

Teacher attrition in the State of Kansas, 2018-2019

by

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## **Executive Summary**

One key determinant of the stability and the progress of an educational system is its teacher workforce. However, in the State of Kansas, teacher shortage has consistently been a problem over the past five years. As the state's task force on teacher vacancy and supply emphasized, teacher attrition had been and would continue to be a contributor to this shortage. Since teacher attrition is unique to each state, a study that specifically examines the turnover factors associated with Kansas teachers is now more than necessary.

Using data from the Kansas Educator Data Collection System and the National Center for Educational Statistics, this study firstly examines the overall pattern of Kansas teacher attrition and the average patterns within a Kansas school, district, county, and region. Secondly, the study examines specific forms of teacher attrition including transferring among schools within the state, switching to a school out of the state, and leaving the teaching profession. Lastly, the study examines particular patterns of teacher attrition in specific Kansas's geographical regions, including the North East, North Central, North West, South East, South Central, and South West.

Statistically significant results show that teachers' employment status, years of experience in the teaching profession and the current school districts, academic qualification, and Kansan education backgrounds are associated with their mobility decisions. Moreover, findings suggest that school' economic status and student body's characteristics are correlated to teacher attrition. Furthermore, external factors including salary and the unique characteristics of the local geographical region are found influential to teacher turnover. Deriving from the study's most robust findings, recommendations for teacher policies in Kansas are suggested.

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## **Introduction**

In 2017, Kansas State Department of Education launched a promising school redesign project called Kansans Can (Kansas State Department of Education, 2020). Toward the goal “Kansas leads the world in the success of each student,” the project aims to provide high-quality instruction to all students by high-quality teaching practices that ensure their academic readiness, socio-emotional growth, and civic engagement (Kansas State Department of Education, 2020). One key determinant of the success of such a reform is a strong and highly effective teacher workforce across the system (Cuban, 2013)<sup>1</sup>. Nevertheless, the state is still in short of teachers, not to mention highly-qualified teachers. By the latest report, Kansas is having 771 teacher vacancies (Bisaha, 2020; Garcia, 2020), slightly down from 815 vacancies last year yet still high in comparison to 642 vacancies in 2018 (Kansas State Department of Education, 2019a). As research points out, one driving contributor to the shortage of teachers nationally and locally is their attrition (Carver-Thomas & Darling-Hamond, 2019; Nguyen, 2020b). In Kansas specifically, addressed by the state’s task force on teacher vacancy and supply, teacher attrition has been and will continue to be a reason for its consistent teacher shortage over many years (Kansas State Department of Education, 2016).

Teacher attrition is also critical to the stability of the schools and the learning outcomes of students, especially low socio-economic status and minority students (Borman & Dowling, 2008; Carver-Thomas & Darling-Hammond, 2019; Darling-Hammond, 2010). In particular, teacher attrition is found to significantly reduce achievement levels of their and other teachers’ students due to the loss in institutional knowledge within the school (Ronfeldt, Loeb & Wyckoff,

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<sup>1</sup> The State Commissioner of Education Randy Watson also emphasized this in the Retention Summit 2019 hosted by Kansas State University, College of Education.

2013). Moreover, when a significant number of teachers decide to leave, it may negatively affect the relational trust in the school (Ronfeldt et al., 2013) and increase the workload of other teachers, especially the few ones who can serve as mentors, resulting in even more turnover as a chain reaction (Darling-Hammond, 2010; Northup, 2018). Furthermore, teacher attrition is costly as it may cost \$21,000 to replace one teacher for an urban school district, \$11,000 for a suburban district, and about \$9,000 for a rural one (Learning Policy Institute, n.d.), let alone the short of teacher supply or financial difficulties of schools in mostly rural areas like Kansas (Nguyen, 2020a). In dealing with draining in the teacher workforce, many schools including low-income ones may have no choice but to recruit underprepared or short-term teachers, by so doing have to constantly pour more money into professional support and more recruitment with little to no chance of benefiting from such investments (Darling-Hammond, 2010). Remarked by Darling-Hammond (2010), “like filling a leaky bucket, these schools are forced to repeat this waste of energy and resources over and over again” (p. 50).

Emphasized by the state’s task force on teacher vacancy and supply (Kansas State Department of Education, 2016), the retention of teachers in Kansas schools has become more urgent than ever. Therefore, a better understanding of factors associated with their turnover is now more than necessary. In the meantime, while empirical research about teacher attrition on the national scale has been substantially conducted over the past several decades (e.g. Carver-Thomas & Darling-Hammond, 2019), there have been fewer studies that focused specifically on Kansas teachers. Moreover, not only that the trend of teacher attrition in Kansas is different from that of teachers nationally, there are also certain differences among the mobility patterns of Kansas teachers across geographical regions and school settings (Nguyen, 2020b). This study, therefore, endeavors to find an answer to not only the question of what factors associated with

Kansas public-school teachers' turnover, but also the patterns of their attrition in different regions of the state. Using educator data provided by the state's department of education, the study is able to determine impactors of specific mobility decisions of Kansas teachers, including switching to another Kansas school, moving out of the state, and leaving the teaching profession completely. Deriving from these findings, potential approaches to sustain teacher workforce in Kansas schools are recommended.

## **Review of the Literature**

### **Factors of teacher attrition**

The factors associated with teacher attrition have been substantially studied over the past several decades. Synthesizing over twenty years of empirical research on this topic (1980 to 2005), Borman & Dowling (2008) found that White teachers, female teachers, younger teachers (under 30 years old), teachers who had been married or had a new child were more likely to turn over. With regard to career status and qualifications, teachers who had less than 5 years of teaching experience, had higher scores in standardized tests (e.g. ACT), had non-traditional certifications, had certifications in math or science, or had a graduate degree were found to turn over at higher levels (Borman & Dowling, 2008). In terms of the workplace, higher attrition rates were found in urban/suburban schools (vs. rural schools) or schools with higher percentages of minority or low socioeconomic students; whereas lower turnover rates were found in secondary schools (vs. elementary schools), public schools (vs. private schools), schools of larger sizes or with higher levels of enrollment, schools with better administrative support and support services (e.g. mentoring programs), schools that supported teacher collaboration, or schools with higher instructional spending or higher levels of student achievement (Borman & Dowling, 2008).

Lastly, Borman & Dowling (2008) discovered that higher salaries slightly decreased the likelihood of early-career teachers (0 to 5 years of experience) turning over, while strongly increased the possibility of mid-career teachers (6 years of experience or more) remaining in their current schools.

As the literature keeps expanding, there has been more rigorous quantitative research on the factors of teacher attrition and retention. In a recent meta-analysis covering nearly forty years of empirical research (1980 to 2018), Nguyen, Pham, Crouch & Springer (2020) found that, in

contrast to Borman & Dowling (2008), neither female teachers nor teachers with graduate degrees were more likely to turn over than their male colleagues or those without graduate degrees respectively. In the same vein, Nguyen et al. (2020) addressed that teachers were not more likely to leave schools that served higher percentages of minority students or students of low socioeconomic status. Such inconsistencies, suspected by the research team, could be due to the more accurate findings from newer studies added to the literature or changes in the patterns of teacher mobility decisions (Nguyen et al., 2020). In addition to these updates, Nguyen et al. (2020) discovered a number of external/policy factors that had effects on teacher attrition, such as teacher evaluation procedures, teacher effectiveness, principal efficiency, meritocracy incentives, salary policies, and union membership (Nguyen et al., 2020). Accordingly, teacher effectiveness and evaluation policies were found to slightly decrease the likelihood of teacher turnover, whereas effective principals and merit pay programs were found highly influential to their decisions to stay (Nguyen et al., 2020). Lastly, teachers were found more likely to turn over by late hiring, yet less likely to do so if they had union memberships or the local area was in periods with high unemployment rates (Nguyen et al., 2020).

In parallel to the effects of individual factors, a variety of differential returns of such factors were found on teacher attrition. As indicated, while Borman & Dowling (2008) noted that salary was likely to have differential returns on teachers' attrition in different stages of their career, Nguyen et al. (2020) discussed the interactive effects of a school's work conditions and its student body characteristics. Moving on to even more recent studies, Bartanen & Grissom (2019) found that racial congruence among teachers and principals were likely to keep them in-position. On the other hand, interactive effects of qualification types and school settings were found significant to the levels of persistence among novice teachers, therefore affecting their

retention (Guthery & Bailes, 2019). Moreover, Rodriguez, Swain, & Springer (2020), discovered that evaluation policies could have differential returns on teacher mobility, particularly slightly increasing the overall attrition rate yet reducing that of more effective teachers. Furthermore, Nguyen (2020a) detected interactive effects by the rural setting of a school and the population density of its local area on teacher attrition, specifically while teachers were more likely to stay in rural schools, they tended to leave those that were located in more sparsely populated areas than densely occupied ones. Most recently, Miller, Youngs, Perrone & Grogan (2021), have found that the matches between teachers' personal factors and the characteristics of the school where they work were significantly likely to influence their mobility decisions.

## **Teacher attrition in Kansas**

Overall, empirical research over many years has identified quite clearly the trends of teacher attrition across the country. However, it is evident that not all these findings are applicable to Kansas teachers specifically (Nguyen, 2020b). Furthermore, as Nguyen (2020b) emphasized, there have been certain differences among the mobility patterns of Kansas teachers across geographical regions and school settings. Studies that focus specifically on teacher attrition in Kansas, therefore, deserve a close look and examination.

