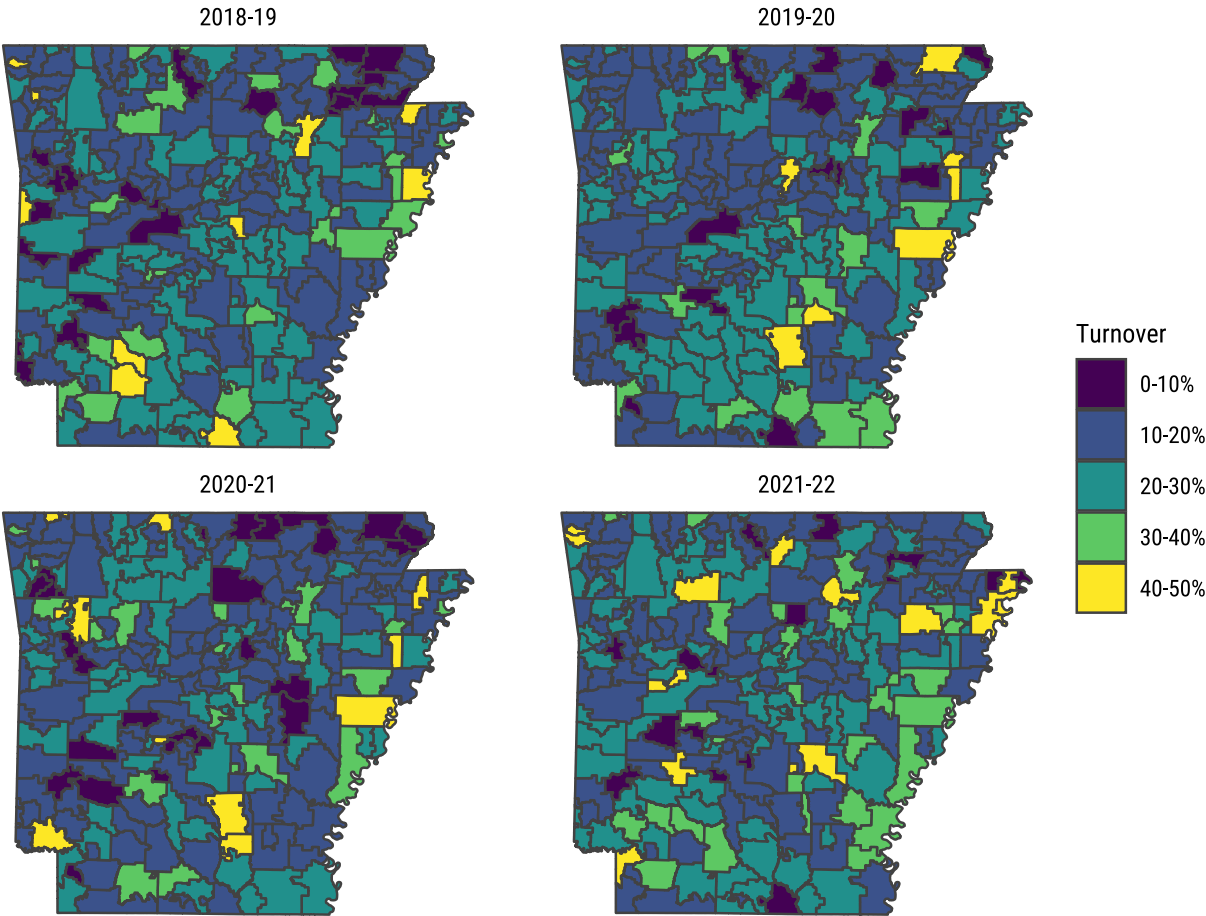


Figure 5 – Attrition, Movement, and Retention of Arkansas Teachers Aged 55 or Older

