AERA Open
October-December 2020, Vol. 6, No. 4, pp. 1–24
DOI: 10.1177/2332858420966336
Article reuse guidelines: sagepub.com/journals-permissions

Examining the Teacher Labor Market in Different Rural Contexts: Variations by Urbanicity and Rural States

Tuan D. Nguyen
Kansas State University

Using repeated cross-sectional nationally representative data, we demonstrate how the teacher labor markets for rural contexts are different from those in urban-suburban areas. We also show that teacher attrition is not uniform across various rural settings. In particular, novice teachers in rural schools in sparsely populated states are more likely to turn over than novice teachers in urban-suburban schools in sparsely populated states. We also examine how teacher and school characteristics are associated with turnover in different rural contexts. The findings indicate there should be a concerted effort to examine teacher attrition in various rural contexts and not simply as delineation from urban-suburban areas.

Keywords: *teacher attrition, teacher turnover, rural education, rurality*

Considerable evidence has shown teachers are the most influential school factor in student achievement (Aaronson et al., 2007; Chetty et al., 2014; Kane & Staiger, 2008). Schools and districts have spent substantial amounts of time and resources to staff classrooms with qualified teachers (Hanushek et al., 2004; Loeb et al., 2012). Yet keeping quality teachers in the classroom has been, and continues to be, a challenge (Sutcher et al., 2016). High levels of teacher turnover can be costly to students because turnover is negatively associated with student achievement (Henry & Redding, 2018; Ronfeldt et al., 2013). There is general agreement among scholars and policymakers that more work needs to be done to shift the uneven distribution of quantity and quality of teachers, particularly for disadvantaged students and communities (Guarino et al., 2006; Ingersoll, 2001; Lankford et al., 2002). For instance, schools and districts have had difficulty with the retention of qualified teachers in some states with large rural areas such as Kansas, Nevada, and Oklahoma (Bihasa, 2018; Carver-Thomas & Darling-Hammond, 2017; Lazarte-Alcala & Miller, 2018; Sisk, 2015). This is partly due to the dwindling supply of teachers in rural areas (McClure & Reeves, 2004), the movement of teachers from rural to urban areas (Boyd et al., 2005), and the challenges specific to rural school context such as lower salary, isolation, limited access to professional development, and the need for teachers to teach many more subjects (Lazarev et al., 2017). For instance, rural schools in Virginia and Kentucky face teacher shortages and high turnover due to lower salary, geographical isolation, and lack of amenities compared with more urbanized districts (Cowen et al., 2012; Lochmiller et al., 2016; Proffit et al., 2004). Similarly, teachers in rural Oklahoma and Kansas have consistently received lower salary, fewer resources, and limited professional development opportunities, which contribute to lower retention of teachers (Kansas Department of Education, 2016; Lazarev et al., 2017). Since teachers are the most important factor to student learning and teacher turnover is often more burdensome to rural communities, it is important to examine how teacher attrition varies by different rural contexts, which rural teachers are most at risk of turning over, and what factors are associated with teacher turnover. A better understanding of these factors may allow researchers and policymakers to identify and implement solutions to retain teachers in rural schools.

More specifically, leveraging four waves of the Schools and Staffing Survey (SASS), this study examines the extent to which teachers turn over at differential rates nationally and in three different rural contexts. Moreover, we consider whether novice teachers and specialty teachers, STEM (science, technology, engineering, and mathematics) and special education teachers specifically, are more likely to turn over in rural settings. This study also aims to address the extent to which teacher and school characteristics are associated with teacher attrition in various rural contexts (as defined by the U.S. Census Bureau, by percent urbanicity, and percent population sparsity). In doing so, this study makes several contributions to the research on teacher attrition and retention, particularly in the context of rural education. First and foremost, as most studies on teacher attrition focus on the urban context, or treat rurality as simply a control in regression analyses, or employ small samples to examine teacher attrition, this study will be the first to employ large-scale data to examine teacher turnover specifically in different rural contexts. Second, instead of using short-term administrative data

for some district or state, this study utilizes repeated cross-sectional state and nationally representative data to provide a more thorough analysis of teacher and school characteristics in various rural contexts as well as analysis of teacher turnover. SASS data are particularly important as the results are generalizable to state and national levels, and the results are not simply idiosyncratic to particular states or one specific rural context. Relatedly, due to the rich data provided by SASS, we can examine how teacher characteristics and the conditions of the schools in which they teach have changed over time in these rural contexts and how these characteristics are associated with turnover. Last, this study is also able to differentiate between teachers who move schools and those who leave the profession and analyze the factors associated with each set of mobility patterns together and separately.

The rest of the article is organized as follows. First, we discuss the current literature on teacher attrition in rural contexts and how teacher and school characteristics influence teacher turnover. Then we discuss the data and methods employed in the article. After we examine the results of the study, we discuss how our findings fit into the current landscape of knowledge and the implications of the findings. As a preview of our results, we find teachers turn over at higher rates in sparsely populated states but at lower rates in rural schools. However, we also find novice teachers in rural schools in sparsely populated states are more at risk of turning over than their counterparts in urban-suburban schools also in sparsely populated states. We find several teacher and school characteristics are associated with turnover, and that patterns of attrition are remarkably similar across various rural contexts. However, some factors are more salient in one form of turnover than another.

Conceptual Framework

Teacher turnover has been examined largely within the context of economic labor market theory, which posits the number of laborers in a specific occupation is the point at which the supply of available labor equals the demand for that labor (Guarino et al., 2006). In its most basic terms, the economic equilibrium stipulates supply and demand for workers fluctuate based on the value assigned to the position under conditions of fixed compensation. Within highly valued positions, there will be a surplus of labor, as more individuals will be seeking to enter that field. When positions are of low value, there will be a shortfall of labor, as fewer individuals will be seeking to enter the field. However, as wages and other forms of compensation are adjusted, we would not necessarily expect long run shortages or surpluses in the labor market.

Applied to the labor market for teachers, teachers value certain teaching positions based on a variety of characteristics, including potential salary, workplace conditions, and geographical location. For instance, research has found teachers to place high importance on school facilities when selecting specific teaching positions, with lower importance placed on student background (Horng, 2009). Schools then are in competition with other schools. In an attempt to attract the best teachers, schools will compete against other schools to offer the greatest values for teachers through higher salaries, improved working conditions, and even amenities provided by the surrounding areas. To this end, rural schools are often at a disadvantage compared with their urban-suburban counterparts since rural schools traditionally have lower levels of financial resources due to how education finance is often based on local property taxes and because the surrounding areas have less amenities (DeYoung & Crowley, 1990; Shuls, 2018). Then, this disparity in education finance, amenities, and resources more broadly plays a significant role in terms of teacher recruitment and retention.

By their very nature, rural schools face challenges in recruiting and retaining quality teachers since they are located in areas of more limited labor supply. The labor market supply has shifted toward urban and suburban settings where amenities are more available, and the labor market for teachers has generally followed this trend (Boyd et al., 2005; Curran, 2017; McClure & Reeves, 2004). As rural schools have difficulties in attracting teachers, they also experience difficulties in retaining the teachers (Borman & Dowling, 2008).

In sum, through the lens of economic labor market theory, we would expect the teacher labor market to have additional challenges in the rural context due to more constrained financial resources and the appeal of community amenities relative to their urban-suburban counterparts. The examination of teacher turnover would be incomplete without the full consideration of how rurality, and the specific context of rurality, contribute to teacher turnover. Next, we discuss the limited knowledge base around teacher attrition in rural contexts.

Teacher Attrition in Rural Contexts

While there is a large and robust literature on the factors of teacher attrition and retention (Borman & Dowling, 2008; Nguyen et al., 2020), the vast majority of this research has focused on large urban areas. Research on teacher attrition has rarely considered rurality on its own (Monk, 2007) and has often included it simply as a covariate in regression models. The research that exists on teacher attrition in rural contexts employs qualitative research that is hard to generalize to other settings, uses small samples, considers only a subset of teachers, or conflates teacher intention or survey result for actual attrition behavior (Hammer et al., 2005; Lowe, 2006; Maranto & Shuls, 2013; Prater et al., 2007; Ulferts, 2016). For instance, Berry et al. (2011) examined special education teacher recruitment and retention in rural

districts by conducting telephone interviews with 203 special educators. Even though the authors discussed retention in their article, the questions they asked were about the respondents' perceptions of the reasons that other special education teachers typically leave the district. Similarly, Davis (2002) examined factors related to teacher retention in small rural schools in Montana using survey responses from 126 teachers, and Fry and Anderson (2011) examined four first-year teachers in rural schools.

Other research has tried to synthesize common themes or causes of turnover in rural settings, but neither are these typically systematic nor do they consider whether the original papers use qualitative or quantitative data. For example, Lowe (2006) examined the most "common causes" of a high turnover rate among rural teachers and concluded that, among others, providing authentic mentoring for new teachers and offering incentives, salary increases, and/or bonuses would be effective in reducing turnover. However, there is no discussion of how these particular policy solutions were chosen or how the support for these solutions come about from the scant information on the references themselves. A more recent study by Maranto and Shuls (2013) provides similar recommendations about efforts and practices that may be used to reduce attrition, but there is little empirical evidence that these suggestions have measurable relationship with actual turnover, and some of the research cited is not specific to teachers in rural settings.

The most comprehensive look at teacher attrition and retention in rural settings is a review by Hammer et al. (2005). In their review, they find more research on recruitment rather than retention and what was known on rural retention was rather thinned and more anecdotal than systematic because, as noted previously, research using rural-specific data is rarely done. From what they are able to synthesize, they conclude the rural-specific literature suggests there are some main challenges related to both recruitment and retention in rural settings: lower pay, geographic and social isolation, difficult working conditions, and the NCLB (No Child Left Behind) requirement for highly qualified teachers, as rural teachers often teach multiple subjects (needing certification for each subject), and professional development can be scarce in rural communities (Beesley et al., 2010; Lazarev et al., 2017). In short, in comparison with what we know about the factors that drive teacher attrition and retention nationally or in large urban areas, there is a relatively little quantitative research on teacher attrition in the rural context and virtually no research on how the factors associated with attrition may vary for different rural contexts.

There are a few large-scale quantitative studies examining teacher attrition in rural contexts. For instance, Cowen et al. (2012) examine the challenges to recruitment and retention of teachers in Appalachian schools and how the geographic isolation of these schools contributes to these difficulties. They find Appalachian teachers are particularly at risk of leaving the profession and leaving Appalachia rather than transferring into it and that interdistrict mobility is rare. Moreover, they find regular certified Appalachian teachers are substantially more likely to leave than regular certified non-Appalachian teachers. In short, they find Appalachian teachers are more likely to turn over and certified Appalachian teachers are even more at risk on top of that.

However, many studies comparing turnover rates between rural and nonrural areas using national and state-level data do not find rural teachers are, on average, more likely to turn over than their urban counterparts (Donaldson & Johnson, 2010; Moore, 2011; Nguyen et al., 2020; Smith, 2006). Lochmiller et al. (2016) found that rural teachers stayed at the same school at higher rates than teachers in urban and suburban areas. These findings suggest teacher turnover is not uniformly higher in all rural contexts; in other words, levels of teacher turnover may be specific to the rural context and the local teacher labor market, not simply divided by the rural-urban delineation. These studies, however, do not examine how teacher and school factors are associated with teacher attrition specifically for the rural context.

In short, there is a dearth of research on what drives teacher attrition and retention in rural context. What is known is based largely on research using small samples, qualitative research that is hard to generalize to other settings, subsets of teachers such as only rural special education teachers, and research that relies on proxy measures of actual attrition behavior. To fill this gap, our study employs large-scale quantitative data to examine teacher attrition behavior in various rural contexts including rural schools, less urbanized states, sparsely populated states, and their interactions. Moreover, we will extend prior work by examining if teacher turnover is higher or lower in various rural contexts. Next, to motivate why we examine certain teacher and school characteristics and their relationships with attrition, we discuss how teacher and school characteristics are associated with teacher turnover. We note these discussions are not specific to the rural contexts as the majority of research on teacher turnover does not focus on rural contexts, one of the main gaps we are beginning to address in this article. However, the prior literature indicates these are important characteristics that do contribute to teacher turnover and should be examined specifically for rural contexts.