In the years 1950s and before, there has been little written about teacher attrition in Kansas (Keeley, 1959). Studying 203 Western Kansas teachers, Terry Keeley (1959) found that the most important reason for them to turn over was chance for professional development, followed by low salary, town being too small, and dissatisfaction with school administration, school facilities, or local community. Similarly, Raymond Hower (1963), investigating 220 high-school teachers in Kansas second-class cities, found that these teachers decided to switch schools for higher salaries, career advancement, getting into their first teaching field, and other reasons

including family responsibilities or better living conditions. In both studies (Hower, 1963; Keeley, 1959), family-related factors were always considered important by the participants (e.g. getting married, taking care of children, taking care of elderly parents, or just working near home), and there had been more women than men deemed these factors more crucial than such impactors as salary or professional improvement.

These financial issues and school characteristics continued to be found influential to Kansas teachers' turnover by later studies. In particular, R. C. Heffley (1983), studying first-year teachers of 137 Kansas school districts in 1980-81, found that salary was the leading individual reason for them to turn over, whereas the lack of administrative support, classroom teaching problems, and evaluation procedures played an important role in their mobility decisions. Data from Heffley's study (1983) also indicated that first-year teachers at the time tended to experience higher levels of classroom teaching problems than their experienced counterparts, and teachers of different subjects considered different types of problem as reasons for leaving. On the other hand, M. S. Clagg (2003), in a qualitative study regarding fifteen first- to second-year teachers in Newton, Kansas, found that their decision to remain in-position was driven by emotional connections within the school, strong support and recognition from administrators, and professional development that was directly and immediately applicable to their teaching. In addition, Clagg (2003) noted, though had decided not to leave, the interviewed teachers were strongly concerned with the low levels of salary and benefit they were receiving.

As more studies had been added to the literature in the following years, more nuances the attrition of teachers were discovered, including differential returns of financial factors and the effects of external/policy influences. In specific, Green, Hamilton, Hampton, & Ridgeway (2005), investigating Kansas University educational graduates during the period 1990-2000,

discovered the effects of merit pay and the differential returns of financial factors on teacher turnover in addition to such factors as personal or school characteristics. Accordingly, the lack of meritocracy when it came to pay raises for experienced teachers was found significant to their decisions of leaving (Green et al., 2005). On the other hand, though teachers were concerned with low salaries, they would not leave *unless* their salaries are insufficient to cover child care and other living expenses (Green et al., 2005). Lastly, Green et al. (2005) noted, when two or more challenges (e.g. personal, working condition, or budgetary) came at one time, teachers were much more likely to ditch teaching for another occupation.

Not only differentiated by teachers' backgrounds, the effects of financial factors on teacher attrition were also found driven by school climate and community influences. In particular, Scott Friesen (2016), in a case study involving thirteen teachers at Stanton school district, found that it was the emotional ties that kept them in-position despite low salaries or insufficient compensation. The teacher participants are motivated to stay by the supportive climate and successful traditions of the school, including comprehensive colleagues and administrators, well-done supporting programs, appropriate class schedules, well-behaved and well-achieving students; as well as the comfortable living conditions of the local area, including lower living cost, closer locations (more convenient transportation), better local schools for their kids, and more friendly community members (Friesen, 2016).

Moving on to more recent years, such influences as personal factors, school factors and external/policy factors have continued to be examined and strongly confirmed. In this vein, analyzing data of nearly three thousand Kansas teachers across seven waves of the School and Staffing Survey administered by the National Center of Educational Statistics (NCES), Tuan Nguyen (2020b) found that teachers under the age of 30 and special education teachers (SPED)

in Kansas are significantly more likely to turn over than their older and non-SPED counterparts, respectively. On the other hand, lower attrition rates were found among teachers in schools with higher levels of administrative support, as well as among those with union membership (Nguyen, 2020b). Moreover, Nguyen (2020b) emphasized on the different mobility patterns between teachers who switched schools and those who left the teaching profession. Furthermore, such patterns among Kansas teachers are substantially different from those of Midwestern teachers, teachers in the Great Plain, and the overall trends of teacher attrition nationally (Nguyen, 2020b). As such, it is plausible to believe that there have been interactions of those factors and the unique contextual characteristics of Kansas on its teachers' mobility decisions.

### **Attrition patterns among Kansas teachers of different disciplines**

Beside the research examining teacher attrition in Kansas as a whole, there have been a number of studies focusing specifically on teachers of certain disciplines, including science, technology, engineering, and math (STEM), and SPED. One the one hand, STEM sector is the area where many non-teaching occupations are better remunerated (Kansas State Department of Education, 2016), whereas SPED sector, in comparison to other sectors, is where significantly higher levels of teacher attrition have been found nationally (Billingsley & Bettini, 2019), and locally (Nguyen, 2020b). On the other hand, SPED and STEM teachers' mobility are either different from that of teachers of other disciplines in Kansas (e.g. Nance & Calarese, 2009), or teachers within the same area of specialty on the national scale (e.g. Stewart, 2018).

In general, similar to the overall pattern of Kansas teachers, the mobility decisions of STEM teachers have been found affected by a variety of factors including their personal characteristics (e.g. Lashier & Ryoo, 1984), school characteristics, and financial influences (e.g. Nassar, 1989). In specific, Lashier & Ryoo (1984), studying chemistry and physics teachers in

Kansas from 1985 to 1990, found that the average rate of turnover among teachers under 29 years old were higher than that of older age groups. The authors also addressed that this attrition was a contributor to the shortage of qualified STEM teachers in the state at the time (Lashier & Ryoo, 1984). On the other hand, Ita Nassar (1989), investigating math and science teachers graduated from Kansas State University during the period 1975-1988, found that financial issues were the most impactful to their decisions of leaving teaching or *never* entering the profession. Moreover, personal factors such as marriage, family responsibilities, family traditions, and career orientation, as well as school factors including non-teaching assignments, satisfaction with school administration, colleagues, and students continued to be found influential to mobility decisions of these teachers (Nassar, 1989). Furthermore, Wright & Nassar (1991), derived from data of Nassar's study (1989), addressed that teachers' preparation programs at the university had effects on their student teaching experiences, by which influenced their mobility decisions or the decision of not entering the profession in the first place. Lastly, Kylie Stewart (2018), analyzing the state's administrative data, reported the differences among attrition rates of Kansas STEM teachers by education levels (higher in high school), and geographical regions (higher in metropolitan areas such as Kansas City). Such mobility patterns of Kansas STEM teachers were considered *opposite* to those of STEM teachers nationwide, where higher attrition rates had been found among rural areas instead of urban ones (Stewart, 2018).

With regard to SPED teachers, on the one hand, similar to teachers of other disciplines, their mobility patterns have been found influenced by their personal factors (e.g. McKnab, 1993), school factors (e.g. Zabel & Zabel, 2002) and educational policies (e.g. No Child Left Behind, VanCise, 2013), as well as vary across Kansas regions, sizes of the school/district, and levels of instruction (McKnab, 1992; 1995; Stewart, 2016). On the other hand, the effects of

those factors on Kansas SPED teachers' mobility decisions were found different from those of other teachers in the state (e.g. Nance & Calarese, 2009). Particularly, Paul McKnab (1983), studying 325 Kansas SPED teachers who had been employed in the school year 1981-82 and did not return in 1982-83, found that lack of support from the administration, heavy workload due to paperwork and record keeping, as well as stresses from the demands the profession were most important reasons for leaving. Whereas professional opportunity and salary were found most influential to teachers of other disciplines in Kansas (e.g. business teachers, Fowler, 1954; STEM teachers, Nassar, 1989), the SPED teacher participants in McKnab's study (1983) listed them in lower importance ranks than such influences as levels of support or non-teaching workload. In later studies by McKnab himself (1993, 2002) and other researchers (Ewy, 2007; Nance & Calabrese, 2009; Zabel & Zabel, 2002), levels and types of support and overwhelming non-teaching duties continued to be found highly influential to SPED teachers' mobility decisions. Accordingly, while Zabel & Zabel (2002) found that administrative support in general was the most influential to Kansas SPED teacher turnover compared to other influences namely colleagues or service delivery models, Ewy (2007) found that SPED teachers appreciated administrators' emotional support above all else (e.g. technical or environmental support). Remarked by Nance & Calarese (2009), due to the unique characteristics of their profession, SPED teachers tended to appreciate emotional motivations for their retention probably more than other factors, leading to the differences in their mobility patterns and those of regular teachers.

### **Contribution of this study**

In summary, the synthesized literature has shown that teacher attrition is not only complicated, but also a complex phenomenon that involves a variety of individual, school, and external factors and their interactions. In other words, the mobility decision of teachers lies in an

interdependent relationship with the factors deriving from themselves, their school, and beyond the school (Nguyen et al., 2020). As such, studies on such macro scales as national level are not completely applicable to specific turnover phenomena on micro scales, including state level or regional level. To better understand teacher attrition in Kansas, there must be a study that focuses specifically on Kansas teachers.

This study aims to contribute to the literature of teacher turnover in three different ways. Firstly, using administrative data provided by Kansas State Department of Education, the study is able to examine a large sample of Kansas public-school teachers, thus can provide closer estimates of the factors of their turnover. Moreover, by the richness of the data set, the study is allowed to examine specific forms of teacher attrition, including switching to another Kansas school, moving out of the state, or leaving the profession completely. Secondly, employing Kansas geographical information and National Center for Education Statistics's Common Core Data, the study is able to control for a large number of variables meanwhile employing fixed effects on various levels, from school to regional. Hence, it is expected to mitigate the problem of omitted variable bias commonly seen in quantitative research. Lastly, the study puts efforts in determining specific patterns of teacher turnover in all six Kansas geographical regions, and top-vacant areas such as Wichita City, Dodge City, or Kansas City (Kansas State Department of Education, 2016). Taken together, this study is promising in providing a better understanding of public-school teacher attrition in Kansas.