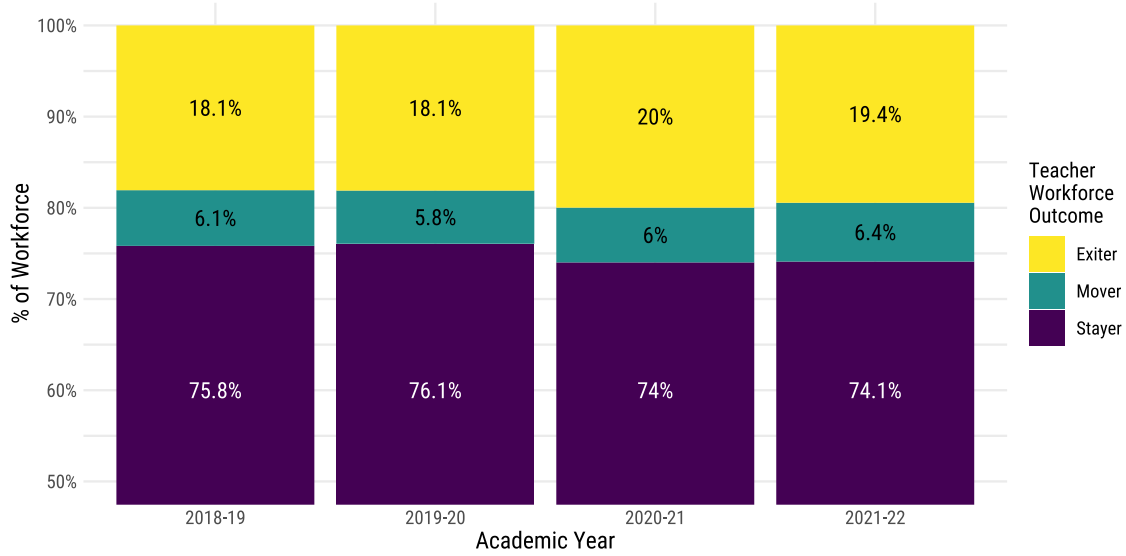


Figure 6 – Attrition, Movement, and Retention of First-Year Arkansas Teachers

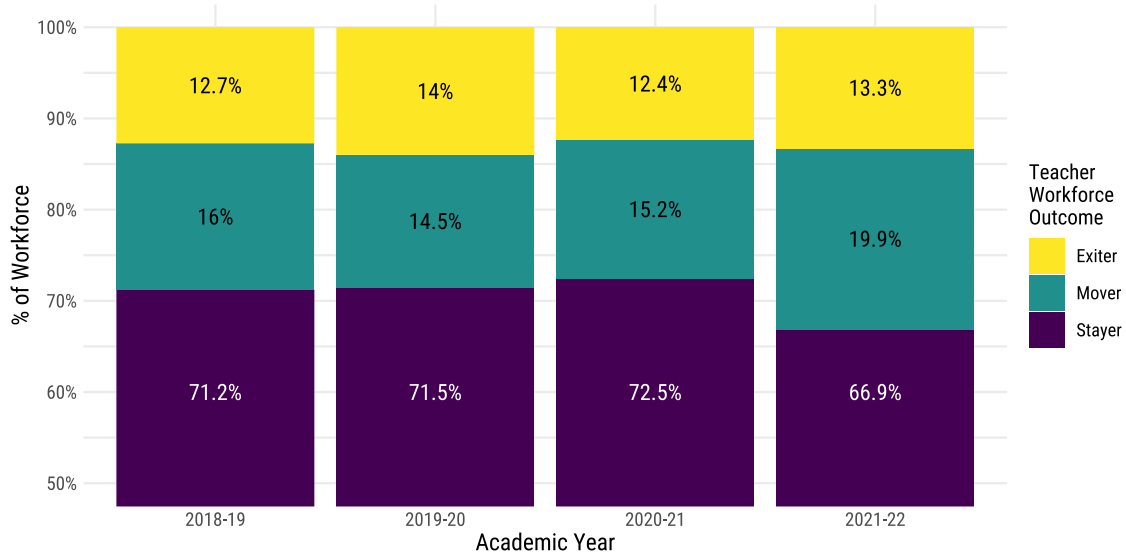


Figure 7 – Attrition, Movement, and Retention of Black Arkansas Teachers

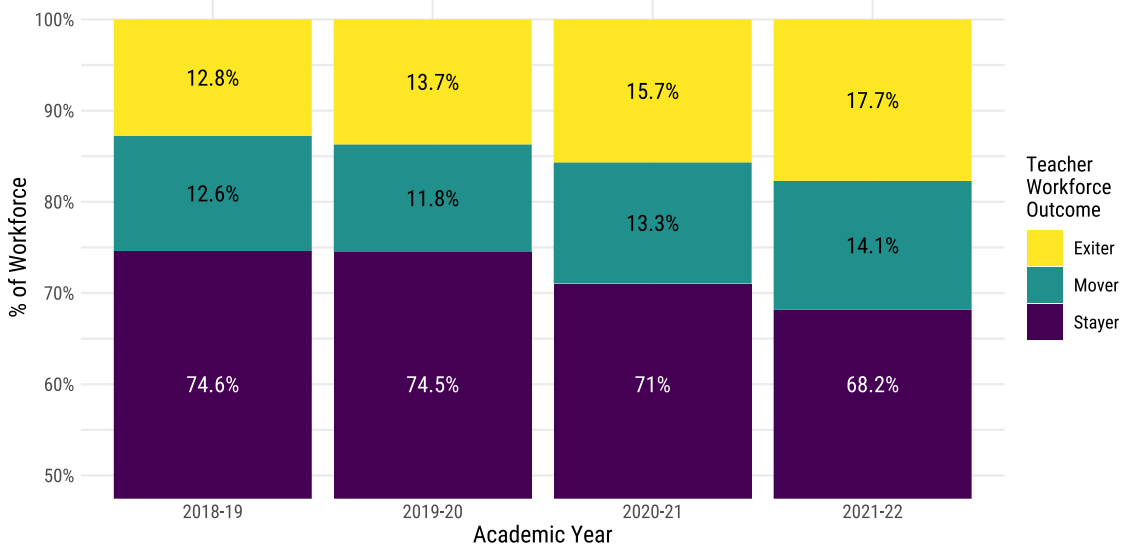


Table 1: Summary Statistics

	2017-18	2018-19	2019-20	2020-21	2021-22
<i>Teacher Characteristic</i>					
N	32,197	32,570	32,640	32,504	32,436
White	0.89	0.89	0.88	0.87	0.87
Black	0.08	0.09	0.09	0.10	0.10
Hispanic	0.01	0.01	0.01	0.01	0.01
Asian	0.00	0.00	0.00	0.00	0.00
Native American/Alaskan Native	0.01	0.01	0.01	0.01	0.01
Two or More Races	0.00	0.00	0.00	0.00	0.00
Native Hawaiian/Pacific Islander	0.00	0.00	0.00	0.00	0.00
Female	0.78	0.78	0.77	0.77	0.77
Age	42.16	42.09	42.12	42.03	41.89
Experience	10.55	10.55	10.66	10.74	10.65
Advanced Degree	0.45	0.46	0.47	0.48	0.49
Licensure/Certification Waiver	0.06	0.08	0.09	0.09	0.08