Teacher Characteristics

Research has found teacher background and characteristics, such as race/ethnicity, gender, age, experience, and certification, are associated with turnover. For instance, some research has found female teachers are more likely to leave the profession, while others have found men are more likely to leave (Barbieri et al., 2011; Boyd et al., 2011; Ingersoll, 2001). In terms of race/ethnicity, White teachers tend to

leave more frequently than minority teachers (Kukla-Acevedo, 2009; Moore, 2011). With regard to new and young teachers, turnover is high for both groups (Borman & Dowling, 2008; Guarino et al., 2006). STEM and special education teachers and teachers with graduate degrees are also more at risk of turning over in many contexts (Clotfelter et al., 2008; Imazeki, 2005; Ingersoll, 2001). Training, certification, and college selectivity are all factors that tend to have significant associations with turnover (Borman & Dowling, 2008; Boyd et al., 2005; Newton et al., 2011). Teachers with higher salaries or belonging to a union tend are less likely to attrit (Hanushek et al., 2004; Kelly & Northrop, 2015; Kukla-Acevedo, 2009; Lankford et al., 2002). In sum, there is a substantial literature on how teacher characteristics are associated with turnover. However, the shortcoming of many of these studies is that they are based on data in urban settings or not focused on rural settings specifically. Therefore, it is important for us to examine whether these relationships hold when we focus on rural settings.

School Characteristics

There are many studies examining how school characteristics are associated with turnover, but the findings are not consistent across studies. These findings may be more mixed due to how teachers sort themselves into various schools and how the relationships between school characteristics and teacher turnover may vary based on the context. As discussed previously, rural teachers may turn over at higher rates in some contexts but not others, so it is important to carefully examine how turnover may vary depending on the rural context, a particular focus of our study. Research suggests school size and enrollment are associated with turnover, but the magnitudes of the effects are small (Goldhaber et al., 2011; Imazeki, 2005; Kelly, 2004). Similarly, while the socioeconomic composition of schools is an important part of the school culture and is related to the working conditions of schools, research has found weak to no connection between it and attrition (Borman & Dowling, 2008). However, an explanation for these findings is that measures of socioeconomic composition are often reported as a percentage, which may not have a strong linear relationship with turnover indicating other comparisons such as quartile comparison or high versus low socioeconomic conditions may provide better results. In terms of student minority composition, teachers working in majority-minority schools are more likely to leave relative to teachers in White-majority schools (Carroll et al., 2000; Dagli, 2012). Last, research has consistently found administrative support and teacher cooperation may be able to reduce turnover (Boyd et al., 2011; Kraft et al., 2016; Smith, 2006; Urick, 2016). In sum, prior research examining school characteristics and teacher turnover suggests school characteristics are important and should be considered in tandem with turnover. Moreover, as school conditions vary substantially across rural contexts, research must consider how they may contribute to teacher turnover (Biddle & Azano, 2016). For instance, students in rural schools tend to perform lower academically and receive less funding than their urban and suburban counterparts (DeYoung & Howley, 1990; Graham & Provost, 2012; Shuls, 2018). By including school characteristics in the analysis, we would be able to examine the extent to which these relationships vary with different rural contexts.

Data and Method

This article uses restricted data from SASS and its supplement, the Teacher Follow-up Survey (TFS), which is administered by the National Center for Education Statistics (NCES). All waves of SASS consist of state representative and nationally representative samples of schools, principals, and teachers for public schools in the United States. These surveys include comprehensive data on teacher characteristics, school characteristics, and teacher attrition behavior.

For this study, four of the most recent waves of SASS are used to examine the teacher characteristics and school characteristics in which they teach in three different rural contexts: (1) rural schools as designated as rural by the U.S. Census Bureau, (2) percent urban at the state level, (3) state-population density. More specifically, we use the 1999–2000, 2003–2004, 2007–2008, and 2011–2012 waves where teacher turnover data are available. We employ appropriate sampling weights to make the results representative at the state and national levels. The overall sample size for the descriptive analysis is 139,170 unique teacher-year observations. The sample sizes are 90,860 teachers in less urbanized states (by percent urban), 91,300 teachers in sparsely populated states (by population density), and 49,110 teachers in rural school designation.

Measures of Rural Contexts

To thoroughly examine the teacher labor market in the rural context, we are using three distinct operationalizations of rurality. The first is simply schools designated as rural by NCES Common Core of Data and by the U.S. Census Bureau (Ratcliffe et al., 2016). The second is by selecting states by percent urban. In the United States, 80.7% of the population lives in urban-suburban areas (U.S. Census Bureau, n.d.). As there is no agreed-upon delineation of what makes a rural or nonrural state, we designate all states whose populations in urban-suburban areas are less than 80%, the U.S. average, as less urbanized rural states. In other words, in these states, 20% or more of the population live in rural areas. By this measure, 32 states are considered rural states by percent urban (Appendix Table A.1). Others might reasonably argue it is not only the percent population living in rural areas that matter, but the population sparsity and geographical isolation that matter more. As noted previously, teacher turnover, and relatedly teacher shortages,

may be driven in part due to geographical isolation and the issues of sparsity and critical density to provide professional development for teachers and infrastructures for schooling (Cowen et al., 2012; Lochmiller et al., 2016; Mathis, 2003; Proffit et al., 2004). Due to (dis)economy of scale, isolated school systems face challenges to recruiting and retaining teachers (Gross & Jochim, 2015; Mathis, 2003). As such, states that are more sparse and geographically isolated like Arizona and Utah may face more of these challenges than less urbanized states that are less sparse such as Michigan and Ohio. To address this issue, we use a third measure of rural context of states by population density (U.S. Census Bureau, n.d.). This third measure then captures how sparsely populated each state is with respect to how large it is geographically. In many ways, this operationalization reflects findings the teacher labor markets in sparse and geographically isolated regions are substantially different from those in urban areas (Cowen et al., 2012). To match the number of states designated as rural by percent urban, we select classify the lowest 32 states in term of population density as rural. In short, using these three rural contexts, we are able to examine how the teacher labor markets vary within each context and the extent to which teacher attrition is more pronounced in one rural context or another. As a sensitivity check of our choice of cutoff for urbanicity, we also create a second cutoff where we select states with less than 70% urban by population and a matching number of sparsely populated states (Appendix Table A.2). We also replicate our analyses for states with both urbanicity and population sparsity characteristics. For district leaders who may consider whether these results are applicable to them, we also run similar analyses for rural districts as classified by the U.S. Census Bureau and rural schools in rural districts.

Measures of Teacher Characteristics, School Characteristics, and Attrition

We include a comprehensive set of teacher and school characteristics in this study. In terms of teacher characteristics, we have gender, race/ethnicity, age, teacher experience, whether the teacher teaches math or science (STEM) or special education, graduate degree(s), certification, undergraduate college selectivity using Barron's Admissions Competitiveness Index, annual salary, and union membership. In terms of school characteristics, we consider the school's urbanicity, enrollment size, secondary or elementary level, the percentage of students with free-and-reduced-price lunch (FRPL) eligibility, percent minority, percent individualized education program (IEP), and percent limited English proficiency (LEP). We also include principal reports of the level of student disciplinary problems, administrative support to teachers as reported by teachers, and the level of cooperative effort among teachers.

The main dependent variables for this study come from the principal report of teachers' employment status (TFS) in the follow-up year following the baseline survey year. Teacher status is classified into one of three categories: stayers, switchers, and leavers. Teachers who remained in the same school in the baseline year are stayers, teachers who switched to a new school are switchers, and teachers who left the teaching profession are leavers. In some analyses, we also combine switchers and leavers into a single group called movers to examine turnover from the perspective of the school where a teacher who is no longer teaching in the same school the next year is a teacher who has to be replaced. A complete description of the variables used can be found in Appendix Table A.3.

Method

This study includes both descriptive and regression analyses. In the descriptive analysis, we examine how teacher and school characteristics and teacher mobility patterns vary in the three different rural contexts and at the national level as a point of comparison. With regression analysis, we estimate an ordinary least squares (OLS) model to examine whether teacher turnover (comparing stayers against movers) varies by the three rural contexts and their interactions. We also examine whether turnover is more pronounced for novice and specialty teachers (STEM and special education) who are often at higher risk of attrition and whether there is differential attrition for these teachers in different rural contexts. Next, we use OLS models to estimate the turnover probabilities for movers, switchers, and leavers separately. The main equation to estimate this relationship is

$$Y_{ijt} = \beta_0 + T_i\beta_1 + S_j\beta_2 + \lambda_k + \gamma_t + \varepsilon_{ijt} \quad (1)$$

Y represents the three forms of turnover (moving, switching, and leaving) for teacher i from school j in year t. T is a vector of teacher characteristics and S is a vector of school characteristics. λ_k is state fixed effects to account for unobserved heterogeneity across states, and γ_t is a wave fixed effect to account for time-specific correlates of teacher turnover, such as the 2008 recession. Last, ε_{ijt} is a random error term. Clustered standard errors at the school level are employed. Nationally representative weights are used for each wave in the main analysis. While these models may be estimated using multinomial logistic regression models, this model is estimated as a linear probability model to ease interpretation. Multinomial logistic regression results, while not presented, are substantively similar (available on request). In sum, this OLS model can account for temporal shocks to teacher turnover that may be specific to particular years and SASS sampling design allows for representativeness at the state level so the use of state fixed effects also allows within state interpretation.

TABLE 1
Teacher and School Characteristics by Various Rural Context

Variables	(1) Nationally	(2) Less Urbanized States	(3) Sparsely Populated States	(4) Rural by Census Bureau
Teacher characteristics				
Female	0.76	0.76	0.76	0.75
Black	0.07	0.08	0.06	0.05
Asian	0.02	0.01	0.01	0.01
American Indian	0.01	0.01	0.01	0.01
Hispanic	0.06	0.02	0.07	0.03
White	0.85	0.89	0.85	0.91
Novice teachers	0.10	0.09	0.10	0.09
STEM	0.14	0.14	0.14	0.15
SPED	0.12	0.12	0.11	0.11
Graduate degree	0.50	0.50	0.44	0.44
No certification	0.02	0.02	0.02	0.02
Most selective college	0.09	0.06	0.05	0.05
Very selective college	0.19	0.19	0.17	0.17
Salary per $1,000	52.50	48.59	45.86	45.59
Union member	0.77	0.71	0.68	0.70
School characteristics				
Rural school	0.23	0.34	0.32	1
Suburban school	0.51	0.46	0.40	0
Urban school	0.26	0.20	0.27	0
K–12 enrollment	812	697	731	564
Secondary school	0.31	0.31	0.31	0.32
Percent FRPL	0.41	0.41	0.45	0.45
Majority FRPL	0.37	0.35	0.42	0.39
Percent minority	0.38	0.29	0.37	0.24
Majority minority	0.34	0.23	0.31	0.18
Percent IEP	0.13	0.13	0.12	0.13
Percent LEP	0.07	0.03	0.07	0.03
Admin. support	0.00	0.01	0.03	0.01
Teacher coop	0.05	0.06	0.06	0.03
Observations	139170	90860	91300	49110

Note. Less urbanized states are states with 20% or more living in rural areas. Sparsely populated states are states with low population density. Rural, suburban, and urban are defined by the U.S. Census Bureau. Novice teachers have less than 3 years of experience. Salary has been converted to constant 2012 dollar. Nationally representative weights are employed. Sample sizes weighted to the nearest 10 in accordance with National Center for Education Statistics nondisclosure rule. Adapted from the U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey. STEM = science, technology, engineering, and mathematics; SPED = special education; FRPL = free or reduced-price lunch; IEP = individualized education program; LEP = limited English proficiency.