## **Data and Method**

### **Data source and Data curation**

This study employed data collected by the Kansas Educator Data Collection System (KEDCS) administered by the Kansas State Department of Education (KSDE) in the school year 2018-2019 and 2019-2020. These data consist of “information about the professional and demographic characteristics of district staff across the state of Kansas” (Kansas State Department of Education, 2019b, p. 3). For anonymity, such information as days of birth or employee names had been removed before the data were handed over to researchers. Whereas the 2019-2020 information was used to confirm teachers’ mobility in the state, such as whether they returned to their 2018-2019 positions in the 2019-2020 school year (stayers), the 2018-2019 data set was utilized for the study’s analyses. This 2018-2019 data set consists of information of 32,924 public school teachers from 285 school districts, including a total of 1,368 school buildings.

Despite being a rich source of data, the provided data set has a number of issues, including duplication, inconsistency, errors, and missing information. In particular, one staff member could be reported multiple times due to their different assignments at one school and/or different positions at multiple schools<sup>2</sup>. Moreover, a position within one school could be reported with different values of the same variable, particularly numerical values such as Full-time or Equivalent status (FTE). Lastly, other impossible errors were found such as negative, zero, or less-than-100-dollar annual salary; greater-than-one FTE; negative or under-14-year-old age; greater-than-age years of experience; etc.

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<sup>2</sup> Such issues are also reported by the state’s task force on teacher vacancy and supply (Kansas State Department of Education, 2016).

Fortunately, since data points came from multiple sources, I was able to triangulate part of the information and correct them accordingly. For example, if the age a particular teacher is reported as 14 years old by one source, yet consistently provided as 23 years old by other data of that same teacher, the wrongly recorded datum would be replaced by the value from the consistent data. Nevertheless, I was unable to reconcile all the information in the data set. The reason was that the correction of one datum must be based on the availability and consistency of other data of the same teacher. For instance, if the teacher is reported two times with two different values of teaching experience, and neither of them violate the criteria for being wrongly recorded (e.g. years of experience must be greater than zero, less than age, and consistent with such entry types as first-year teacher), it is not possible to determine which one is the correct value. As a result, such data entries that could not be corrected were then flagged and accounted for by the regression analysis.

With respect to duplication, I employed a random process to select one datum for each block of duplicates with respect to each staff identification number. Initially, since the goal of the study was to examine teacher attrition among Kansas public school teachers, all the buildings that are not public school were removed from the data set. Next, I removed entries that are not teaching positions, such as positions at Central Office buildings or service personnel. The random process then began with the selection of one school for every teacher. In the second stage, one datum within the chosen school of the teacher was randomly selected. This method ensured that no public-school teacher is removed from the data set. For each teacher, every school where the teacher was employed has the same chance of being selected, so did every assignment that the teacher had within the selected school.

After being curated, the KSDE's data set was merged with NCES's Common Core Data (CCD) for school characteristics. Moreover, to account for different regions of the state, Kansas geographical information, derived from the report by the state's task force on teacher vacancy and supply (Kansas State Department of Education, 2016), was added to the data set. Lastly, to control for teachers' educational backgrounds, NCES-Barron's Admissions Competitiveness Index data was included. The resulted in-sample data set contains information of 31,446 public school teachers from 1,283 schools of 283 school districts.

## Methodology

### Primary analysis

In the first stage of the primary analysis, the study employs a linear probability model to examine factors associated with teacher turnover in Kansas. The analysis model is driven by the following equation:

$$\mathbf{Y} = \beta_0 + \beta_j \mathbf{T}_j + \beta_k \mathbf{S}_k + \beta_l \mathbf{E}_l + \mathbf{u} \quad (1.0)$$

where  $\mathbf{Y}$  is the vector of teacher mobility at the end of the school year 2018-2019;  $\mathbf{T}_j$ ,  $\mathbf{S}_k$ , and  $\mathbf{E}_l$  are respectively vectors of teachers' personal factor  $j$ , school characteristics  $k$ , and external factor  $l$ ; and,  $\mathbf{u}$  is the vector accounting for the unobserved factors.

Specifically, the dependent variable  $\mathbf{Y}$  takes 0 if the respective teacher continued to hold the current teaching position in the following school year, and takes 1 if they turned over for reasons including transferring to a school within the same district, switching to another district in the state, switching to a private school, leaving the teaching profession, moving out of state, leaving temporary (i.e. leave of absence) but not returning in the following school year, and leaving for academic studies, for a position in the administration, or a position in the military.

The detailed descriptions of the dependent variable encoding and attrition forms are given in Table 1 and Appendix Table 1, respectively.

**Table 1. Dependent variable encoding**

Teacher mobility	Dependent variables	$\gamma$	$\gamma_\tau$				Leavers	Movers + leavers	
			Movers						
		Overall Turnover	In-district transferrer	In-state switcher	Out-of-state switcher				
Stayer	0	0	0	0	0	0			
In-district transferrer	1	1	.	.	.	.		1	
In-state switcher	1	.	1	.	.	.		1	
Out-of-state switcher	1	.	.	.	1	.		1	
Leaver	1	.	.	.	.	1		1	
To private school	1	.	.	.	.	.		.	
Retired	1	.	.	.	.	.		.	
Leave of absence	1	.	.	.	.	.		.	
Leadership	1	.	.	.	.	.		.	
Military	1	.	.	.	.	.		.	
Academic Study	1	.	.	.	.	.		.	
Unknown reason	1	.	.	.	.	.		.	
Terminated/Reduced	.	.	.	.	.	.		.	
Health or Decease	.	.	.	.	.	.		.	

Stating otherwise, the dependent variable in equation 1.0 accounts for all forms of teachers' attrition that involve a choice in their end. For instance, teachers can choose to retire for reasons other than their ages (Dorsey, 2016). By controlling for the retirement age (above 60 years old), the analysis model is expected to discover the factors associated with their decisions to turn over. In this vein, two mobility forms that are not included in the analysis are the ones in

which there is little to no room for a teacher's choice: turnover because of termination or reduction in force, and turnover due to decease or health issues<sup>3</sup>.

Regarding the independent variables,  $\mathbf{T}_j$ 's represent teachers' personal factors including demographic information (gender, age, and race/ethnicity), educational backgrounds (degree level, university ranking, and whether university is in Kansas), and career factors (part-time/full-time status, stages of career/teaching experience, teaching categories, and educator types). In the same vein,  $\mathbf{S}_k$ 's represent the characteristics of the school where the teacher works, including school levels (e.g. elementary, secondary), school types and school structure (e.g. charter, magnet, virtual, alternative, and whether the school was reconstituted), eligibility for financial assistance programs (e.g. Targeted-Assistance Title I, School-wide Title I, National School Lunch Program), school size and workforce (e.g. total enrollment and total FTEs), and student body characteristics (e.g. percent female students, free or reduced-price-lunch eligible students, minority students). Lastly,  $\mathbf{E}_l$ 's represent the external factors including the teacher's salary and the geographical region where their school is located. The detailed description of all independent variables is also provided in Appendix Table 1.

In the second stage of the primary analysis, multiple levels of fixed effect are employed to examine Kansas teacher turnover in various ranges of context. The equation with fixed effects is given as follows:

$$\mathbf{Y} = \beta_0 + \beta_j \mathbf{T}_j + \beta_k \mathbf{S}_k + \beta_l \mathbf{E}_l + \lambda_s + \mathbf{u} \quad (1.1-1.4)$$

where the term  $\lambda_s$  represents the fixed effects at the level  $s$ , including school, district, county, and regional level.

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<sup>3</sup> Including health issues, all forms of turnover are not identified unless the respective teacher did not return to their 2018-2019 position in the 2019-2020 school year.

The school-level fixed-effect transformation derived from this equation sweeps away all time-invariant school characteristics and factors at or beyond the school level, leaving only teachers' personal factors and salary for the examination. This fixed-effect transformation is also called *within-school* transformation, meaning that it estimates turnover factors of teachers within the same school. In the same regard, the fixed-effect transformations at district, county, and regional level respectively wipe out the heterogeneity across school districts, counties, and regions. As a result, these *within* transformations produce estimates of turnover factors of teachers within the same district, the same county, and the same region of Kansas.

## **Secondary analysis**

Whereas the primary analysis examines factors of teacher turnover in the overall form, the secondary analysis considers the association of these factors with specific forms of turnover and the turnover patterns in specific Kansas regions.

In particular, the first part of the secondary analysis reexamines the primary analysis' first equation (1.0) yet with another set of dependent variables. Accordingly, the equations employed for this analysis are given as follows:

$$Y_{\tau} = \beta_0 + \beta_j T_j + \beta_k S_k + \beta_l E_l + u \quad (2.0-2.4)$$

where the dependent variables  $Y_{\tau}$  account for teacher turnover in the specific form  $\tau$ , including in-district transferring, in-state switching, out-of-state switching (together are called *movers*), and leaving profession (leavers), and the overall form of these specific turnovers (all types of mover plus leavers). The detailed description of these variable's encoding is provided in Table 1.

Stating otherwise, this part of the secondary analysis specifically examines the *major* forms of teacher turnover at the end of the school year 2018-2019 in Kansas. The reason is that these forms of attrition together account for the majority of teacher mobility in Kansas in that

school year. Particularly, not counting retirement and leaving for unknown reasons, the highestportion form of teacher turnover in Kansas that year is switching to a school in another district within the state (4.09%), followed by transferring to a school within the same district (3.47%), leaving the teaching profession (1.12%), and moving out of the state (0.72%) (Table 2).