Stayers	.	0.80	0.80	0.80	0.78
Movers	.	0.10	0.10	0.10	0.11
Exiters	.	0.10	0.10	0.10	0.11
<i>School/Student Characteristics</i>					
Statewide Enrollment	491,865	489,851	494,849	482,878	.
Average School Enrollment	476	472	475	466	.
Free- or Reduced-price Lunch	0.37	0.68	0.70	0.70	.
White	0.64	0.63	0.62	0.62	.
Black	0.20	0.21	0.21	0.21	.
Hispanic	0.11	0.11	0.12	0.12	.
Asian	0.01	0.01	0.01	0.01	.
Native American/Alaskan Native	0.01	0.01	0.01	0.01	.
Two or More Races	0.03	0.03	0.03	0.03	.
Native Hawaiian/Pacific Islander	0.01	0.01	0.01	0.01	.
Stayers	.	0.78	0.78	0.79	0.76
Movers	.	0.10	0.10	0.09	0.11
Exiters	.	0.12	0.12	0.12	0.13
Central AR	0.26	0.26	0.27	0.27	0.27
Northeast AR	0.22	0.21	0.21	0.21	0.21
Northwest AR	0.35	0.34	0.34	0.34	0.34
Southeast AR	0.06	0.07	0.07	0.07	0.07
Southwest AR	0.12	0.12	0.12	0.12	0.11

Note: Student characteristics are not yet available for the 2021-22 school year.