Results

Teacher and School Characteristics in Rural Contexts

Table 1 presents the teacher characteristics and school characteristics nationally, for rural states by percent urban (less urbanized states), for rural states by population density (sparsely populated states), and for teachers in rural schools. From 2000 to 2012, nationally about three quarters of teachers are women, 85% are White, 10% are novice teachers, and 14% and 12% are STEM and special education teachers. Half of the teachers nationally have graduate degrees, 2% have no certification, 9% come from the most selective colleges, 19% come from very selective colleges, earn about $52,500 a year on average, and about three quarters have union membership. In comparison, less urbanized states most closely resemble teacher characteristics nationally, albeit with some minor differences. In these rural states with 20% or more of the population living in rural areas, 89% of teachers are White and they earn, on average, about $48,590 with 71% having union membership. In comparison, teachers in sparsely populated states tend to be less educated (only 44% have graduate degrees) and come from less selective colleges. What is perhaps a stark difference is the average salary for teachers in these states is only $45,860 in constant

TABLE 2
Rate of Attrition by Rural Context

Teacher Status	(1) Nationally	(2) Less Urbanized States	(3) Sparsely Populated States	(4) Rural by Census Bureau
Stayer	85.49	85.41	84.17	86.38
Switcher	7.20	7.60	7.91	7.07
Leaver	7.31	7.00	7.92	6.55
Observations	139,170	90,860	91,300	49,110

Note. Nationally representative weights are employed. Sample sizes weighted to the nearest 10 in accordance with National Center for Education Statistics nondisclosure rule. Stayers are teachers who remain in the school where they taught in the previous year. Switchers are teachers who remain in teaching but have moved to a different school. Leavers are teachers who leave teaching altogether. Adapted from the U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey.

TABLE 3
Rate of Attrition in Rural Schools and Various Rural Contexts

Variable	(1) Turnover in Rural Schools	(2) Turnover in Less Urbanized States	(3) Turnover in Sparsely Populated States	(4) Interaction of Rural Schools and Less Urbanized States	(5) Interaction of Rural Schools and Sparsely Populated States
Rural school	−0.011** (0.004)			−0.011 (0.007)	−0.021** (0.005)
Rural states by urbanicity		0.001 (0.004)		0.004 (0.004)	
Rural states by density			0.023** (0.004)		0.024** (0.004)
Interaction of rural context				−0.001 (0.008)	0.007 (0.007)
N	139,170	139,170	139,170	139,170	139,170

Note. Nationally representative weights are employed. Year fixed effects are employed. Clustered standard errors at the school level are in parentheses. Adapted from the U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey.
$^{+}p < .10$. $*p < .05$. $**p < .01$.

2012 dollars, about $6,600 less than the national average. In rural schools, teachers tend to be more White (91%), with 44% having graduate degrees, and have a similar salary to those working in sparsely populated states. In short, teachers in various rural contexts, on average, have lower rates of holding graduate degrees, attended less selective colleges, earn less, and are less likely to have union membership than teachers nationally.

With regard to school characteristics nationally, less than a quarter of the schools are rural, half are suburban, and a little more than a quarter are urban. About 37% are majority-FRPL schools (low-income) and 34% are majority-minority schools. About 13% of students have IEP and 7% have LEP. In comparison, about a third of schools are located in rural areas in less urbanized states with lower K–12 enrollment, comparable majority-FRPL schools, lower majority-minority schools, and lower percentage of LEP students. Schools in sparsely populated states are comparable with less urbanized states except the percentage of majority-FRPL and majority-minority schools are higher, which may contribute to differences in attrition rates. In comparison, rural schools have substantially lower enrollment, about 39% are majority-FRPL schools, and only 18% are majority-minority schools. In short, rural schools tend to have less students on average, have more students who are FRPL eligible, and are less diverse in terms of race/ethnicity.

Teacher Attrition in Rural Contexts

In terms of attrition, nationally about 14.5% of teachers turn over every year, half are switching schools, and half are leaving the profession (Table 2). These rates are similar to those in less urbanized states. On the other hand, teachers tend to turn over at a higher rate in sparsely populated states (about 8% are switchers and 8% are leavers). In rural schools, however, less than 14% turn over every year, with 7% switching and 6.6% leaving. These descriptive results suggest teacher attrition is not constant across various rural contexts, which we examine in more details next.

In Table 3, we examine whether turnover rates are statistically different in various rural contexts, employing wave fixed effects. We observe teachers in rural schools, on average, are 1.1 percentage points less likely to turn over than teachers in urban-suburban schools (Model 1 of Table 3). We note that a 1 percentage point difference in turnover is very meaningful as it may represent 300 teachers in a state that employs 30,000 teachers. Turnover in less urbanized states are not significantly different from that in more urbanized

states (Model 2). On the other hand, teachers in sparsely populated states are 2.3 percentage points more likely to turn over (Model 3). To put this in context, this is nearly a 16% increase in turnover rate compared with the national average. In Models 4 and 5, we examine whether there may be differential rates of turnover for rural schools in less urbanized and sparsely populated states. In Model 4, we find no evidence of the interaction of rural schools and less urbanized states. In Model 5, we also do not find an interaction effect. However, we observe teachers are less likely to turn over in rural schools (2.1 percentage points) by nearly the same amount as they are more likely to turn over in sparsely populated states (2.4 percentage points). In sum, the results from Tables 2 and 3 suggest teacher attrition is not constant across different rural contexts. In particular, teachers in rural schools are consistently less likely to turn over than teachers in urban-suburban areas, but teachers in sparsely populated states are substantially more likely to turn over compared with teachers in more densely populated states.

Rural Teachers More at Risk of Turning Over

Next, we specifically examine how attrition rates vary for teachers who have been identified to be at a higher risk of turning over in the literature, namely, novice teachers and specialty teachers (STEM and special education). In Table 4, the first three models examine the extent to which novice and specialty teachers are more or less likely to leave their current schools (switch and leave), switch schools, and leave teaching, respectively, at the national level, and whether these relationships vary based on the rural status of the school. Models 4 to 6 and Models 7 to 9 replicate these analyses focusing on less urbanized states and sparsely populated states, respectively.

In Model 1, we find novice teachers and special education teachers in urban-suburban areas are particularly at risk of turning over. In particular, novice teachers, teachers with 1 or 2 years of teaching experience, are 9.1 percentage points more likely to turn over than veteran teachers in urban-suburban areas. There is some evidence to suggest novice teachers in rural schools are even more at risk of turning over in comparison with novice teachers in urban-suburban areas (this result is only marginally significant). Moreover, when turnover is disaggregated into switching and moving (Models 2 and 3), we observe novice teachers are both more likely to switch and to move relative to more veteran teachers. Similarly, special education teachers are more at risk of turning over overall, including switching and leaving, but special education teachers are less likely to leave teaching in rural schools than their counterparts in urban-suburban schools.[1] On the other hand, there is no evidence that STEM teachers are more likely to turn over compared with general teachers (Model 1), and there is some evidence they are less likely to switch schools in urban-suburban areas but STEM teachers may be more at risk of switching schools in rural schools.

In comparison, when we replicate this analysis for less urbanized states (Models 4–6), we generally find similar patterns of attrition except the differential relationships between novice and specialty teachers in rural schools are no longer significant (examining the interaction terms). In other words, novice and specialty teachers in rural schools are not more or less likely to turn over (move, switch, or leave) than their counterparts in urban-suburban schools. On the other hand, when we focus on sparsely populated states (Models 7–9), we observe that novice teachers in rural schools are 4.7 percentage points more likely to leave than novice teachers at urban-suburban schools who are already more likely to turn over compared to more experienced teachers. Stated differently, novice teachers in rural schools have higher risks of turning over compared with their counterparts in urban-suburban schools. We have marginally significant evidence that special education teachers in rural schools in sparsely populated states are less likely to turn over compared with special education teachers in urban-suburban schools in sparsely populated states (Model 9) but as noted previously this finding is reversed when we are able to account for teacher and school characteristics. Relatedly, STEM teachers in rural schools are more likely to turn over than their counterparts in urban-suburban schools. In particular, STEM teachers in rural schools in less urbanized states are 1.5 percentage points, nearly 20% relative to baseline, more likely to switch schools than their counterparts.

In sum, the results of Tables 3 and 4 suggest differential attrition happens in rural schools and in sparsely populated states. The attrition rates, for novice teachers and specialty teachers, at less urbanized states are not substantially different from those at the national level. Moreover, some of the differential attrition observed at the national level is driven more by sparsely populated states and not by less urbanized states (examining the interaction terms for novice and specialty teachers and rural schools across the nine models). Due to these findings, when we examine the factors that are associated with teacher mobility patterns in different rural contexts in Table 5, we focus on rural schools nationally (Models 1–3), on sparsely populated states (Models 4–6), and finally rural schools in sparsely populated states (Models 7–9).

Factors of Teacher Attrition in Rural Contexts

In Models 1 to 3 where we examine the factors associated with various forms of turnover behavior in rural schools nationally, we observe that Black teachers are 4.1 percentage points more likely to turn over relative to White teachers in rural schools, driven mainly by Black teachers leaving the profession. Similar to before, novice teachers are more at risk of turning over relative to more veteran teachers. Special education teachers are more likely to switch schools as are teachers with graduate degrees. Unsurprisingly, teachers without certification are more likely to turn over, particularly leaving the profession, and teachers with union membership are less

TABLE 4

Teacher Mobility for New Teachers, STEM teachers, and Special Education Teachers

	National Level			Less Urbanized States			Sparsely Populated States		
Variable	(1) Overall Turnover	(2) Switching Schools	(3) Leaving Schools	(4) Overall Turnover	(5) Switching Schools	(6) Leaving Schools	(7) Overall Turnover	(8) Switching Schools	(9) Leaving Schools
Rural schools	−0.012** (0.004)	−0.005 (0.003)	−0.009** (0.003)	−0.014** (0.005)	−0.010** (0.004)	−0.005 (0.003)	−0.017** (0.006)	−0.004 (0.005)	−0.016** (0.004)
Novice	0.091** (0.007)	0.071** (0.006)	0.039** (0.006)	0.099** (0.009)	0.084** (0.009)	0.036** (0.007)	0.085** (0.010)	0.072** (0.010)	0.032** (0.008)
SPED	0.036** (0.007)	0.026** (0.005)	0.017** (0.006)	0.028** (0.008)	0.022** (0.006)	0.010^{+} (0.006)	0.041** (0.012)	0.029** (0.009)	0.020^{+} (0.011)
STEM	−0.005 (0.005)	−0.012** (0.004)	0.005 (0.004)	−0.006 (0.006)	−0.013** (0.005)	0.007 (0.005)	−0.006 (0.008)	−0.008 (0.006)	0.000 (0.007)
Rural * Novice	0.026^{+} (0.013)	0.022^{+} (0.013)	0.008 (0.010)	0.000 (0.014)	−0.008 (0.013)	0.007 (0.011)	0.047** (0.017)	0.034^{+} (0.017)	0.024* (0.012)
Rural * SPED	−0.017 (0.011)	−0.001 (0.009)	−0.019* (0.008)	−0.005 (0.012)	0.007 (0.010)	−0.014 (0.009)	−0.028^{+} (0.015)	−0.007 (0.012)	−0.028* (0.013)
Rural * STEM	0.014 (0.008)	0.013* (0.006)	0.003 (0.007)	0.014 (0.009)	0.015* (0.007)	0.002 (0.008)	0.018 (0.012)	0.014^{+} (0.009)	0.007 (0.010)
N	139,170	128,690	129,130	90,860	84,200	84,160	91,300	84,260	84,350

Note. Nationally representative weights are employed. Sample sizes weighted to the nearest 10 in accordance with National Center for Education Statistics nondisclosure rule. Year fixed effects are employed. Clustered standard errors at the school-level are in parentheses. Adapted from the U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey. STEM = science, technology, engineering, and mathematics; SPED = special education.

$^{+}p < .10$. *$p < .05$. **$p < .01$.