In terms of teacher turnover in specific areas, the second part of the secondary analysis also examines the primary analysis' first equation (1.0) but on different groups of teachers in specific geographical regions in Kansas, including North East, North Central, North West, South East, South Central, and South West. Accordingly, the equation for this examination is given as:

$$Y = \beta_0 + \beta_j T_j + \beta_k S_k + \beta_l Sal + \beta_m Hotspot_m + u \quad (3.1-3.6)$$

where **Sal** represents the teachers' total annual salary plus fringe benefits in the school year 2018-2019, and **Hotspot<sub>m</sub>** accounts for the teacher-vacant area *m* in the respective region.

More specifically, due to the range of comparison in this secondary analysis (regional level), whereas teachers and school variables stay the same as they are in the primary analysis, the external factor strand is reduced to containing only teacher salary and specific places within the regions (instead of the whole region). In this vein, the **Hotspot<sub>m</sub>** variables in the equation represent the top teacher-vacant areas of each region, including Kansas City (North East), Wichita City and Goddard (South Central), and Dodge City, Garden City, and Liberal (South West) (Kansas State Department of Education, 2016).

## **Methodological limitations**

In summary, the study examines the relationship between Kansas teachers' attrition and their personal characteristics, school characteristics, and external factors using data from three major sources including the KSDE, NCES's CCD and NCES-Barron's Index. The data curation process consists of two main phases including correcting and accounting for inconsistently or

wrongly recorded data, and random selection of duplicated data. The analysis process also contains two analyses. Whereas the primary analysis examines teacher turnover in Kansas as a whole and with multiple levels of fixed effects (model 1.0-1.4), the secondary analysis examines Kansas teacher turnover in specific major forms (model 2.0-2.4) and turnover patterns in the state's specific geographical regions (model 3.1-3.6).

In addition to the incompleteness of the data set (e.g. inconsistency, errors, and missing data), the study faces a number of methodological limitations including the use of proxies and potentially omitted variable bias. For instance, whereas NCES-Barron's university ranking is employed as a proxy for teachers' academic ability, the variable indicating whether the university is in Kansas is utilized as a proxy for the places where teachers earned their education. In the same vein, the eligibility of the school for such programs as Title-I programs or National School Lunch program (NSLP) are included as proxies for its economic status. Similarly, the percentages of female students, students that are eligible for free or reduced-price lunch (FRPL), and minority students are analyzed to account for the student body's characteristics.

Pertaining to potentially omitted variable bias, the study does not account for several teachers' personal factors including family status, career orientation, job satisfaction, and types of qualification. Moreover, such factors as levels of administrative support, frequency and quality of supporting services, classroom autonomy, resources and facilities, and school climate are not included in the analyses. In addition, there are a number of external/policy factors that could not be retrieved and accounted for including accountability policies, administrators' effectiveness, local areas' characteristics, and community climate. Although several attempts have been made to alleviate these potential biases, the issues remain not completely solved.

# Results

## Descriptive statistics

In general, selected descriptive statistics (Table 2) indicate that most Kansas teachers remained in-position at the end of the school year 2018-2019 (85.7%). The largest portion of teachers who turned over was in-state switchers (4.1%), followed by in-district transferrers (3.5%), and retirement (2.0%). On the other hand, the portions of teachers who left the teaching profession and moved out of the state were quite small, of about 1.1 percent and 0.7 percent respectively. Noticeably, there were about 1.8 percent of teachers exiting for unknown reasons, even higher than the percent of leavers and out-of-state switchers.

**Table 2. Selected descriptive statistics**

	N	Mean	S.D.
<b>Teacher mobility</b>			
Stayer	31446	.8572155	
In-district transferer	31446	.0347262	
In-state switcher	31446	.0408955	
Out-of-state switcher	31446	.0071551	
To private school	31446	.0002862	
Leaver	31446	.011162	
Retired	31446	.0195255	
Unknown exit reason(s)	31446	.0177447	
<b>Personal factors</b>			
Female	31446	.7616867	
Under 30 years old	31446	.1162946	
Above 60 years old	31446	.1592571	
White	31446	.9255549	
Full-time in 1 school	31446	.8450041	
Experienced teacher	31446	.6120015	
Has master degree(s)	31446	.3232208	
Has doctoral degree(s)	31446	.0039433	
Very selective university	31446	.1895631	
Most selective university	31446	.0739363	
Got PS education in KS	31446	.7815302	
English Language Arts	31446	.1238949	
Life & Physical Sciences	31446	.0712968	
Mathematics	31446	.1045284	
SPED/ESOL teacher	31446	.1048782	
EC/PreK/Ele teacher	31446	.4263817	
<b>School characteristics</b>			

Suburban School	31446	.1555683
Rural School	31446	.5754945
Charter School	31446	.0023532
Magnet School	31446	.0311009
Virtual School	31446	.0037843
Reconstitution	31446	.0049927
Targeted Assist. Title I	31446	.1872098
School-wide Title I	31446	.6257712
National School Lunch	31446	.9961839
EC/PreK/Ele School	31446	.5036889
Secondary School	31446	.4931311
Alternative School	31446	.0000954
Total FTEs per 10.0	31446	4.038352
School enrollment per 1k	31446	.5931232
% female students	31446	.485146
% FRL eligibility	31446	.4866216
% minority students	31446	.355755
<b>External factors</b>		
Salary per \$1000	31446	55.51586
North East	31446	.475132
North Central	31446	.0650321
North West	31446	.0170769
South East	31446	.0770527
South Central	31446	.2956179
South West	31446	.0700884

*Note.* Full descriptive results are provided in Appendix Table 2.

Pertaining to personal factors, it can be seen that most Kansas teachers in the school year 2018-2019 are female (76%), White (93%), and were in between 30 to 60 years old (about 72%). On the other hand, most Kansas teachers at the time were employed full-time and were holding positions in only one school (nearly 85%). Moreover, the majority of teachers in that school year were experienced in either the teaching profession or in their school districts (61%). Furthermore, about one fifth of the teachers went to very selective universities (19%), 32 percent of them hold a master's degree, nearly zero percent with a doctoral degree, and the majority earned post-secondary education in Kansas (78%).

Regarding school characteristics, more than half of Kansas teachers in the school year 2018-2019 taught in rural schools (58%). On the other hand, there were a little portion of the teachers working in schools that were reconstituted (0.50%). Similarly, there were fairly small

portions of those teachers working in public-charter schools (0.24%), public-magnet schools (3.11%), virtual schools (0.38%), and alternative schools (0.01%). Moreover, whereas about 81.2% of the teachers were employed by schools that were eligible for Title I programs (school-wide Title I already accounts for 62.6%), and nearly all teachers were recruited by schools that were eligible for NSLP (99.6%). Furthermore, the 2018-2019 Kansas teachers taught in schools that, on average, had 40 full-time employments and served about 593 students. Lastly, those teachers were teaching in schools with, on average, 49 percent female students, 49 percent FRPL eligible students, and about 36 percent minority students.

In terms of the set of external factors, Kansas teachers in the school year 2018-2019 received, on average, 55 thousand dollars in total of base salary plus fringe benefits. On the other hand, the largest portion of teachers in that school year was Northeastern personnel with nearly 48 percent, followed by Southcentral teachers with about 30 percent. The portions of teachers working in the North Central, South East, and South West were fairly similar (6.5%, 7.7%, and 7.0% respectively), whereas the least number of teachers were those working in the Northwestern region (only 1.7%).

## **Primary analysis results**

### **Teachers' personal factors**

Overall, the results in Table 3 show that teachers' work status, academic backgrounds, teaching categories, and educator types are significantly correlated with their mobility decisions across all within models and the state model. In particular, after control for demographic characteristics, teachers who were employed in one school and holding positions in other schools are significantly more likely to turn over, relative to those who were employed full-time in only one school. More specifically, the probability of turning over for part-time/multiple-position

teachers, and full-time/multiple-position are about 10 and 30 percentage points, respectively, higher than full-time and single-position teachers, statistically significant across all models.

**Table 3. Primary analysis results**

	(1.1) W/in-school model	(1.2) W/in-district model	(1.3) W/in-county model	(1.4) W/in-region model	(1.0) State model
Part-time in 1 school	0.007 (0.010)	-0.002 (0.010)	-0.002 (0.009)	0.003 (0.009)	0.003 (0.009)
Full-time in m/th 1 school	0.277** (0.105)	0.299** (0.103)	0.304** (0.101)	0.323** (0.101)	0.323** (0.101)
Part-time in m/th 1 school	0.100** (0.011)	0.095** (0.011)	0.095** (0.011)	0.093** (0.011)	0.093** (0.011)
Experienced b/ new	0.050** (0.006)	0.053** (0.006)	0.053** (0.006)	0.054** (0.006)	0.054** (0.006)
Novice teacher	0.058** (0.008)	0.063** (0.008)	0.064** (0.008)	0.065** (0.008)	0.065** (0.008)
Has master degree(s)	0.021** (0.005)	0.020** (0.005)	0.020** (0.005)	0.020** (0.005)	0.020** (0.005)
Has doctoral degree(s)	0.059+ (0.035)	0.063+ (0.036)	0.060+ (0.036)	0.058 (0.036)	0.058 (0.036)
Very selective university	-0.003 (0.005)	-0.004 (0.005)	-0.004 (0.005)	-0.002 (0.005)	-0.002 (0.005)
Most selective university	-0.007 (0.009)	-0.005 (0.009)	-0.004 (0.009)	-0.003 (0.009)	-0.003 (0.009)
Got PS education in KS	-0.022** (0.006)	-0.022** (0.006)	-0.021** (0.006)	-0.020** (0.006)	-0.020** (0.006)
English Language Arts	0.003 (0.007)	0.003 (0.007)	0.002 (0.006)	0.004 (0.006)	0.004 (0.006)
Life & Physical Sciences	0.002 (0.008)	0.004 (0.008)	0.004 (0.007)	0.006 (0.008)	0.006 (0.008)
Mathematics	0.000 (0.007)	0.003 (0.007)	0.003 (0.007)	0.003 (0.007)	0.003 (0.007)
SPED/ESOL teacher	0.050** (0.010)	0.048** (0.010)	0.050** (0.010)	0.053** (0.010)	0.053** (0.010)
EC/PreK/Ele teacher	-0.022+ (0.012)	-0.027* (0.011)	-0.029* (0.012)	-0.026* (0.012)	-0.026* (0.012)
Other educator types	-0.064** (0.014)	-0.094** (0.023)	-0.093** (0.024)	-0.128** (0.017)	-0.128** (0.017)
Suburban School	0.013 (0.011)	0.008 (0.009)	0.009 (0.008)	0.009 (0.008)	0.009 (0.008)
Rural School	0.003 (0.010)	0.010 (0.009)	0.016+ (0.009)	0.016+ (0.009)	0.016+ (0.009)
Reconstitution	0.096** (0.021)	0.091** (0.020)	0.100*** (0.016)	0.100*** (0.016)	0.100*** (0.016)
Charter School	-0.028 (0.022)	-0.014 (0.016)	-0.013 (0.017)	-0.013 (0.017)	-0.013 (0.017)
Magnet School	-0.043** (0.014)	-0.042** (0.013)	-0.038** (0.013)	-0.038** (0.013)	-0.038** (0.013)