**Table 2: Logit Regression for the Probability of Staying in the Same School
(Average Marginal Effects)**

	Pre-COVID	2020-21	2021-22	2021-22
Teacher: Black	0.002 (0.006)	-0.030*** (0.008)	-0.039*** (0.008)	-0.042*** (0.009)
Teacher: Hispanic	0.036** (0.016)	0.048** (0.021)	0.003 (0.019)	0.000 (0.020)
Teacher: Other Race/Eth	0.011 (0.014)	0.016 (0.020)	-0.035* (0.019)	-0.044** (0.020)
Teacher: Female	0.040*** (0.004)	0.035*** (0.005)	0.034*** (0.006)	0.038*** (0.006)
Teacher: Aged 35-44	0.049*** (0.004)	0.046*** (0.006)	0.048*** (0.006)	0.051*** (0.007)
Teacher: Aged 45-54	0.074*** (0.005)	0.061*** (0.006)	0.062*** (0.006)	0.057*** (0.007)
Teacher: Aged 55+	-0.001 (0.005)	-0.023*** (0.006)	0.002 (0.007)	-0.007 (0.007)
Teacher: First Year	-0.055*** (0.006)	-0.048*** (0.009)	-0.069*** (0.009)	-0.052*** (0.011)
School: Elementary	0.009** (0.004)	0.022*** (0.006)	-0.002 (0.006)	-0.010 (0.006)
School: Middle	-0.020*** (0.004)	-0.013** (0.006)	-0.031*** (0.006)	-0.037*** (0.007)
School: Rural	-0.031*** (0.005)	-0.019*** (0.007)	-0.029*** (0.007)	-0.033*** (0.008)
School: Town	-0.023*** (0.005)	-0.031*** (0.007)	-0.012 (0.008)	-0.019** (0.009)
School: Suburb	-0.047*** (0.006)	-0.024*** (0.008)	-0.037*** (0.008)	-0.043*** (0.009)
School: % FRL	-0.019*** (0.007)	-0.058*** (0.012)	-0.050*** (0.012)	-0.049*** (0.014)
School: % Non-white	-0.104*** (0.008)	-0.088*** (0.012)	-0.103*** (0.012)	-0.055*** (0.015)
District: Central	-0.033*** (0.004)	-0.009 (0.006)	0.002 (0.006)	0.005 (0.007)
District: Northeast	-0.034*** (0.005)	0.022*** (0.007)	-0.007 (0.007)	-0.004 (0.008)
District: Southeast	-0.019** (0.008)	0.002 (0.010)	-0.003 (0.011)	0.002 (0.014)
District: Southwest	-0.028*** (0.006)	0.012 (0.008)	-0.017* (0.009)	-0.031*** (0.010)
District: Changed Modes				-0.039*** (0.006)
Pseudo R ²	0.021	0.023	0.021	0.021
Observations	64,433	32,640	32,504	26,255

Note: .01 - ***; .05 - **; .1 - *; Bold numbers represent statistically significant differences in estimated coefficients compared with pre-pandemic years

Table 3: Multinomial Logit Teacher Labor Transitions (Average Marginal Effects)

	Pre-pandemic Years (2018-2019 & 2019-2020)			Pandemic Year 1 (2020-2021)			Pandemic Year 2 (2021-2022)		
	Stayers	Movers	Exiters	Stayers	Movers	Exiters	Stayers	Movers	Exiters
Teacher: Black	0.002 (0.006)	0.003 (0.004)	-0.005 (0.004)	-0.030*** (0.008)	0.014** (0.006)	0.016*** (0.006)	-0.042*** (0.009)	-0.000 (0.007)	0.042*** (0.007)
Teacher: Hispanic	0.037** (0.016)	-0.035*** (0.013)	-0.002 (0.012)	0.049** (0.021)	-0.045*** (0.017)	-0.004 (0.015)	-0.001 (0.020)	-0.012 (0.015)	0.013 (0.015)
Teacher: Other Race/Eth	0.012 (0.014)	-0.018 (0.011)	0.005 (0.010)	0.016 (0.020)	-0.004 (0.014)	-0.012 (0.015)	-0.043** (0.020)	0.012 (0.015)	0.031** (0.014)
Teacher: Female	0.039*** (0.004)	-0.033*** (0.003)	-0.006** (0.003)	0.034*** (0.005)	-0.028*** (0.004)	-0.006 (0.004)	0.037*** (0.006)	-0.033*** (0.005)	-0.004 (0.005)
Teacher: Aged 35-44	0.047*** (0.004)	-0.029*** (0.003)	-0.019*** (0.003)	0.046*** (0.006)	-0.025*** (0.004)	-0.021*** (0.005)	0.049*** (0.007)	-0.033*** (0.005)	-0.016*** (0.005)
Teacher: Aged 45-54	0.072*** (0.005)	-0.044*** (0.003)	-0.028*** (0.004)	0.059*** (0.006)	-0.037*** (0.005)	-0.022*** (0.005)	0.055*** (0.007)	-0.036*** (0.005)	-0.019*** (0.006)
Teacher: Aged 55+	0.016*** (0.005)	-0.076*** (0.004)	0.060*** (0.003)	-0.001 (0.007)	-0.074*** (0.006)	0.075*** (0.004)	0.011 (0.008)	-0.077*** (0.007)	0.066*** (0.005)
First Year Teacher	-0.056*** (0.006)	0.023*** (0.004)	0.033*** (0.004)	-0.048*** (0.009)	0.021*** (0.006)	0.027*** (0.007)	-0.048*** (0.011)	0.038*** (0.007)	0.010 (0.009)
School: Elementary	0.008** (0.004)	-0.001 (0.003)	-0.008*** (0.003)	0.022*** (0.006)	-0.009** (0.004)	-0.013*** (0.004)	-0.010 (0.007)	0.010** (0.005)	0.000 (0.005)
School: Middle	-0.019*** (0.004)	0.026*** (0.003)	-0.006* (0.003)	-0.012** (0.006)	0.018*** (0.004)	-0.005 (0.005)	-0.037*** (0.007)	0.028*** (0.005)	0.010* (0.005)