TABLE 5
The Association of Select Teacher and School Characteristics and Teacher Mobility in Various Rural Contexts

	Rural Schools Nationally			Sparsely Populated States			Rural Schools in Sparsely Populated States		
Characteristic	(1) Overall Turnover	(2) Switching Schools	(3) Leaving Schools	(4) Overall Turnover	(5) Switching Schools	(6) Leaving Schools	(7) Overall Turnover	(8) Switching Schools	(9) Leaving Schools
Black	0.037* (0.017)	0.016 (0.014)	0.029* (0.013)	0.033* (0.015)	0.010 (0.012)	0.032* (0.013)	0.049* (0.021)	0.022 (0.020)	0.038* (0.016)
Novice	0.100** (0.012)	0.078** (0.011)	0.044** (0.008)	0.078** (0.009)	0.064** (0.008)	0.032** (0.007)	0.113** (0.014)	0.090** (0.014)	0.050** (0.009)
STEM	0.002 (0.007)	−0.002 (0.005)	0.004 (0.006)	−0.002 (0.006)	−0.003 (0.004)	−0.000 (0.005)	0.004 (0.008)	0.002 (0.007)	0.003 (0.007)
SPED	0.021* (0.008)	0.025** (0.007)	−0.001 (0.006)	0.032** (0.009)	0.027** (0.007)	0.012 (0.008)	0.012 (0.010)	0.021* (0.009)	−0.008 (0.007)
Graduate degree	0.012^{+} (0.006)	0.015** (0.005)	0.000 (0.005)	0.019** (0.006)	0.016** (0.004)	0.007 (0.005)	0.031** (0.008)	0.028** (0.007)	0.009^{+} (0.005)
No certification	0.061** (0.022)	0.032 (0.021)	0.046** (0.017)	0.061** (0.019)	0.012 (0.014)	0.066** (0.018)	0.065* (0.027)	0.053^{+} (0.029)	0.031^{+} (0.017)
Union	−0.018** (0.007)	−0.009^{+} (0.005)	−0.012* (0.005)	−0.025** (0.006)	−0.014** (0.005)	−0.016** (0.005)	−0.019* (0.008)	−0.010 (0.006)	−0.013* (0.006)
Majority FRPL	0.008 (0.007)	0.002 (0.006)	0.008 (0.005)	0.015* (0.006)	0.012* (0.005)	0.006 (0.005)	0.012 (0.008)	0.003 (0.007)	0.012* (0.006)
Majority minority	0.024* (0.010)	0.014 (0.009)	0.015* (0.008)	0.017^{+} (0.009)	0.007 (0.007)	0.014* (0.007)	0.034** (0.013)	0.023^{+} (0.012)	0.018* (0.009)
Admin support	−0.019** (0.003)	−0.014** (0.003)	−0.009** (0.002)	−0.023** (0.003)	−0.015** (0.002)	−0.013** (0.002)	−0.020** (0.004)	−0.013** (0.003)	−0.011** (0.003)
Teacher coop	−0.010** (0.003)	−0.010** (0.002)	−0.002 (0.002)	−0.012** (0.002)	−0.010** (0.002)	−0.005* (0.002)	−0.013** (0.004)	−0.014** (0.003)	−0.002 (0.003)
N	49,110	45,450	45,550	91,300	84,260	84,350	39,420	36,410	36,430

Note. Nationally representative weights are employed. Other teacher and school characteristics are included in the model but not shown. Sample sizes weighted to the nearest 10 in accordance with National Center for Education Statistics nondisclosure rule. Year fixed effects are employed. Clustered standard errors at the school level are in parentheses. Adapted from the U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey. STEM = science, technology, engineering, and mathematics; SPED = special education.
$^{+}p < .10$. *$p < .05$. **$p < .01$.

likely to turn over. Teachers in majority-minority rural schools are 2.4 percentage points more likely to turn over than teachers in majority White rural schools. Last, teachers who report stronger administrative support are less likely to turn over as are teachers who report more cooperation among teachers in the schools. Remarkably, we observe substantively similar patterns when we examine teacher attrition in all schools in sparsely populated states (Models 4–6) where Black teachers, novice teachers, special education teachers, teachers with graduate degrees, teachers without certification, and teachers in majority-minority schools are more at risk of turning over compared with their peers, while teachers with union membership, teachers who report more administrative support, and teachers who report more cooperation among themselves are less likely to turn over. However, we observe teachers working in low-income schools are more likely to turn over than teachers working in more affluent schools. In comparison with rural schools nationally, we observe similar patterns when we examine teacher attrition in rural schools in sparsely populated states (Models 7–9).[2] In sum, our results show there are some factors significantly associated with various forms of teacher attrition and these relationships are consistent and persist in various rural contexts.[3]

To further explore why some teachers turn over, we also leverage the TFS that includes some reasons teachers indicate that are very important in their decision to turn over. Since the TFS is available only on a small subset of teachers who turn over, we view this as a purely exploratory analysis that may provide suggestive evidence for future work, but for which the results may not be as generalizable as the main analyses. The results indicate that location of work (residence), dissatisfaction with administration, and working conditions are three of the most important reasons why teachers turn over for teachers in both sparsely populated states and less urbanized states (Appendix Figure A.1). About 20% of teachers who turn over also indicate that salary and dissatisfaction with job assignment are very important reasons why they leave. While these are suggestive findings, they do correspond to previous findings from systematic reviews and meta-analyses of teacher turnover (Borman & Dowling, 2008; Nguyen et al., 2020).

Sensitivity and Robustness Checks

To ensure our results are not driven solely by our choice of using states with 20% or more rural populations and comparable number of sparsely populated states, we utilize a second cutoff of lesser urbanized states where 30% or more of the population is considered rural by urbanicity (see Appendix Table A.2 for specific states). These results are substantively similar to our main analyses (Appendix Tables A.5 and A.6) except Black teachers are not consistently more likely to turn over in these states or in rural schools within these states. For instance, we consistently observe special education teachers are more likely to turn over, particularly in the form of switching schools, in these rural settings. As another sensitivity check, when we examine these relationships in nine states with the highest rates of rural population and are most sparsely populated, we find these relationships remain substantively similar (Appendix Table A.7).

We also replicate our analyses at the district level, which we believe will be helpful for district leaders who may wonder whether these state-level results are applicable to rural districts more broadly. We find teachers in rural districts turn over at around 14.3% every year with about half switching to other schools and half leaving the profession, similar to the results for less urbanized states. However, teachers in rural districts are 1.1 percentage point less likely to turn over relative to more urban districts, which is similar to the results for turnover in rural schools nationally. When we examine whether certain teachers are more likely to turn over in rural districts, we find novice teachers in rural schools in rural districts are substantially more likely to switch schools, while novice teachers in nonrural schools in rural districts are not more likely to switch schools (Model 2 of Appendix Table A.8). In short, for rural districts, novice teachers working in rural schools are more at risk of turning over.

In terms of teacher and school characteristics associated with turnover, the results are similar to the results for sparsely populated states and for rural schools in sparsely populated states (Appendix Table A.9). We find Black teachers, novice teachers, and special education teachers are more likely to turn over. We also find teachers with union membership, and teachers who report better administrative support or better teacher cooperation are less likely to turn over. In short, we find teachers in rural districts are less likely to turn over compared with more urban districts, but novice teachers in rural schools in these districts are more likely to move from one school to another, and the relationships between teacher and school characteristics are similar to those in sparsely populated states.

We also examine whether teacher mobility patterns vary monotonically with respect to the state's urbanicity level and the population density level (Appendix Table A.10). To divide states into quartiles, we have 12 states in the first quartile (least urban or least dense) and 12 states in the fourth quartile (most urban or most dense), and 13 states in the second and third quartiles each. While these results are generally comparable with the main results, there is evidence to suggest that teacher mobility patterns do not necessarily vary monotonically with respect to urbanicity and density level. For instance, the finding that teachers in rural schools in less urbanized states are less likely to turn over (Model 4 of Table 4) are driven mainly by teachers in the third quartile in terms of urbanicity (Model 3 of Appendix Table A.10). On the other hand, the finding that novice teachers in rural schools in sparsely populated states are more likely to turn over (Model 7 of Table 4) are mainly driven by teachers in the second quartile in terms of population density (Model 6 of Appendix Table A.10). In sum,

these results suggest some teacher mobility patterns do not vary monotonically in terms of urbanicity and density. We also observe similar patterns when we examine the associations of teacher and school characteristics and turnover by quartiles in Appendix Table A.11.

Taken altogether, these findings illustrate how, in some aspects, there are some similarities between rural contexts, but in others, the same set of rural contexts may exhibit entirely different relationships. As such, it is important to examine teacher turnover, and more broadly the teacher labor market, specific to particular rural contexts.

Discussion and Conclusion

The descriptive analysis in Table 1 illustrates how teacher demographics in various rural contexts are generally reflective of the teacher labor work force nationally. However, in some important ways, there are important differences between rural teachers and the schools in which they teach compared with teachers nationally. Rural teachers tend to be more White, have lower rates of graduate degrees, attended less selective colleges, earn substantially less, and are less likely to have union membership, and the schools in which they teach have more students who are FRPL eligible and are less diverse racially/ethnically. However, even with a less diverse student population, 18% to 31% of schools in different rural contexts are still majority-minority schools, while the vast majority of rural teachers are White. As student populations change over time, our findings highlight how schools and districts may adjust their recruitment and retention practices to better serve their students. A comprehensive systematic review on the effect of student-teacher racial/ethnic match suggests having a same-race teacher is associated with more favorable teacher ratings and higher achievement tests for minority students (Redding, 2019). These positive effects come at no cost to White students, and arguably, White students also benefit from interacting and socializing with non-White teachers as socialization with adults who are different from one's family is an important outcome of schooling (Redding, 2019). Given the academic and social benefits to students when the teacher workforce is more diversified and representative of the student populations, our findings suggest diversifying the teacher work force in rural settings is important, particularly for traditionally underserved students.

Next when we turn to attrition, we find teacher attrition is higher in sparsely populated states but lower in rural schools. Formal tests show that teachers in rural schools are less likely to turn over than teachers in urban-suburban areas, while teachers in sparsely populated states are more likely to turn over than teachers in more densely populated states. On the other hand, teachers in less urbanized states turn over at the same rate as teachers in more urbanized states. This analysis strongly indicates that teacher attrition issues in rural settings are heterogeneous, specific to particular contexts. It is incumbent on researchers and policymakers to be aware of this crucial difference and not treat rurality as a monolithic entity. Furthermore, when we examine teachers who have been identified by prior research as particularly at risk of turning over (novice, special education, and STEM), we find consistent evidence that novice teachers and special education teachers (but not STEM teachers) are more likely to turn over at the national level, in less urbanized states, and in sparsely populated states. Additionally, we find differential attrition patterns in sparsely populated states while attrition patterns in less urbanized states largely reflect national patterns. In particular, we find novice teachers teaching in rural schools in sparsely populated states are at higher risk of turning over, even more so than novice teachers in urban-suburban schools in the same states.

When we examine the factors associated with teacher attrition, we do find some disconcerting patterns that can be seen in rural schools nationally, in sparsely populated states and in rural schools in sparsely populated states (Table 5), and to a lesser degree, in less urbanized states (Appendix Table A.4). First, we find, in contrast to the broader research on teacher attrition (Borman & Dowling, 2008), that Black teachers in various rural settings are substantially more likely to turn over, specifically more likely to leave teaching, relative to White teachers. This is particularly disconcerting for rural schools because of the need to diversify its teaching force as discussed previously. Along this line of concerns of equity, we also observe evidence that rural teachers in low-income schools and in majority-minority schools are more likely to turn over than their counterparts in high-income and majority-White schools. In other words, traditionally underserved schools and schools that need more teachers of color the most are more at risk of losing their teachers. We also observe novice teachers and special education teachers are more likely to turn over, especially in rural schools in sparsely populated states. In particular, our findings that special education teachers are more likely to turn over support previous research suggesting that special education teachers in rural schools are particularly at risk of turning over (Berry et al., 2011; Prater et al., 2007).

These patterns of attrition are consistent across various rural contexts but are most pronounced in rural schools in sparsely populated states. Not every factor points to increased risk of attrition however. We consistently find teachers with union membership, teachers who report more administrative support, and teachers who report more cooperation among faculty and staff are less likely to turn over, which generally reflects the broader literature on teacher attrition (Borman & Dowling, 2008; Nguyen et al., 2020). We note that our results as percentage point increase or decrease represent substantial numbers of teachers for individual states (100 teachers for every 10,000 teachers in a state), who serve thousands of students and would require substantial resources to replace every year (Barnes et al., 2007). Our exploratory analysis provides some suggestive evidence that the location of the school, dissatisfaction with administration, working conditions, low salary and job assignments are some important reasons teachers provide as to

why they turn over. While these findings are only suggestive, they do resonate with prior findings (Borman & Dowling, 2008; Nguyen et al., 2020).

As we have observed, teacher attrition may be more challenging for one context of rurality but less so for others. In particular, how rurality is defined and operationalized, whether it is measured at the school, district, or state level, and whether it is measured by percent urbanicity or sparsity, does matter. The results indicate while some relationships are fairly similar across rural contexts, others may be drastically different. Moreover, mobility patterns and teacher and school factors associated with turnover also do not vary monotonically with percent urbanicity and population density. These findings have two important implications. First, it is critical to examine teacher turnover, and more broadly, the teacher labor market, in rural and nonrural contexts. Second, the specific rural context and how rural is operationalized also matter. To this end, our results suggest future studies should consider the various ways rurality may be operationalized and show how their findings may vary based on different operationalizations.