Virtual School	0.157 (0.120)	0.205* (0.097)	0.140** (0.054)	0.140** (0.054)
Alternative School	-0.323** (0.061)	-0.343** (0.055)	-0.316** (0.046)	-0.316** (0.046)
Targeted Assist. Title I	0.004 (0.009)	0.008 (0.008)	0.009 (0.008)	0.009 (0.008)
School-wide Title I	-0.005 (0.010)	-0.009 (0.009)	-0.004 (0.010)	-0.004 (0.010)
National School Lunch	0.261* (0.120)	0.282** (0.098)	0.217** (0.056)	0.217** (0.056)
EC/PreK/Ele School	0.008 (0.011)	0.011 (0.012)	0.010 (0.012)	0.010 (0.012)
Other level School	-0.055 (0.052)	-0.065 (0.051)	-0.050 (0.051)	-0.050 (0.051)
Total FTEs per 10.0	-0.007 <sup>+</sup> (0.003)	-0.004 (0.003)	-0.003 (0.003)	-0.003 (0.003)
School enrollment per 1k	0.007 (0.020)	-0.007 (0.017)	-0.010 (0.019)	-0.010 (0.019)
% female students	0.061 (0.075)	0.047 (0.071)	0.057 (0.074)	0.057 (0.074)
% FRL eligibility	0.034 (0.035)	0.052* (0.026)	0.048* (0.024)	0.048* (0.024)
% minority students	0.052 (0.036)	0.047 <sup>+</sup> (0.026)	0.076** (0.021)	0.076** (0.021)
Salary per \$1000	-0.002** (0.000)	-0.002** (0.000)	-0.002** (0.000)	-0.002** (0.000)
North Central				-0.028** (0.010)
North West				-0.046** (0.017)
South East				-0.021* (0.010)
South Central				-0.008 (0.007)
South West				-0.020 (0.013)
Observations	31173	31173	31173	31173
				31173

Note. School-level clustered standard errors are in parentheses. <sup>+</sup>  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$   
 Reference groups: Male; 30-60 years old; White; Full-time in only one school; Having 5 or more years of experience in the teaching profession and the current school district; Having bachelor degree(s) or lower; Endorsed by universities ranked 4<sup>th</sup> or lower in Barron's Index; Endorsed by universities not in Kansas; Teaching courses other than English Language Arts, Life & Physical Sciences, and Mathematics; Secondary educator type; Urban school; Not charter school; Not reconstituted school; Non-title-I school; Not magnet school; School ineligible for NLSPI; Not virtual school; Secondary school; and, School in Northeastern Kansas.

The full result is provided in Appendix Table 3.

With regard to stages of career, novice teachers – having less than five years of experience in the profession and in the current school district, and experienced-but-new teachers – having more than five years in the profession but less than five years in the current school

district, are about five to six percentage points more likely to turn over than those who were experienced in either categories. Similar to work status, the estimated effects of these variables are consistent and statistically significant across all models.

Pertaining to academic backgrounds, results across all models indicate that teachers with master's degrees are two percentage points significantly more likely to turn over than those with bachelor's degrees or lower. In the same regard, teachers with doctoral degrees are marginally more likely to turn over than their colleagues with no graduate degree within the same school, district, and county. By contrast, in all comparisons, teachers who were endorsed by either very selective universities or most selective universities are not more or less likely to turn over. Noticeably, the probabilities of turning over by teachers who earned their post-secondary education in Kansas are about two percentage points higher than by those endorsed by out-of-state universities, statistically significant across all models.

Regarding teaching categories and educator types, the results show that English teachers, science teachers, and math teachers are not more or less likely to turnover than teachers of other disciplines. On the other hand, elementary-school teachers are about two to three percentage points less likely to turn over than secondary-school teachers. While being only marginally significant in the within-school model, these findings are statistically significant across all other models. By contrast, special education and English as a second language (SPED/ESOL) teachers, relative to secondary-school teachers, are about five percentage points significantly more likely to turn over across all comparisons.

## **School characteristics**

In terms of school characteristics, there is no significance shown on many coefficients regarding school urbanicity, except two positive and marginally significant estimates on turnover

of rural-school teachers relative to urban-school teachers in the within-region and the state model. Similarly, no significant estimation is found on turnover of teachers working in elementary schools in comparison to those employed by secondary schools. In the same vein, no significant prediction of turnover is found among teachers working in schools of larger sizes, including comparisons with respect to school enrollment and school total workforce.

Related to the school structure, school types, and school levels, teachers who worked in schools that were reconstituted are about 10 percentage points more likely to turn over than their colleagues in schools that were not. Such results are statistically significant in all comparisons from within-school to state model. By contrast, the likelihoods of teachers working in public-magnet schools turning over are about four percentage points lower than those employed by non-magnet schools, statistically significant in models from within-district to state model. On the other hand, whereas all coefficients on charter-school teachers are insignificant, the within-county, within-region, and state model indicate that teachers working in virtual schools are more likely to turn over, from 14 to 20 percentage points higher than those teaching in non-virtual schools. Lastly, while findings suggest that teachers employed by alternative schools are more than 30 percentage points significantly less likely to turn over than those holding positions in regular schools across all models where this factor is examined, no significant estimation is found in relationships between turnover and teachers holding positions in elementary schools in comparison to those teaching in secondary schools.

Pertaining to the school's economic status, teachers who were employed by Title-I-eligible schools, regardless of programs, are found not more or less likely to turn over relative to their colleagues in non-eligible schools. By contrast, those who worked in schools that were eligible for NSLP are more likely to turn over with probabilities of about 22 to nearly 28

percentage points higher than their counterparts in NSLP non-eligible schools, statistically significant across all comparisons.

Finally, regarding student body's characteristics, the results show that teachers working in schools serving more students eligible for FRPL, while being not more or less likely to turn over than their colleagues in other schools within the same district, are significantly more likely to leave positions than those in school with fewer FRPL eligible students within the same county, region, and in the state. Similarly, higher turnover rates are found among teachers working in schools with higher percent of minority students, marginally significant in within-county comparison, and statistically significant in the within-region and state model.

### **External factors**

With regard to salary, the results show that for each thousand dollar increase in salary, teachers are about 0.2 percentage point less likely to turnover. This estimate is statistically significant and consistent across all comparisons.

Pertaining to regional factors, relative to those working in the North East, teachers employed by schools located in the North Central, South East, and especially, the North West, are significantly less likely to turn over. In particular, these teachers are respectively 2.8, 2.1, and 4.6 percentage points less likely to leave positions compared to their Northeastern colleagues. Nevertheless, no significant estimate is found among teachers working in the South Central and South West in this vein of comparison.

## Secondary analysis results

### Specific forms of teacher turnover

#### *Teachers' personal factors*

In general, the secondary analysis on specific forms of teacher turnover (Table 4) adds more details to the findings of the primary analysis. Particularly, while being not more or less likely to turn over in the overall form of movers and leavers (model 2.0), part-time/single-position teachers are significantly more likely to switch to a school out of the state relative to their full-time/single-position counterparts. In the same vein, part-time/multiple-position teachers are significantly more likely to turn over as in-district transmitters and in-state switchers, relative to their colleagues who were employed full-time in only one school. By contrast, interesting patterns are found among full-time and multiple-position teachers. Specifically, compared to full-time/single-position teachers, they are about 39 percentage points significantly more likely to switch to another school district in the state, yet are slightly less likely to turn over as in-district transmitters, out-of-state switchers, and leavers.