Table 3: Multinomial Logit Teacher Labor Transitions (Average Marginal Effects)-Continuation

	Pre-pandemic Years (2018-2019 & 2019-2020)			Pandemic Year 1 (2020-2021)			Pandemic Year 2 (2021-2022)		
	Stayers	Movers	Exiters	Stayers	Movers	Exiters	Stayers	Movers	Exiters
School: Rural	-0.032*** (0.005)	0.021*** (0.004)	0.010*** (0.004)	-0.018*** (0.007)	0.004 (0.005)	0.014*** (0.005)	-0.033*** (0.008)	0.037*** (0.006)	-0.004 (0.006)
School: Town	-0.023*** (0.005)	0.012*** (0.004)	0.012*** (0.004)	-0.030*** (0.007)	0.020*** (0.005)	0.010* (0.006)	-0.019** (0.009)	0.009 (0.007)	0.010 (0.006)
School: Suburb	-0.046*** (0.006)	0.033*** (0.004)	0.014*** (0.004)	-0.024*** (0.008)	0.010* (0.006)	0.014** (0.006)	-0.043*** (0.009)	0.031*** (0.007)	0.012* (0.007)
School: % FRL	-0.019*** (0.007)	0.009* (0.005)	0.010* (0.005)	-0.057*** (0.012)	0.051*** (0.009)	0.006 (0.009)	-0.049*** (0.014)	0.047*** (0.010)	0.003 (0.011)
School: % Non-white	-0.104*** (0.008)	0.052*** (0.006)	0.052*** (0.006)	-0.088*** (0.012)	0.028*** (0.009)	0.059*** (0.009)	-0.054*** (0.015)	0.049*** (0.011)	0.005 (0.011)
Central	-0.033*** (0.004)	0.019*** (0.003)	0.014*** (0.003)	-0.009 (0.006)	-0.000 (0.004)	0.009** (0.004)	0.005 (0.007)	0.001 (0.005)	-0.006 (0.005)
Northeast	-0.034*** (0.005)	0.027*** (0.003)	0.007* (0.004)	0.022*** (0.007)	-0.023*** (0.005)	0.001 (0.005)	-0.004 (0.008)	0.008 (0.006)	-0.004 (0.006)
Southeast	-0.019** (0.008)	0.013** (0.006)	0.006 (0.006)	0.003 (0.010)	-0.016** (0.008)	0.013* (0.008)	0.002 (0.014)	0.009 (0.010)	-0.010 (0.011)
Southwest	-0.028*** (0.006)	0.024*** (0.004)	0.005 (0.005)	0.011 (0.008)	-0.007 (0.006)	-0.005 (0.006)	-0.031*** (0.010)	0.019*** (0.007)	0.012* (0.007)
School: Changed Modes							-0.039*** (0.006)	0.020*** (0.004)	0.019*** (0.004)
Pseudo R ²	0.029	0.029	0.029	0.033	0.033	0.033	0.029	0.029	0.029
Observations	64,433	64,433	64,433	32,640	32,640	32,640	26,255	26,255	26,255

Note: .01 - ***; .05 - **; .1 - *;