While the article brings clarity to some questions, there are also questions that are left unanswered. In particular, future research should attend to issues such as limited access to professional development, difficult working conditions, including the need and challenge for multiple certifications in rural settings, and the salary and/or bonus needed to recruit and retain teachers in rural settings (Hammer et al., 2005; Lazarev et al., 2017). As some states have continually experienced teacher shortages, particularly in their rural schools (Bihasa, 2018; Lazarte-Alcala & Miller, 2018; Sisk, 2015), this research suggests attrition may be one part of the issue but recruitment may also play a role as highlighted by the economic labor market framework. To alleviate these annual shortages of teachers, previous research suggests there are some characteristics common in effective recruitment and retention practices for rural teachers: strategic (including recruiting teachers with rural backgrounds and reducing isolation), specific to the context (the region, the school itself, or the hard-to-staff subject areas), sustained, and rooted in the community (Beesley et al., 2010; Hammer et al., 2005; Maranto, 2013; Monk, 2007; Ulferts, 2016). More efforts and experimentation should be made in this regard.

In conclusion, this study demonstrates how the teacher labor markets for rural contexts are different from those at urban-suburban areas. It also provides evidence that teacher attrition is not uniform across rural contexts. In particular, teacher attrition in rural schools and sparsely populated states are substantially different from teacher attrition in less urbanized states or nationally (Elfers et al., 2006; Hammer et al., 2005). The results suggest the factors that are associated with teacher mobility operate differently in various rural contexts, particularly in sparsely populated states. Many of these factors are associated with increased risk of teacher turnover in different rural contexts. However, prior works suggest there are positive steps that can be taken to reduce turnover for novice and special education teachers and to enable administrators to be more supportive and encouraging to teachers to increase retention for all teachers (Billingsley & Bettini, 2019; Northrup, 2018; Redding & Nguyen, 2020). In many ways, this research highlights how teacher labor market and attrition in rural contexts, and by extension rural education, should not be lumped together with urban-suburban research. Moreover, research in teacher attrition should make a concerted effort to examine the drivers of teacher attrition for the rurality context, not just treat it as an afterthought or simply as a covariate in regression analyses, and also be aware that there may be substantial differences among the various rural contexts.

Appendix

TABLE A.1
Less Urbanized States and Sparsely Populated States

Less Urbanized States	Sparsely Populated States
Alabama	Alabama
Alaska	Alaska
Arkansas	Arizona
Georgia	Arkansas
Idaho	Colorado
Indiana	Idaho
Iowa	Iowa
Kansas	Kansas
Kentucky	Kentucky
Louisiana	Louisiana
Maine	Maine
Michigan	Minnesota
Minnesota	Mississippi
Mississippi	Missouri
Missouri	Montana
Montana	Nebraska
Nebraska	Nevada
New Hampshire	New Hampshire
New Mexico	New Mexico
North Carolina	North Dakota
North Dakota	Oklahoma
Ohio	Oregon
Oklahoma	South Carolina
Pennsylvania	South Dakota
South Carolina	Tennessee
South Dakota	Texas
Tennessee	Utah
Vermont	Vermont
Virginia	Washington
West Virginia	West Virginia
Wisconsin	Wisconsin
Wyoming	Wyoming

Note. U.S. Census Bureau (n.d.).

TABLE A.2
Second Cutoff of Less Urbanized States (<70% Urban) and Sparsely Populated States

Less Urbanized States	Sparsely Populated States	States With Both 30% or More Rural and Most Sparsely Populated
Alabama	Alaska	Alaska
Alaska	Arizona	Arkansas
Arkansas	Arkansas	Iowa
Iowa	Colorado	Maine
Kentucky	Idaho	Montana
Maine	Iowa	North Dakota
Mississippi	Kansas	Oklahoma
Montana	Maine	South Dakota
New Hampshire	Montana	Wyoming
North Carolina	Nebraska	
North Dakota	Nevada	
Oklahoma	New Mexico	
South Carolina	North Dakota	
South Dakota	Oklahoma	
Tennessee	Oregon	
Vermont	South Dakota	
West Virginia	Utah	
Wyoming	Wyoming	

Note. U.S. Census Bureau (n.d.).

TABLE A.3
Variable Descriptions

Operationalization of Rural Measure/Context	
Less urbanized states	States with 20% or more of the populations living in rural nonurbanized areas
Sparsely populated states	States that are sparsely populated by density; number of states to match number of less urbanized states
Rural district	Designated as rural by NCES CCD and by Census Bureau
Rural school	Designated as rural by NCES CCD and by Census Bureau
Employment Status	
Leavers, switchers, movers, and stayers	Leavers are teachers who left the teaching profession, switchers are teachers switched to a new school, movers are teachers who left their current school (leavers + switchers) and stayers are teachers who are currently teaching in same school.
Teacher Characteristics	
Female	A dichotomous variable where 1 = female and 0 = male.
Black	A dichotomous variable where 1 = Black and 0 = non-Black.
Asian	A dichotomous variable where 1 = Asian and 0 = non-Asian.
American Indian	A dichotomous variable where 1 = American Indian and 0 = non-American Indian.
Hispanic	A dichotomous variable where 1 = Hispanic and 0 = non-Hispanic.
White	A dichotomous variable where 1 = White and 0 = non-White.
Novice	A dichotomous variable where 1 = teacher has less than 3 years of teaching experience and 0 = teacher has 3 or more years of teaching experience.

(continued)

TABLE A.3 (CONTINUED)

Teacher Characteristics	
Under 30	A dichotomous variable where 1 = teacher is at least 30 years old and 0 = teacher is older than 30 years.
Graduate degree	A dichotomous variable where 1 = teacher has graduate degree and 0 = no graduate degree.
Teaches STEM	A dichotomous variable where 1 = teacher's subject is math or science and 0 = other subjects.
Teaches SPED	A dichotomous variable where 1 = teacher's subject is special education and 0 = other subjects.
No certification	A dichotomous variable where 1 = teacher has no certification and 0 = teacher has any certification.
Most selective college	A dichotomous variable where 1 = teacher's undergraduate college/university has Barron's classification of most competitive or highly competitive and 0 = Barron's classification is competitive, less competitive, or noncompetitive.
Very selective college	A dichotomous variable where 1 = teacher's undergraduate college/university has Barron's classification of very competitive and 0 = Barron's classification is competitive, less competitive, or noncompetitive.
Salary ($1,000)	A continuous variable of the base teaching salary for the entire school year, scaled in $1,000s, and in constant 2012 dollar.
Satisfy w/ salary (std.)	On a scale of 1 = strongly disagree and 4 = strongly agree, teachers report on how satisfied they are with their salary. Measure standardized for each wave.
Union member	A dichotomous variable where 1 = teacher is a union member and 0 = teacher is not a union member.
School Characteristics	
Urban school	A dichotomous variable where 1 = school is classified as urban by U.S. Census Bureau and 0 = nonurban areas as classified by U.S. Census Bureau.
K–12 enrollment	A continuous variable of the size of school where the teacher is teaching in the base year.
Secondary school	A dichotomous variable where 1 = the school is classified as a secondary school and 0 = the school is not classified as a secondary school.
Combined elem-sec	A dichotomous variable where 1 = the school is classified as a combined elementary and secondary (K–8) school and 0 = the school is not classified as a combined elementary and secondary school.
Percent FRPL students	Percentage of students eligible for the federal FRPL program.
Majority FRPL	A dichotomous variable where 1 = the majority of students at the school is eligible for federal FRPL and 0 = the majority of students at the schools is not eligible for federal FRPL.
Percent minority students	Percentage of non-White students enrolled in a school.
Majority minority	A dichotomous variable where 1 = the majority of students at the school is non-White and 0 = the majority of students at the school is White.
Percent IEP	Percentage of students with IEPs
Percent LEP	Percentage of students classified as having LEP
Student discipline (std.)	On a scale of 1 = never happens to 5 = happens daily, the principal reports of six kinds of student discipline problems: physical conflict, robbery or theft, vandalism, student use of alcohol, drug use, and possession of weapons.
Admin support (std.)	On a scale of 1 = strongly disagree and 4 = strongly agree, teachers report on the school administration's behavior toward the staff is supportive and encouraging (standardized).
Teacher coop (std.)	On a scale of 1 = strongly disagree and 4 = strongly agree, teachers report on the level of cooperative effort among the staff members. Measure standardized for each wave.

Note. STEM = science, technology, engineering, and mathematics; SPED = special education; FRPL = free or reduced-price lunch; IEP = individualized education program; LEP = limited English proficiency; NCES = National Center for Educational Statistics; CCD = Common Core of Data.

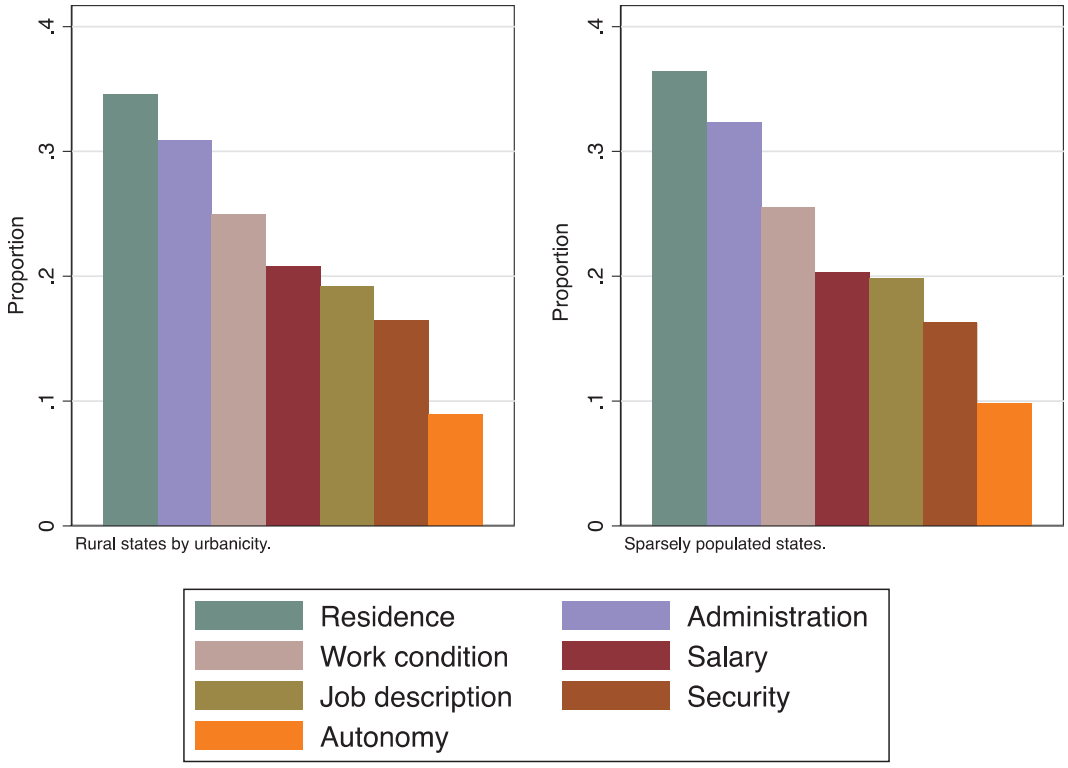

FIGURE A.1. *Proportions of teachers' reasons that are very important in their decision to turn over.*

TABLE A.4
The Association of Select Teacher and School Characteristics and Teacher Mobility in Rural States With Lower Rates of Urbanicity