**Table 4. Specific forms of teacher turnover**

	(2.0) Mover + Leaver	(2.1) In-district transmitter	(2.2) In-state switcher	(2.3) Out-of-state switcher	(2.4) Leaver
Part-time in 1 school	0.008 (0.008)	0.010 <sup>+</sup> (0.006)	-0.009 <sup>+</sup> (0.005)	0.008* (0.003)	0.001 (0.003)
Full-time in m/th 1 school	0.343** (0.118)	-0.020** (0.006)	0.389** (0.120)	-0.006* (0.003)	-0.015** (0.005)
Part-time in m/th 1 school	0.098** (0.010)	0.087** (0.009)	0.022** (0.007)	0.001 (0.003)	0.006 (0.004)
Experienced b/ new	0.049** (0.005)	0.010** (0.004)	0.035** (0.004)	0.004* (0.002)	0.006* (0.002)
Novice teacher	0.059** (0.007)	0.012* (0.005)	0.045** (0.005)	0.010** (0.003)	0.002 (0.003)
Has master degree(s)	0.013** (0.004)	0.004 (0.003)	0.007* (0.003)	0.003* (0.001)	0.001 (0.001)
Has doctoral degree(s)	0.019 (0.030)	-0.006 (0.023)	0.019 (0.019)	-0.006** (0.002)	0.014 (0.014)
Very selective university	-0.008 <sup>+</sup>	-0.007*	-0.005	0.000	0.003

	(0.004)	(0.003)	(0.003)	(0.001)	(0.002)
Most selective university	-0.004 (0.008)	0.002 (0.006)	-0.005 (0.005)	-0.007* (0.004)	0.004 (0.003)
Got PS education in KS	-0.015** (0.005)	-0.006 <sup>+</sup> (0.004)	0.004 (0.004)	-0.019** (0.003)	0.002 (0.002)
English Language Arts	0.003 (0.006)	0.002 (0.004)	-0.002 (0.004)	-0.000 (0.002)	0.003 (0.002)
Life & Physical Sciences	0.004 (0.007)	0.002 (0.004)	0.003 (0.005)	0.001 (0.002)	-0.001 (0.003)
Mathematics	0.002 (0.006)	0.002 (0.004)	-0.001 (0.004)	-0.001 (0.002)	0.001 (0.003)
SPED/ESOL teacher	0.040** (0.009)	0.032** (0.007)	0.007 (0.006)	0.006 (0.004)	0.003 (0.004)
EC/PreK/Ele teacher	-0.025* (0.011)	-0.020* (0.008)	-0.008 (0.007)	0.003 (0.003)	-0.004 (0.004)
Other educator types	-0.092** (0.016)	-0.015 (0.011)	-0.042** (0.010)	-0.018** (0.005)	-0.027** (0.006)
Suburban School	0.013 <sup>+</sup> (0.007)	0.025** (0.006)	0.000 (0.004)	-0.002 (0.002)	-0.010** (0.002)
Rural School	0.006 (0.007)	0.003 (0.006)	0.003 (0.004)	0.004 <sup>+</sup> (0.002)	-0.004 (0.003)
Reconstitution	0.053* (0.026)	0.003 (0.029)	0.068** (0.016)	-0.008** (0.002)	-0.004 (0.007)
Charter School	-0.041 <sup>+</sup> (0.022)	-0.007 (0.013)	-0.013 (0.022)	-0.012** (0.004)	-0.018** (0.005)
Magnet School	-0.023 (0.014)	-0.008 (0.011)	-0.006 (0.010)	-0.010** (0.004)	-0.003 (0.003)
Virtual School	0.049 (0.050)	-0.012 (0.032)	0.104* (0.046)	-0.018 <sup>+</sup> (0.010)	-0.037* (0.015)
Alternative School	-0.234** (0.041)	-0.067** (0.020)	-0.173** (0.036)	-0.009 <sup>+</sup> (0.005)	-0.008 (0.013)
Targeted Assist. Title I	-0.003 (0.008)	-0.006 (0.006)	0.003 (0.005)	-0.003 (0.002)	0.002 (0.003)
School-wide Title I	-0.015 <sup>+</sup> (0.009)	-0.010 (0.006)	-0.002 (0.006)	-0.006* (0.002)	-0.001 (0.003)
National School Lunch	0.082 (0.052)	0.001 (0.029)	0.118** (0.045)	-0.019* (0.010)	-0.025 <sup>+</sup> (0.015)
EC/PreK/Ele School	0.016 (0.011)	0.028** (0.009)	-0.007 (0.007)	-0.003 (0.003)	0.002 (0.004)
Other level School	-0.021 (0.041)	0.010 (0.042)	-0.033 (0.025)	0.000 (0.011)	0.001 (0.014)
Total FTEs per 10.0	-0.001 (0.003)	0.001 (0.002)	-0.003 (0.002)	-0.000 (0.001)	0.001 (0.001)
School enrollment per 1k	-0.014 (0.016)	-0.016 (0.011)	0.005 (0.011)	-0.001 (0.004)	-0.002 (0.005)
% female students	0.021 (0.067)	-0.008 (0.050)	0.045 (0.048)	0.003 (0.019)	-0.015 (0.022)
% FRL eligibility	0.039 <sup>+</sup> (0.021)	0.005 (0.015)	0.053** (0.013)	0.003 (0.005)	-0.019* (0.008)
% minority students	0.074** (0.018)	0.086** (0.013)	-0.019 (0.012)	0.015** (0.006)	0.004 (0.006)

Salary per \$1000	-0.002** (0.000)	-0.000 (0.000)	-0.001** (0.000)	-0.000* (0.000)	-0.001** (0.000)
North Central	-0.018* (0.008)	-0.005 (0.005)	-0.020** (0.006)	0.005* (0.003)	0.001 (0.004)
North West	-0.047** (0.013)	-0.014* (0.006)	-0.035** (0.009)	0.003 (0.005)	-0.007 (0.006)
South East	-0.021* (0.008)	-0.009* (0.005)	-0.020** (0.006)	0.006* (0.003)	0.001 (0.004)
South Central	-0.003 (0.006)	0.003 (0.004)	-0.011** (0.004)	0.005** (0.002)	0.000 (0.002)
South West	-0.018 (0.012)	-0.029** (0.007)	0.001 (0.009)	0.001 (0.003)	0.006 (0.004)
Observations	29910	28048	28242	27181	27307

*Note.* School-level clustered standard errors are in parentheses. +  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$

Reference groups: Male; 30-60 years old; White; Full-time in only one school; Having 5 or more years of experience in the teaching profession and the current school district; Having bachelor degree(s) or lower; Endorsed by universities ranked 4<sup>th</sup> or lower in Barron's Index; Endorsed by universities not in Kansas; Teaching courses other than English Language Arts, Life & Physical Sciences, and Mathematics; Secondary educator type; Urban school; Not charter school; Not reconstituted school; Non-title-I school; Not magnet school; School ineligible for NLSP; Not virtual school; Secondary school; and, School in Northeastern Kansas.

The full result is provided in Appendix Table 4.

With regard to stages of career, similar to primary analysis results, either the teachers are new to the teaching profession or experienced but new to the school district, they are significantly more likely to turn over in most specific forms relative to experienced teachers. Particularly, while experienced-but-new teachers are significantly more likely to either switch schools or leave the profession, novice teachers, though being significantly more likely to switch schools, are not more or less likely to ditch teaching for another occupation.

In terms of academic backgrounds, teachers with master's degrees are significantly more likely to switch to either a school in Kansas or a school out of Kansas but not more or less likely to leave the teaching profession, relative to their colleagues with bachelor's degrees or lower. By contrast, also relative to those with no graduate degree, teachers having doctoral degrees are significantly less likely to relocate themselves out of the state. Moreover, relative to teachers who went to universities with lower competitiveness, those who were endorsed by very selective universities are significantly less likely to transfer to a school within the same district, and those who were endorsed by most selective universities are significantly less likely to move out of the

state. Lastly, the results suggest that teachers who went to a university in Kansas are significantly less likely to turn over in the overall form of movers and leavers, and significantly less likely to relocate themselves out of the state, compared to those endorsed by universities out of Kansas.

Pertaining to teaching categories, the results are also similar to those from the primary analysis. In specific, relative to teachers of other disciplines, no significant estimate is found in any specific turnover of English language arts, science, and mathematics teachers. In terms of educator types, the estimates regarding specific forms of turnover of SPED/ESOL teachers and elementary-school teachers in comparison to secondary-school teachers are completely opposite to each other. Particularly, while SPED/ESOL teachers are significantly more likely to turn over in the overall form of movers and leavers relative to their secondary-school counterparts, elementary-school teachers are significantly less likely to make such similar decisions. On the other hand, also relative to secondary-school teachers, while elementary-school teachers are significantly less likely to transfer to another school within their districts, SPED/ESOL teachers are found significantly more likely to do so.

### ***School characteristics***

With respect to school characteristics, the results show that suburban-school teachers, though being more likely to transfer within their districts relative to urban-school teachers, are significantly less likely to leave the teaching profession. In the same regard, no statistically significant estimate is found on turnover of rural-school teachers compared to their colleagues working in urban schools.

In terms of school structure, school types, and school levels, teachers working in schools that were reconstituted are more likely to switch to another school in the state but significantly and slightly less likely to move out of the state. Similarly, significantly lower probabilities of

moving out of state are also found among charter-school and magnet-school teachers, relative to those working in non-charter schools and non-magnet schools, respectively. Moreover, teachers working in public-charter schools are also found significantly less likely to leave the teaching profession. On the other hand, virtual-school teachers, while being significantly less likely to ditch teaching for another occupation, are significantly more likely to switch to another school district in the state than their colleagues working in non-virtual schools. By contrast, alternative-school teachers are found significantly less likely to transfer within their districts and switch to another school district in the state relative to regular-school teachers. Lastly, no significant estimate is found among teachers working in elementary schools except that they are significantly more likely to transfer within their districts relative to their colleagues working in secondary schools.

With respect to school's economic status and student body's characteristics, teachers working in schools that were eligible for Title-I programs are not more or less likely to turn over in most examined forms. More specifically, to those employed by schools that were eligible for school-wide Title I program, the probability of turning over as out-of-state movers are significantly and slightly less than those working in Title-I non-eligible schools. By contrast, teachers working in schools that were eligible for NSLP, though being not more or less likely to turn over in the overall form of movers and leavers, are significantly more likely to switch to another school district in the state with the probability of about 12 percentage points higher than those employed by non-eligible schools. Finally, teachers working in schools serving higher percent of FRPL eligible students are significantly more likely to switch to a school in another district, whereas those employed by schools serving higher percent of minority students are significantly more likely to either transfer within their districts or move out of the state.

### ***External factors***

Unlike the results from the primary analysis, though being significant to teacher turnover in all major forms<sup>4</sup>, the predicted effect magnitudes of salary are different with respect to each form of attrition. In particular, a thousand dollar increase in salary is likely to reduce the probabilities of in-state switching and leaving profession by 0.1 percentage points, whereas only decreasing the likelihood of teachers moving out of the state by less than 0.01 percentage points.

With regard to the regional factors, in comparison to the North East region, teachers in the North Central, North West, South East, and South Central are significantly less likely to switch to another school district in the state. By contrast, Northcentral, Southeastern, and Southcentral teachers are slightly more likely to move out of the state relative to Northeastern teachers. Lastly, no significant prediction is found among turnover of all these non-Northeastern teachers with respect to leaving the profession.

### **Turnover patterns in specific Kansas regions**

Initially, it should be noted that the number of teachers and the factors associated with them are not evenly distributed across the regions of Kansas (descriptive statistics by Kansas regions are provided in Appendix Table 5). For instance, there were 14,941 Northeastern teachers in the sample, whereas the numbers of teachers in the South East and North West regions are only 2,423 and 537, respectively. In the same vein, there was no Asian teacher working in the North West and South East regions in the school year 2018-2019. Similarly, the number of teachers having doctoral degrees in the North West is nearly zero by the time of the data collection, whereas the portions of teachers working in rural schools in the North Central, North West, and South East are completely 100%. Due to these uneven distributions of teachers

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<sup>4</sup> Salary is insignificant to in-district transferrers because it is counted by districts rather than school building.

and turnover factors, there are a number of variables not available for the regional analyses (they appear as “blank spaces” in the regional result tables).

### ***Teachers' personal factors***

Overall, the patterns of teacher turnover in specific Kansas regions are different from each other and from that of the state as a whole. For instance, while the primary analysis' state model (1.0) does not predict significant relationship between such characteristics as gender or ages under 30 years old, the regional models show that Southeastern female teachers are significantly less likely to turn over compared to their male colleagues in the South East, and Northcentral young teachers are significantly more likely to turn over relative to ones who were in between 30 to 60 years old and working in the same region.

**Table 5. Teacher turnover in specific Kansas regions**

	(3.1) North East	(3.2) North Central	(3.3) North West	(3.4) South East	(3.5) South Central	(3.6) South West
Female	-0.006 (0.007)	-0.000 (0.021)	-0.040 (0.038)	-0.034* (0.017)	0.007 (0.010)	-0.002 (0.019)
Under 30 years old	0.000 (0.013)	0.091** (0.033)	0.052 (0.078)	-0.024 (0.037)	0.014 (0.015)	-0.006 (0.035)
Part-time in 1 school	-0.032 (0.021)	0.070 (0.047)	-0.077 (0.060)	0.062 (0.054)	-0.003 (0.011)	0.054 (0.061)
Full-time in m/th 1 school	-0.158** (0.016)	-0.122** (0.038)	0.143** (0.046)	-0.151+ (0.080)	0.301* (0.152)	0.628** (0.153)
Part-time in m/th 1 school	0.120** (0.019)	0.062* (0.028)	0.030 (0.046)	0.082** (0.029)	0.109** (0.021)	0.017 (0.037)
Experienced b/ new	0.043** (0.009)	0.057* (0.023)	0.027 (0.032)	0.074** (0.019)	0.058** (0.012)	0.081** (0.024)
Novice teacher	0.050** (0.011)	0.061* (0.029)	0.031 (0.052)	0.121** (0.028)	0.061** (0.013)	0.105** (0.033)
Has master degree(s)	0.013+ (0.007)	0.020 (0.017)	0.021 (0.037)	0.035* (0.017)	0.027** (0.009)	0.022 (0.020)
Has doctoral degree(s)	0.080 (0.051)	0.045 (0.146)		0.009 (0.072)	0.041 (0.080)	0.043 (0.172)
Very selective university	-0.010 (0.007)	-0.018 (0.016)	-0.005 (0.044)	0.051* (0.021)	0.011 (0.011)	-0.010 (0.022)
Most selective university	-0.010 (0.011)	-0.008 (0.048)	-0.157* (0.070)	-0.004 (0.041)	0.026 (0.023)	-0.016 (0.034)
Got PS education in KS	-0.022** (0.008)	0.020 (0.025)	-0.142** (0.045)	0.019 (0.020)	-0.026* (0.013)	-0.019 (0.019)

English Language Arts	-0.002 (0.009)	0.014 (0.023)	-0.047 (0.037)	0.002 (0.018)	0.014 (0.012)	0.033 (0.025)
Life & Physical Sciences	-0.003 (0.010)	0.059 <sup>+</sup> (0.030)	-0.078 <sup>*</sup> (0.038)	-0.031 (0.021)	0.027 <sup>+</sup> (0.016)	0.012 (0.029)
Mathematics	0.004 (0.010)	0.027 (0.024)	0.051 (0.053)	-0.018 (0.023)	0.005 (0.013)	-0.006 (0.027)
SPED/ESOL teacher	0.070 <sup>**</sup> (0.016)	0.006 (0.033)	0.070 (0.112)	0.057 (0.044)	0.014 (0.019)	0.074 <sup>*</sup> (0.030)
EC/PreK/Ele teacher	-0.025 (0.020)	-0.044 (0.039)	-0.023 (0.053)	-0.085 <sup>**</sup> (0.032)	-0.025 (0.021)	0.029 (0.029)
Other educator types						-0.074 (0.046)
Suburban School	0.013 (0.009)				0.018 (0.020)	
Rural School	0.032 <sup>**</sup> (0.012)				-0.005 (0.019)	
Reconstitution	0.110 <sup>**</sup> (0.018)					
Charter School	0.034 (0.027)			-0.024 (0.021)	-0.016 (0.011)	-0.343 <sup>**</sup> (0.114)
Magnet School	-0.039 (0.026)			-0.061 <sup>**</sup> (0.020)	-0.035 <sup>*</sup> (0.017)	
Virtual School	-0.106 <sup>**</sup> (0.033)					
Alternative School						-0.424 <sup>**</sup> (0.084)
Targeted Assist. Title I	0.005 (0.011)	0.057 <sup>**</sup> (0.018)	0.070 <sup>*</sup> (0.034)	0.012 (0.028)	0.002 (0.017)	-0.072 <sup>+</sup> (0.044)
School-wide Title I	-0.018 (0.014)	0.048 <sup>**</sup> (0.018)			-0.000 (0.019)	-0.050 (0.046)
National School Lunch					0.117 <sup>**</sup> (0.037)	0.127 <sup>+</sup> (0.074)
EC/PreK/Ele School	0.016 (0.021)	0.009 (0.038)	-0.029 (0.060)	0.062 <sup>+</sup> (0.032)	0.019 (0.022)	-0.080 <sup>**</sup> (0.027)
Other level School	-0.115 (0.090)				0.067 (0.061)	-0.094 <sup>*</sup> (0.047)
Total FTEs per 10.0	-0.001 (0.008)	-0.028 <sup>+</sup> (0.014)	-0.055 (0.064)	-0.011 (0.018)	-0.000 (0.003)	-0.011 (0.017)
School enrollment per 1k	-0.017 (0.049)	0.100 (0.096)	0.332 (0.393)	0.112 (0.116)	-0.024 (0.018)	0.032 (0.092)
% female students	-0.007 (0.123)	-0.507 <sup>*</sup> (0.230)	0.350 (0.296)	0.104 (0.165)	0.200 (0.130)	-0.046 (0.285)
% FRL eligibility	0.048 (0.034)	0.138 (0.095)	0.020 (0.174)	0.136 <sup>+</sup> (0.080)	0.042 (0.046)	-0.080 (0.133)
% minority students	0.084 <sup>*</sup> (0.033)	0.192 <sup>+</sup> (0.109)	0.154 (0.183)	-0.102 (0.077)	0.109 <sup>**</sup> (0.042)	0.074 (0.085)
Salary per \$1000	-0.003 <sup>**</sup> (0.000)	-0.002 (0.001)	-0.005 <sup>**</sup> (0.002)	-0.001 <sup>+</sup> (0.001)	-0.002 <sup>**</sup> (0.000)	-0.003 <sup>**</sup> (0.001)
Kansas City	0.032 <sup>+</sup> (0.016)					
Wichita City					0.028	

Goddard				(0.018)	
Dodge City				-0.015	
Garden City				(0.024)	
Liberal					-0.027
					(0.038)
					0.000
					(0.038)
					-0.023
					(0.046)
<b>Observations</b>	<b>14873</b>	<b>2041</b>	<b>531</b>	<b>2414</b>	<b>9128</b>
					<b>2186</b>

*Note.* School-level clustered standard errors are in parentheses. <sup>+</sup>  $p < 0.10$ , <sup>\*</sup>  $p < 0.05$ , <sup>\*\*</sup>  $p < 0.01$

Reference groups: Male; 30-60 years old; White; Full-time in only one school; Having 5 or more years of experience in the teaching profession and the current school district; Having bachelor degree(s) or lower; Endorsed by universities ranked 4<sup>th</sup> or lower in Barron's Index; Endorsed by universities not in Kansas; Teaching courses other than English Language Arts, Life & Physical Sciences, and Mathematics; Secondary educator type; Urban school; Not charter school; Not reconstituted school; Non-title-I school; Not magnet school; School ineligible for NLSP; Not virtual school; Secondary school; and, School in other cities/areas of the respective Kansas region. The full result is provided in Appendix Table 6.