	Less Urbanized States			Rural Schools in Less Urbanized States		
Characteristic	(1) Overall Turnover	(2) Switching Schools	(3) Leaving Schools	(4) Overall Turnover	(5) Switching Schools	(6) Leaving Schools
Black	0.027** (0.010)	0.009 (0.008)	0.024** (0.008)	0.031* (0.016)	0.008 (0.013)	0.030* (0.014)
Novice	0.079** (0.008)	0.060** (0.007)	0.036** (0.006)	0.084** (0.011)	0.061** (0.010)	0.041** (0.009)
STEM	0.003 (0.005)	−0.002 (0.004)	0.006 (0.004)	0.004 (0.007)	0.001 (0.005)	0.004 (0.006)
SPED	0.024** (0.006)	0.024** (0.005)	0.005 (0.005)	0.025** (0.009)	0.031** (0.008)	−0.002 (0.007)
Graduate degree	0.014** (0.004)	0.013** (0.004)	0.003 (0.003)	0.008 (0.006)	0.012* (0.005)	−0.002 (0.005)
No certification	0.056** (0.017)	0.018 (0.015)	0.053** (0.013)	0.051* (0.024)	0.012 (0.020)	0.050* (0.020)
Union	−0.019** (0.005)	−0.011** (0.004)	−0.012** (0.004)	−0.015* (0.007)	−0.006 (0.005)	−0.012* (0.005)
Majority FRPL	0.010^{+} (0.005)	0.008^{+} (0.004)	0.003 (0.004)	0.001 (0.007)	−0.001 (0.006)	0.002 (0.005)
Majority minority	0.028** (0.007)	0.013* (0.006)	0.021** (0.005)	0.029** (0.011)	0.009 (0.009)	0.026** (0.008)
Admin support	−0.019** (0.002)	−0.010** (0.002)	−0.013** (0.002)	−0.017** (0.003)	−0.010** (0.003)	−0.010** (0.003)
Teacher coop	−0.009** (0.002)	−0.008** (0.002)	−0.002 (0.002)	−0.007* (0.003)	−0.008** (0.002)	−0.000 (0.002)
N	90,860	84,200	84,160	40,340	37,340	37,400

Note. Nationally representative weights are employed. Other teacher and school characteristics are included in the model but not shown. Sample sizes weighted to the nearest 10 in accordance with National Center for Education Statistics nondisclosure rule. Year fixed effects are employed. Clustered standard errors at the school-level are in parentheses. Adapted from the U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey.
$^{+}p < .10$. *$p < .05$. **$p < .01$.

TABLE A.5

Association of Select Teacher and School Characteristics and Teacher Mobility for States With 30% or More Rural Populations

	Lowest Urbanized States			Rural Schools in Lowest Urbanized States		
Characteristic	(1) Overall Turnover	(2) Switching Schools	(3) Leaving Schools	(4) Overall Turnover	(5) Switching Schools	(6) Leaving Schools
Black	0.013 (0.012)	−0.011 (0.010)	0.027** (0.010)	0.032^{+} (0.019)	0.003 (0.016)	0.036* (0.017)
Novice	0.087** (0.011)	0.057** (0.010)	0.050** (0.008)	0.082** (0.015)	0.058** (0.013)	0.043** (0.011)
STEM	0.013^{+} (0.007)	0.003 (0.006)	0.013* (0.006)	0.006 (0.009)	0.000 (0.007)	0.007 (0.007)
SPED	0.022* (0.008)	0.020** (0.007)	0.005 (0.007)	0.029* (0.012)	0.035** (0.011)	−0.002 (0.009)
Graduate degree	0.016* (0.006)	0.014** (0.005)	0.004 (0.005)	0.011 (0.009)	0.014^{+} (0.007)	−0.001 (0.007)
No certification	0.040^{+} (0.022)	−0.007 (0.017)	0.057** (0.019)	0.022 (0.030)	−0.004 (0.026)	0.029 (0.020)
Union	−0.020** (0.006)	−0.010^{+} (0.005)	−0.014** (0.005)	−0.014 (0.009)	−0.008 (0.007)	−0.009 (0.007)
Majority FRPL	0.012 (0.007)	0.015* (0.006)	−0.002 (0.005)	0.012 (0.010)	0.012 (0.009)	0.002 (0.007)
Majority minority	0.028** (0.010)	0.014^{+} (0.008)	0.020** (0.007)	0.033* (0.014)	0.007 (0.012)	0.032** (0.011)
Admin support	−0.021** (0.003)	−0.013** (0.003)	−0.013** (0.002)	−0.021** (0.004)	−0.013** (0.004)	−0.012** (0.003)
Teacher coop	−0.011** (0.003)	−0.013** (0.003)	−0.000 (0.002)	−0.008* (0.004)	−0.011** (0.004)	0.001 (0.003)
N	48,890	45,250	45,210	25,330	23,370	23,450

Note. Nationally representative weights are employed. Other teacher and school characteristics are included in the model but not shown. Sample sizes weighted to the nearest 10 in accordance with National Center for Education Statistics nondisclosure rule. Year fixed effects are employed. Clustered standard errors at the school-level are in parentheses. Adapted from the U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey. STEM = science, technology, engineering, and mathematics; SPED = special education; FRPL = free or reduced-price lunch.
$^{+}p < .10$. $*p < .05$. $**p < .01$.

TABLE A.6

Association of Select Teacher and School Characteristics and Teacher Mobility for the Most Sparsely Populated States

	Sparsely Populated States			Rural Schools in Sparsely Populated States		
Characteristic	(1) Overall Turnover	(2) Switching Schools	(3) Leaving Schools	(4) Overall Turnover	(5) Switching Schools	(6) Leaving Schools
Black	0.018 (0.024)	0.006 (0.018)	0.017 (0.021)	0.022 (0.043)	0.026 (0.037)	−0.002 (0.029)
Novice	0.070** (0.010)	0.055** (0.009)	0.031** (0.007)	0.086** (0.014)	0.058** (0.011)	0.048** (0.011)
STEM	0.001 (0.006)	0.002 (0.005)	−0.000 (0.005)	0.017^{+} (0.009)	0.011 (0.007)	0.009 (0.007)
SPED	0.035** (0.009)	0.039** (0.008)	0.002 (0.006)	0.044** (0.013)	0.049** (0.012)	0.002 (0.010)
Graduate degree	0.012* (0.005)	0.011** (0.004)	0.004 (0.005)	0.014^{+} (0.008)	0.010^{+} (0.006)	0.006 (0.006)
No certification	0.078** (0.023)	0.023 (0.020)	0.077** (0.020)	0.052^{+} (0.031)	0.040 (0.030)	0.026 (0.021)
Union	−0.022** (0.006)	−0.012* (0.005)	−0.014** (0.005)	−0.023** (0.009)	−0.016* (0.007)	−0.010 (0.007)
Majority FRPL	0.012^{+} (0.007)	0.009 (0.006)	0.005 (0.005)	−0.003 (0.010)	−0.007 (0.008)	0.003 (0.008)
Majority minority	0.014 (0.009)	0.001 (0.008)	0.017* (0.007)	0.004 (0.014)	0.005 (0.012)	0.001 (0.011)
Admin support	−0.024** (0.003)	−0.013** (0.002)	−0.016** (0.002)	−0.017** (0.004)	−0.008* (0.003)	−0.013** (0.003)
Teacher coop	−0.011** (0.003)	−0.012** (0.002)	−0.001 (0.002)	−0.012** (0.004)	−0.011** (0.003)	−0.003 (0.003)
N	49,210	45,420	45,490	22,680	20,890	20,990

Note. Nationally representative weights are employed. Other teacher and school characteristics are included in the model but not shown. Sample sizes weighted to the nearest 10 in accordance with National Center for Education Statistics nondisclosure rule. Year fixed effects are employed. Clustered standard errors at the school-level are in parentheses. Adapted from the U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey. STEM = science, technology, engineering, and mathematics; SPED = special education; FRPL = free or reduced-price lunch.
$^{+}p < .10$. $*p < .05$. $**p < .01$.

TABLE A.7

Association of Select Teacher and School Characteristics and Teacher Mobility for States With 30% or More Rural Populations and for the Most Sparsely Populated States

	Most Rural States by Urbanicity and Density			Rural Schools in Most Rural States		
Characteristic	(1) Overall Turnover	(2) Switching Schools	(3) Leaving Schools	(4) Overall Turnover	(5) Switching Schools	(6) Leaving Schools
Black	0.016 (0.033)	−0.004 (0.022)	0.022 (0.027)	0.045 (0.051)	0.052 (0.047)	−0.004 (0.031)
Novice	0.092** (0.013)	0.069** (0.012)	0.043** (0.010)	0.085** (0.018)	0.069** (0.015)	0.034* (0.014)
STEM	0.015^{+} (0.009)	0.009 (0.007)	0.009 (0.007)	0.022^{+} (0.012)	0.007 (0.010)	0.019* (0.009)
SPED	0.028** (0.011)	0.031** (0.009)	0.001 (0.007)	0.018 (0.014)	0.028* (0.013)	−0.008 (0.009)
Graduate degree	0.016* (0.008)	0.012^{+} (0.006)	0.006 (0.005)	0.018^{+} (0.010)	0.019* (0.008)	0.003 (0.007)
No certification	0.023 (0.028)	−0.024 (0.017)	0.052^{+} (0.027)	0.019 (0.031)	−0.007 (0.022)	0.029 (0.025)
Union	−0.015* (0.008)	−0.011^{+} (0.006)	−0.006 (0.005)	−0.016 (0.010)	−0.010 (0.009)	−0.009 (0.008)
Majority FRPL	0.009 (0.010)	0.006 (0.008)	0.005 (0.007)	0.004 (0.013)	−0.003 (0.011)	0.008 (0.009)
Majority minority	0.005 (0.012)	−0.014 (0.010)	0.020* (0.010)	−0.006 (0.017)	−0.016 (0.014)	0.010 (0.013)
Admin support	−0.018** (0.004)	−0.011** (0.003)	−0.011** (0.003)	−0.015** (0.004)	−0.008* (0.004)	−0.010** (0.003)
Teacher coop	−0.011** (0.004)	−0.012** (0.003)	−0.001 (0.003)	−0.012** (0.005)	−0.012** (0.004)	−0.003 (0.004)
N	25,690	23,830	23,750	14,360	13,260	13,300

Note. Nationally representative weights are employed. Other teacher and school characteristics are included in the model but not shown. Sample sizes weighted to the nearest 10 in accordance with National Center for Education Statistics nondisclosure rule. Year fixed effects are employed. Clustered standard errors at the school-level are in parentheses. Adapted from the U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey. STEM = science, technology, engineering, and mathematics; SPED = special education; FRPL = free or reduced-price lunch.
$^{+}p < .10$. *$p < .05$. **$p < .01$.

TABLE A.8

Teacher Mobility for New Teachers, STEM Teachers, and Special Education Teachers in Rural Districts

Characteristic	(1) Overall Turnover	(2) Switching Schools	(3) Leaving Schools
Rural schools	0.017 (0.019)	0.009 (0.012)	0.010 (0.017)
Novice	0.060 (0.051)	−0.002 (0.024)	0.069 (0.051)
SPED	0.116^{+} (0.061)	0.024 (0.028)	0.109^{+} (0.060)
STEM	0.064^{+} (0.035)	0.007 (0.022)	0.063^{+} (0.033)
Rural#Novice	0.063 (0.053)	0.104** (0.027)	−0.022 (0.051)
Rural#SPED	−0.091 (0.062)	0.002 (0.029)	−0.105^{+} (0.061)
Rural#STEM	−0.056 (0.036)	−0.010 (0.022)	−0.052 (0.034)
N	41690	38610	38670

Note. Nationally representative weights are employed. Sample sizes weighted to the nearest 10 in accordance with National Center for Education Statistics nondisclosure rule. Year fixed effects are employed. Clustered standard errors at the school-level are in parentheses. Adapted from the U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey. STEM = science, technology, engineering, and mathematics; SPED = special education; FRPL = free or reduced-price lunch.
$^{+}p < .10$. *$p < .05$. **$p < .01$.

TABLE A.9

Association of Select Teacher and School Characteristics and Teacher Mobility in Rural Districts

	Rural Districts			Rural Schools in Rural Districts		
Characteristic	(1) Overall Turnover	(2) Switching Schools	(3) Leaving Schools	(4) Overall Turnover	(5) Switching Schools	(6) Leaving Schools
Black	0.046* (0.018)	0.014 (0.015)	0.043** (0.015)	0.048* (0.019)	0.016 (0.016)	0.043** (0.016)
Novice	0.102** (0.013)	0.078** (0.013)	0.047** (0.010)	0.104** (0.013)	0.084** (0.013)	0.045** (0.009)
STEM	0.006 (0.007)	−0.004 (0.005)	0.011^{+} (0.007)	0.002 (0.007)	−0.005 (0.005)	0.007 (0.007)
SPED	0.031** (0.010)	0.025** (0.008)	0.012 (0.008)	0.024* (0.010)	0.026** (0.008)	0.003 (0.007)
Graduate degree	0.009 (0.007)	0.011* (0.005)	0.000 (0.005)	0.009 (0.007)	0.010^{+} (0.006)	0.001 (0.005)
No certification	0.060* (0.025)	0.039 (0.025)	0.039* (0.018)	0.060* (0.025)	0.037 (0.025)	0.041* (0.018)
Union	−0.023** (0.007)	−0.012* (0.005)	−0.015** (0.005)	−0.020** (0.006)	−0.012* (0.005)	−0.012* (0.005)
Majority FRPL	0.010 (0.007)	0.004 (0.006)	0.008 (0.005)	0.015* (0.007)	0.006 (0.006)	0.010* (0.005)
Majority minority	0.040** (0.011)	0.027** (0.010)	0.021* (0.009)	0.046** (0.011)	0.030** (0.011)	0.025** (0.009)
Admin support	−0.018** (0.003)	−0.012** (0.003)	−0.009** (0.003)	−0.018** (0.003)	−0.012** (0.003)	−0.010** (0.003)
Teacher coop	−0.005^{+} (0.003)	−0.007** (0.002)	0.000 (0.003)	−0.008* (0.003)	−0.009** (0.003)	−0.001 (0.003)
N	41,690	38,610	38,670	40,230	37,250	37,300

Note. Nationally representative weights are employed. Other teacher and school characteristics are included in the model but not shown. Sample sizes weighted to the nearest 10 in accordance with National Center for Education Statistics nondisclosure rule. Year fixed effects are employed. Clustered standard errors at the school-level are in parentheses. Adapted from the U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey. STEM = science, technology, engineering, and mathematics; SPED = special education; FRPL = free or reduced-price lunch.
$^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$.

TABLE A.10

Teacher Mobility for New Teachers, STEM Teachers, and Special Education Teachers in Less Urbanized States and Sparsely Populated States by Quartiles

	Rural States by Urbanicity				Rural States by Density			
Variables	(1) Q1 Least Urban	(2) Q2	(3) Q3	(4) Q4 Most Urban	(5) Q1 Least Dense	(6) Q2	(7) Q3	(8) Q4 Most Dense
Rural schools	−0.005 (0.007)	−0.002 (0.008)	−0.031** (0.009)	−0.019* (0.009)	−0.017* (0.007)	−0.026** (0.009)	−0.015* (0.007)	−0.022** (0.008)
Novice	0.129** (0.015)	0.109** (0.013)	0.061** (0.013)	0.104** (0.012)	0.079** (0.017)	0.072** (0.015)	0.089** (0.013)	0.101** (0.011)
SPED	0.014 (0.012)	0.039** (0.012)	0.034* (0.014)	0.042** (0.011)	0.022 (0.014)	0.044* (0.018)	0.036** (0.012)	0.036** (0.010)
STEM	0.017 (0.011)	0.007 (0.010)	−0.022* (0.009)	0.001 (0.008)	−0.017^{+} (0.010)	−0.007 (0.013)	−0.008 (0.009)	−0.001 (0.007)
Rural#Novice	−0.021 (0.021)	0.009 (0.021)	0.052^{+} (0.028)	0.028 (0.034)	0.034 (0.023)	0.079** (0.025)	0.008 (0.022)	−0.021 (0.030)
Rural#SPED	0.012 (0.017)	−0.031^{+} (0.019)	−0.017 (0.022)	−0.005 (0.027)	0.039 (0.024)	−0.035 (0.023)	−0.018 (0.019)	−0.016 (0.022)
Rural#STEM	−0.001 (0.015)	−0.011 (0.014)	0.048** (0.017)	−0.020 (0.016)	0.033* (0.014)	0.031^{+} (0.018)	0.003 (0.014)	0.005 (0.016)
Observations	31,640	38,970	36,090	32,470	30,770	41,970	33,490	32,940

Note. Nationally representative weights are employed. Sample sizes weighted to the nearest 10 in accordance with National Center for Education Statistics nondisclosure rule. Year fixed effects are employed. Clustered standard errors at the school-level are in parentheses. To divide states into quartiles, there are 12 states in Q1 and Q4 each, and 13 states in Q2 and Q3. Adapted from the U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey. STEM = science, technology, engineering, and mathematics; SPED = special education; FRPL = free or reduced-price lunch.

$^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$.

TABLE A.11

Association of Select Teacher and School Characteristics and Teacher Mobility in Less Urbanized States and Sparsely Populated States by Quartiles

	Rural States by Urbanicity				Rural States by Density			
Variable	(1) Q1 Least Urban	(2) Q2	(3) Q3	(4) Q4 Most Urban	(5) Q1 Least Dense	(6) Q2	(7) Q3	(8) Q4 Most Dense
Black	0.023^{+} (0.014)	0.009 (0.014)	0.054** (0.018)	0.008 (0.017)	0.048 (0.045)	0.045* (0.022)	0.021^{+} (0.013)	0.020 (0.015)
Novice	0.102** (0.011)	0.091** (0.011)	0.048** (0.012)	0.076** (0.012)	0.072** (0.013)	0.074** (0.013)	0.065** (0.011)	0.073** (0.011)
STEM	0.014^{+} (0.008)	0.006 (0.007)	−0.010 (0.008)	0.006 (0.008)	0.003 (0.007)	−0.003 (0.010)	−0.005 (0.007)	0.006 (0.007)
SPED	0.019* (0.009)	0.028** (0.009)	0.029** (0.011)	0.043** (0.010)	0.034** (0.011)	0.034* (0.013)	0.027** (0.009)	0.034** (0.009)
Graduate degree	0.022** (0.006)	0.007 (0.007)	0.026** (0.007)	0.003 (0.007)	0.006 (0.007)	0.028** (0.009)	0.019** (0.007)	0.005 (0.006)
No certification	0.035 (0.023)	0.062** (0.023)	0.057* (0.024)	0.083** (0.025)	0.084** (0.028)	0.050^{+} (0.028)	0.075** (0.024)	0.061** (0.023)
Union	−0.026** (0.007)	−0.020** (0.007)	−0.020* (0.009)	−0.043** (0.011)	−0.031** (0.008)	−0.022* (0.009)	−0.015* (0.007)	−0.045** (0.012)
Majority FRPL	0.017* (0.008)	0.010 (0.008)	0.008 (0.009)	0.006 (0.009)	0.012 (0.009)	0.016^{+} (0.009)	0.006 (0.008)	0.003 (0.008)
Majority minority	0.031* (0.012)	0.025* (0.010)	0.023* (0.011)	0.023* (0.009)	0.015 (0.014)	0.015 (0.012)	0.032** (0.009)	0.024** (0.009)
Admin support	−0.019** (0.003)	−0.021** (0.004)	−0.022** (0.003)	−0.014** (0.003)	−0.025** (0.003)	−0.025** (0.004)	−0.019** (0.003)	−0.014** (0.003)
Teacher coop	−0.009** (0.003)	−0.010** (0.003)	−0.012** (0.003)	−0.015** (0.003)	−0.008** (0.003)	−0.018** (0.004)	−0.006^{+} (0.003)	−0.013** (0.003)
Observations	31,640	38,970	36,090	32,470	30,770	41,970	33,490	32,940

Note. Nationally representative weights are employed. Other teacher and school characteristics are included in the model but not shown. Sample sizes weighted to the nearest 10 in accordance with National Center for Education Statistics nondisclosure rule. Year fixed effects are employed. Clustered standard errors at the school-level are in parentheses. To divide states into quartiles, there are 12 states in Q1 and Q4 each, and 13 states in Q2 and Q3.

Adapted from the U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey. STEM = science, technology, engineering, and mathematics; SPED = special education; FRPL = free or reduced-price lunch.

$^{+}p < .10$. *$p < .05$. **$p < .01$.

Acknowledgments

I thank the editors and anonymous reviewers for their constructive feedback and suggestions, which substantially improved the article. I also thank Andrew Kidd and Kate Nelson for their feedback in earlier drafts. All remaining errors are my own.

Notes

1. We note, however, this relationship is no longer negative when we account for working conditions in regression analyses.

2. Although we do not focus on teacher attrition in less urbanized states, the findings are substantively similar, albeit attenuated, for teachers in less urbanized states and for teachers in rural schools in less urbanized states (Appendix Table A.4). In other words, while these relationships are significant in less urbanized states, they are more salient in sparsely populated states and in rural schools in sparsely populated states.

3. Salary is included in the models, and it is statistically significant, but practically small. A $1,000 increase is associated with a 0.1 percentage point reduction in the probability of turning over. Covariates that are included in the analysis but not shown include female, Asian, American Indian, Hispanic, college selectivity, K–12 enrollment size, percent IEP, and percent LEP.

ORCID iD

Tuan D. Nguyen https://orcid.org/0000-0002-2920-3333

References

Aaronson, D., Barrow, L., & Sander, W. (2007). Teachers and student achievement in the Chicago public high schools. *Journal of labor Economics*, *25*(1), 95–135. https://doi.org/10.1086/508733

Barbieri, G., Rossetti, C., & Sestito, P. (2011). The determinants of teacher mobility: Evidence using Italian teachers' transfer applications. *Economics of Education Review*, *30*(6), 1430–1444. https://doi.org/10.1016/j.econedurev.2011.07.010

Barnes, G., Crowe, E., & Schaefer, B. (2007). *The cost of teacher turnover in five school districts: A pilot study*. National Commission on Teaching and America's Future.

Beesley, A. D., Atwill, K., Blair, P., & Barley, Z. A. (2010). Strategies for recruitment and retention of secondary teachers in central US rural schools. *Rural Educator*, *31*(2). https://doi.org/10.35608/ruraled.v31i2.937

Berry, A. B., Petrin, R. A., Gravelle, M. L., & Farmer, T. W. (2011). Issues in special education teacher recruitment, retention, and professional development: Considerations in supporting rural teachers. *Rural Special Education Quarterly*, *30*(4), 3–11. https://doi.org/10.1177/875687051103000402

Biddle, C., & Azano, A. P. (2016). Constructing and reconstructing the "rural school problem" a century of rural education research. *Review of Research in Education*, *40*(1), 298–325. https://doi.org/10.3102/0091732X16667700

Bihasa, S. (2018). *Kansas' worsening teacher shortage in four graphs*. KMUW. https://www.kmuw.org/post/kansas-worsening-teacher-shortage-four-graphs

Billingsley, B., & Bettini, E. (2019). Special education teacher attrition and retention: A review of the literature. *Review of Educational Research*, *89*(5), 697–744. https://doi.org/10.3102/0034654319862495

Borman, G. D., & Dowling, N. M. (2008). Teacher attrition and retention: A meta-analytic and narrative review of the research. *Review of Educational Research*, *78*(3), 367–409. https://doi.org/10.3102/0034654308321455

Boyd, D., Grossman, P., Ing, M., Lankford, H., Loeb, S., & Wyckoff, J. (2011). The influence of school administrators on teacher retention decisions. *American Educational Research Journal*, *48*(2), 303–333. https://doi.org/10.3102/0002831210380788

Boyd, D., Lankford, H., Loeb, S., & Wyckoff, J. (2005). The draw of home: How teachers' preferences for proximity disadvantage urban schools. *Journal of Policy Analysis and Management*, *24*(1), 113–132. https://doi.org/10.1002/pam.20072

Carroll, S., Reichardt, R., Guarino, C., & Mejia, A. (2000). *The distribution of teachers among California's school districts and schools*. Rand Corporation. https://www.rand.org/content/dam/rand/pubs/monograph_reports/2007/MR1298.0.pdf

Carver-Thomas, D., & Darling-Hammond, L. (2017). *Teacher turnover: Why it matters and what we can do about it*. Learning Policy Institute. https://learningpolicyinstitute.org/sites/default/files/product-files/Teacher_Turnover_REPORT.pdf

Chetty, R., Friedman, J. N., & Rockoff, J. E. (2014). Measuring the impacts of teachers II: Teacher value-added and student outcomes in adulthood. *American Economic Review*, *104*(9), 2633–2679. https://doi.org/10.1257/aer.104.9.2633

Clotfelter, C., Glennie, E., Ladd, H., & Vigdor, J. (2008). Would higher salaries keep teachers in high-poverty schools? Evidence from a policy intervention in North Carolina. *Journal of Public Economics*, *92*(5), 1352–1370. https://doi.org/10.1016/j.jpubeco.2007.07.003

Cowen, J. M., Butler, J. S., Fowles, J., Streams, M. E., & Toma, E. F. (2012). Teacher retention in Appalachian schools: Evidence from Kentucky. *Economics of Education Review*, *31*(4), 431–441. https://doi.org/10.1016/j.econedurev.2011.12.005

Curran, F. C. (2017). Teach for America placement and teacher vacancies: Evidence from the Mississippi Delta. *Teachers College Record*, *119*(2), 1–24.

Dagli, U. Y. (2012). America's public school kindergarten teachers' job turnover and associated factors. *Educational Sciences: Theory and Practice*, *12*(4), 3121–3134.

Davis, M. S. (2002). *An investigation of factors related to teacher retention in small rural school districts in Montana* [Doctoral dissertation, Montana State University]. MSU ScholarWorks. https://scholarworks.montana.edu/xmlui/bitstream/handle/1/8187/31762103589360.pdf

DeYoung, A. J., & Howley, C. B. (1990). The political economy of rural school consolidation. *Peabody Journal of Education*, *67*(4), 63–89. https://doi.org/10.1080/01619569009538701

Donaldson, M. L. (2012). The promise of older novices: Teach for America teachers' age of entry and subsequent retention in teaching and schools. *Teachers College Record*, *114*(10), 1–37.

Elfers, A. M., Plecki, M. L., & Van Windekens, A. (2017). *Understanding teacher retention and mobility in Washington State*. University of Washington. http://www.education.uw.edu/ctp/sites/default/files/UW_Teacher%20Report%20Jan2017.pdf

Fry, S. W., & Anderson, H. (2011). Career changers as first-year teachers in rural schools. *Journal of Research in Rural Education*, *26*(12), 1–15.

Goldhaber, D., Gross, B., & Player, D. (2011). Teacher career paths, teacher quality, and persistence in the classroom: Are public schools keeping their best? *Journal of Policy Analysis and Management*, *30*(1), 57–87. https://doi.org/10.1002/pam.20549

Graham, S. E., & Provost, L. E. (2012). *Mathematics achievement gaps between suburban students and their rural and urban peers increase over time* (Issue Brief No. 52). Carsey Institute. https://doi.org/10.34051/p/2020.172

Gross, B., & Jochim, A. (2015). *The SEA of the future: Uncovering the productivity promise of rural education* (Vol. 4). Building State Capacity and Productivity Center. http://www.elabs10.com/content/2010000862/SEAF4-FINAL.pdf

Guarino, C. M., Santibanez, L., & Daley, G. A. (2006). Teacher recruitment and retention: A review of the recent empirical literature. *Review of Educational Research*, *76*(2), 173–208. https://doi.org/10.3102/00346543076002173

Hammer, P. C., Hughes, G., McClure, C., Reeves, C., & Salgado, D. (2005). *Rural teacher recruitment and retention practices: A review of the research literature, National Survey of Rural Superintendents, and case studies of programs in Virginia*. Appalachia Educational Laboratory at Edvantia. https://files.eric.ed.gov/fulltext/ED489143.pdf

Hanushek, E. A., Kain, J. F., & Rivkin, S. G. (2004). Why public schools lose teachers. *Journal of Human Resources*, *39*(2), 326–354. https://doi.org/10.2307/3559017

Henry, G. T., & Redding, C. (2020). The consequences of leaving school early: The effects of within-year and end-of-year teacher turnover. *Education Finance and Policy*, *15*(2), 332–356. https://doi.org/10.1162/edfp_a_00274

Horng, E. L. (2009). Teacher tradeoffs: Disentangling teachers' preferences for working conditions and student demographics. *American Educational Research Journal*, *46*(3), 690–717. https://doi.org/10.3102/0002831208329599

Imazeki, J. (2005). Teacher salaries and teacher attrition. *Economics of Education Review*, *24*(4), 431–449. https://doi.org/10.1016/j.econedurev.2004.07.014

Ingersoll, R. M. (2001). Teacher turnover and teacher shortages: An organizational analysis. *American Educational Research Journal*, *38*(3), 499–534. https://doi.org/10.3102/00028312038003499

Kane, T. J., & Staiger, D. O. (2008). *Estimating teacher impacts on student achievement: An experimental evaluation* (Working Paper No. 14607). National Bureau of Economic Research. https://doi.org/10.3386/w14607

Kansas Department of Education. (2016). *Kansas Commissioner of Education's Blue Ribbon Task Force (KSDE) on teacher vacancies and supply: Final report*. http://www.ksde.org/Portals/0/Communications/Publications/BRTF%20Final.pdf

Kelly, S. (2004). An event history analysis of teacher attrition: Salary, teacher tracking, and socially disadvantaged schools. *Journal of Experimental Education*, *72*(3), 195–220. https://doi.org/10.3200/JEXE.72.3.195-220

Kelly, S., & Northrop, L. (2015). Early career outcomes for the "best and the brightest" selectivity, satisfaction, and attrition in the beginning teacher longitudinal survey. *American Educational Research Journal*, *52*(4), 624–656. https://doi.org/10.3102/0002831215587352

Kraft, M. A., Marinell, W. H., & Yee, D. (2016). School organizational contexts, teacher turnover, and student achievement: Evidence from panel data. *American Educational Research Journal*, *53*(5), 1411–1449. https://doi.org/10.3102/0002831216667478

Kukla-Acevedo, S. (2009). Leavers, movers, and stayers: The role of workplace conditions in teacher mobility decisions. *Journal of Educational Research*, *102*(6), 443–452. https://doi.org/10.3200/JOER.102.6.443-452

Lankford, H., Loeb, S., & Wyckoff, J. (2002). Teacher sorting and the plight of urban schools: A descriptive analysis. *Educational Evaluation and Policy Analysis*, *24*(1), 37–62. https://doi.org/10.3102/01623737024001037

Lazarev, V., Toby, M., Zacamy, J., Lin, L., & Newman, D. (2017). *Indicators of successful teacher recruitment and retention in Oklahoma rural schools* (REL 2018-275). Regional Educational Laboratory Southwest. https://ies.ed.gov/ncee/edlabs/regions/southwest/pdf/REL_2018275.pdf

Lazarte-Alcalá, N., & Miller, M. (2018). *2018 Oklahoma educator supply & demand report: Trends, projections and recommendations*. Oklahoma State Department of Education.

Lochmiller, C. R., Sugimoto, T. J., & Muller, P. A. (2016). *Teacher retention, mobility, and attrition in Kentucky public schools from 2008 to 2012* (REL 2016-116). Regional Educational Laboratory Appalachia. https://files.eric.ed.gov/fulltext/ED562734.pdf

Loeb, S., Kalogrides, D., & Béteille, T. (2012). Effective schools: Teacher hiring, assignment, development, and retention. *Education*, *7*(3), 269–304. https://doi.org/10.1162/EDFP_a_00068

Lowe, J. M. (2006). Rural education: Attracting and retaining teachers in small schools. *Rural Educator*, *27*(2), 28–32. https://doi.org/10.35608/ruraled.v27i2.495

Maranto, R., & Shuls, J. (2013). How do we get them on the farm? Efforts to improve rural teacher recruitment and retention in Arkansas. *The Rural Educator*, *34*(1). https://doi.org/10.35608/ruraled.v34i1.406

Mathis, W. J. (2003). Financial challenges, adequacy, and equity in rural schools and communities. *Journal of Education Finance*, *29*(2), 119–136.

McClure, C., & Reeves, C. (2004). *Rural teacher recruitment and retention review of the research and practice literature*. Appalachia Educational Laboratory. https://files.eric.ed.gov/fulltext/ED484967.pdf

Monk, D. H. (2007). Recruiting and retaining high-quality teachers in rural areas. *Future of Children*, *17*(1), 155–174. https://doi.org/10.1353/foc.2007.0009

Moore, C. M. (2011). *Why do teachers quit? An investigation of the influence of school environment and teacher characteristics on discontent and attrition* [Doctoral dissertation]. Temple University.

Newton, X. A., Rivero, R., Fuller, B., & Dauter, L. (2011). *Teacher stability and turnover in Los Angeles: The influence of teacher and school characteristics* [Working paper]. Policy Analysis for California Education. https://www.edpolicyinca.org/sites/default/files/2011_PACE_WP_NEWTON.pdf

Nguyen, T. D., Lam, P., Springer, M., & Crouch, M. (2020). The correlates of teacher turnover: An updated and expanded

meta-analysis of the literature. *Educational Research Review*, *31*, Article 100355. https://doi.org/10.1016/j.edurev.2020.100355

Northup, K. M. (2018). *Teacher intra-district migration out of Title 1 Schools: Case study of a Midwestern suburban school district* [Doctoral dissertation, University of Kansas]. KU ScholarWorks. https://kuscholarworks.ku.edu/bitstream/handle/1808/28028/Northup_ku_0099D_16264_DATA_1.pdf

Prater, M. A., Harris, T., & Fisher, L. (2007). Special education attrition in the state of Utah: Rural vs. urban school districts. *Rural Special Education Quarterly*, *26*(3), 25–31. https://doi.org/10.1177/875687050702600304

Proffit, A. C., Sale, R. P., Alexander, A. E., & Andrews, R. S. (2004). The Appalachian Model Teaching Consortium. *The Rural Educator*, *26*(1). https://doi.org/10.35608/ruraled.v26i1.518

Ratcliffe, M., Burd, C., Holder, K., & Fields, A. (2016). *Defining rural at the US Census Bureau* (Issue Brief No. ACSGEO-1). U.S. Census Bureau. https://www2.census.gov/geo/pdfs/reference/ua/Defining_Rural.pdf

Redding, C. (2019). A teacher like me: A review of the effect of student–teacher racial/ethnic matching on teacher perceptions of students and student academic and behavioral outcomes. *Review of Educational Research*, *89*(4), 499–535. https://doi.org/10.3102/0034654319853545

Redding, C., & Nguyen, T. D. (2020). Recent trends in the characteristics of new teachers, the schools in which they teach, and their turnover rates. *Teacher College Record*, *122*(7), Article 23337.

Ronfeldt, M., Loeb, S., & Wyckoff, J. (2013). How teacher turnover harms student achievement. *American Educational Research Journal*, *50*(1), 4–36. https://doi.org/10.3102/0002831212463813

Shuls, J. V. (2018). School finance in rural America. In M. Q. McShane, & A. Smarick (Eds.), *No longer forgotten: The triumphs and struggles of rural education in America* (pp. 99–116). Rowman & Littlefield.

Sisk, A. (2015). Teacher shortage being felt across North Dakota. *Grand Forks Herald*. https://www.grandforksherald.com/business/3881805-teacher-shortage-being-felt-across-north-dakota

Smith, T. M. (2006). How do state-level induction and standards-based reform policies affect induction experiences and turnover among new teachers? *American Journal of Education*, *113*(2), 273–309. https://doi.org/10.1086/510168

Sutcher, L., Darling-Hammond, L., & Carver-Thomas, D. (2016). *A coming crisis in teaching? Teacher supply, demand, and shortages in the US*. Learning Policy Institute. https://learningpolicyinstitute.org/sites/default/files/product-files/A_Coming_Crisis_in_Teaching_REPORT.pdf

Ulferts, J. D. (2016). A brief summary of teacher recruitment and retention in the smallest Illinois rural schools. *The Rural Educator*, *37*(1). https://doi.org/10.35608/ruraled.v37i1.292

United States Census Bureau. (n.d.). *Annual Estimates of the Population for the United States, Regions, States, and Puerto Rico: 2010-2019.* https://www.census.gov/data/tables/time-series/demo/popest/2010s-state-total.html

Urick, A. (2016). The influence of typologies of school leaders on teacher retention: A multilevel latent class analysis. *Journal of Educational Administration*, *54*(4), 434–468. https://doi.org/10.1108/JEA-08-2014-0090

Author

TUAN D. NGUYEN is an assistant professor in the Department of Curriculum and Instruction at Kansas State University. His main research interests include teacher leadership and school improvement, teacher labor markets, and financial aid and postsecondary success.