Regarding employment status, findings suggest different patterns of turnover among teachers in different Kansas regions. Particularly, relative to full-time/single-position teachers in the same region, significantly higher turnover rates are found among full-time/multiple-position teachers in the North West, South Central, and South West, whereas significantly lower turnover rates are found among teachers of that employment status in the Northeastern and Northcentral regions. On the other hand, whereas part-time/multiple-position teachers in the North East, North Central, South East, and South Central are significantly more likely to turn over than their full-time/single-position counterparts in their respective regions, no significant estimation is found among Northwestern and Southwestern teachers in this line of comparison.

With regard to stages of career and academic backgrounds, relative to experienced teachers in the same region, teachers in the early stage of career or being experienced but new to the school districts are more likely to turn over in all regional models, except the North West's (where no significant estimation is found). On the other hand, in comparison to teachers having bachelor's degrees or lower in the same areas, whereas teachers with master's degrees are significantly more likely to turn over in the South East and South Central, those with doctoral

degrees are not more or less likely to do so across all regional models. Moreover, relative to those endorsed by universities with lower levels of competitiveness in the same region, Southeastern teachers who went to very selective universities are significantly more likely to turn over, whereas Northwestern teachers who went to most selective universities are significantly less likely to do so. Furthermore, while teachers who were endorsed by a Kansas's university in the North East, North West, and South Central are significantly less likely to turn over relative to those from universities out of the state, no significant prediction is found to their colleagues with the same factor in other regional models.

Finally, regarding teaching categories, no significant estimate is found with respect to turn over of teachers across regions, except that science teachers in the North West region are significantly less likely to turn over compared to those of other disciplines. Pertaining to educator types, relative to secondary-school teachers in the same area, SPED/ESOL teachers in the North East and South West are significantly more likely to turn over, whereas elementary-school teachers in the South East are significantly less likely to leave positions.

### ***School characteristics***

Regarding school characteristics, while most patterns addressed by the primary analysis remain the same in these regional models, they do suggest a number of noticeable findings that are different from the primary analysis results. Particularly, while the state model (1.0) does not detect a significant relationship between teacher turnover and working conditions in rural schools, the Northeastern model finds that teachers working in those schools are significantly more likely to turn over than their colleagues in urban schools of the same area. Moreover, whereas in the within-region and state model, teachers are more likely to turn over from virtual schools, they are significantly less likely to make such a decision in the Northeastern region.

Lastly, whereas no significant estimation is found in primary-analysis examinations regarding school levels, Southwestern elementary-school teachers are found significantly less likely to turn over relative to their secondary-school colleagues in the same area.

In relevance to school economics, teachers employed by schools that are eligible for Title-I programs in the Northcentral region are significantly more likely to turn over relative to their fellows in non-eligible schools in the same region. This finding does not hold significant to teachers in other regions except the North West, where teachers working in targeted-assistance Title-I eligible schools are found significantly more likely to turn over. Similarly, only Southcentral teachers working in schools that are eligible for NSLP are significantly more likely to turn over than their counterparts in non-eligible schools in the same area. In this regard, except for the positively and marginally significant estimate found in turnover of Southwestern teachers, no other significant relationship is detected in other regions.

In terms of student body's characteristics, the Northcentral model suggests that teachers working in school serving more female students are significantly less likely to turn over than their colleagues in schools that serve fewer female students in the same area. On the other hand, while significant relationships are found in the state model regarding percent of FRPL students in school and teacher turnover, no statistically significant estimation is found with respect to this variable across all regional analyses. Regarding schools serving higher percent of minority students, only Northeastern and Southcentral teachers are found significantly more likely to turnover relative to their colleagues working in schools with fewer minority students in the same region.

### ***External factors***

With respect to the external factors, teacher salary continues to be found significant to the reduction of turning over among teachers in all but the Northcentral region. In addition, while salary is likely to reduce 0.5 percentage points in turnover of Northwestern teachers, it is found to only decrease 0.3 percentage points in that of Northeastern and Southwestern teachers, and only 0.2 percentage points in attrition rates of teachers working in the South Central.

Finally, the regional models do not suggest significantly higher turnover rates in top teacher-vacant areas in each region except Kansas City. In particular, teachers working in Kansas-City schools are about three percentage points, marginally significant, more likely to turn over than those employed in other areas of the Northeastern region.

### **Robustness check**

In order to check the robustness of the study's findings, all the analysis models were replicated on multiple sets of teachers' data selected by the random process. The results of these replicates came out consistent with the presented findings. This happens for three reasons.

Firstly, it should be noted that the random selection process chose one school from each data block of the same teacher, then one assignment of the teacher was chosen from the selected school. This implies that the variables that had been fixed to each teacher within one school year remained fixed, including race, gender, age, and academic backgrounds. Moreover, when one assignment of a teacher was selected from a school, the variables that had been fixed to the school also stayed constant, including employment status, school characteristics, and external factors including teacher salary.

Secondly, the variables that varied with respect to teachers' assignments within one school (e.g. course subject names, grade levels) had been coded in the broadest categories before

the random selection took place. For example, if a teacher taught both chemistry and biology, their course category would be coded as “Life and Physical Sciences.” Similarly, if a teacher taught both elementary mathematics and secondary mathematics, the course category variable would only take the information as “Mathematics.” In the same vein, if a teacher was reported to teach both junior-high and middle schools, their educator type would be coded as “Secondary teacher.” This unification reduced a substantial amount of duplication and allowed the measurement to be highly consistent across the sample.

Thirdly, the group of teachers that were employed in more than one schools occupies a very small portion in the whole data set. Shown by the statistics in Appendix Table 2, about 94 percent<sup>5</sup> of teachers in the school year 2018-2019 were employed in only one school. Therefore, though many variables associated with those teachers varied with respect to their positions in multiple schools (e.g. employment status, school characteristics, and salary), such variations did not alter much the overall results generated from the whole sample. The only differences that were shown by the results from the replicates lie from thousandth or ten-thousandth places of the coefficient estimates, and a few factors that had been changed from marginally significant to insignificant. All the statistically significant findings remain the same.

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<sup>5</sup> This number is worked out by adding the percentages of teachers employed full-time plus part-time in one school.

## **Discussion**

### **Significant findings of the study**

In summary, employing data from multiple sources including KSDE's educator data, NCES's Common Core data, and NCES-Barron's University Competitiveness Index, the study examines the relationships between teacher turnover in Kansas and a variety of factors including the characteristics of the teachers themselves, the school, and beyond the school. In prior to the study's analyses, a dedicated data curation process was conducted in which information from multiple sources was triangulated and random selection was utilized to ensure the reliability and validity of the information. These analyses not only account for various control variables, but also examine them on multiple sets of response variables, including comparisons on state level with multiple fixed effects and regional level. Finally, the analysis models of the study were replicated on multiple sets of teachers' data to ensure the robustness of the estimates.

Derived from the study's statistically significant estimates, a map of factors is drawn to provide a detailed picture of their association with teacher attrition in Kansas (Figure 1). The map shows that there are a number of factors that are consistently significant to teacher turnover. Moreover, there are factors that are significantly and positively correlated with teachers' turnover in certain comparisons, yet are negatively associated with their attrition in other examinations. At the bottom line, the map describes the overall picture of Kansas teacher attrition in various contexts, especially the different patterns in the state as a whole and in its specific geographical regions.

**Figure 1. Kansas teacher turnover: Factor map**

Turnover Factors	Overall turnover in the state					Specific turnover in the state					Overall turnover in specific regions					
	W/in school	W/in district	W/in county	W/in region	State model	M/ers+ L/ers	In-dist tra/ers	In-st sw/ers	Out-st sw/ers	Lea/ers	N.E.	N.C.	N.W.	S.E.	S.C.	SW
Part-time/lscn									+							
Full-time/more	+	+	+	+	+	+	-	+	-	-	-	-	+		+	+
Part-time/more	+	+	+	+	+	+	+	+			+	+		+	+	
Exp. b/ new	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+
Novice	+	+	+	+	+	+	+	+	+		+	+		+	+	+
MS degree	+	+	+	+	+	+		+	+					+	+	
Doctor degree									-							
Very sel. univ.							-									
Most sel. univ.									-				-			
PS ED in KS	-	-	-	-	-	-			-		-	-	-		-	
English																
Science												-				
Mathematics																
SPED/ESOL	+	+	+	+	+	+	+	+			+					+
EC/PreK/Ele	-	-	-	-	-	-	-	-						-		
Suburban							+			-						
Rural										+						
TA Title I											+	+	+			
SW Title I								-			+	+				
NSLP	+	+	+	+				+	-					+		
Reconstitution	+	+	+	+	+	+		+	-			+				
Charter Sch.									-	-					-	
Magnet Sch.	-	-	-	-	-				-					-	-	
Virtual Sch.			+	+	+			+		-	-					
Alternative Sch.	-	-	-	-	-	-	-	-	-						-	
EC/Pre/Ele Sch.							+								-	
Σ FTEs/10.0																
Enrollment/1k																
% female											-					
% FRPL elig.		+	+	+				+		-						
% minority			+	+	+	+	+	+		+	+			+		
Salary/\$1k	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
North Central						-	-	-	-	+						
North West						-	-	-	-							
South East						-	-	-	-		+					
South Central									-	+						
South West								-								

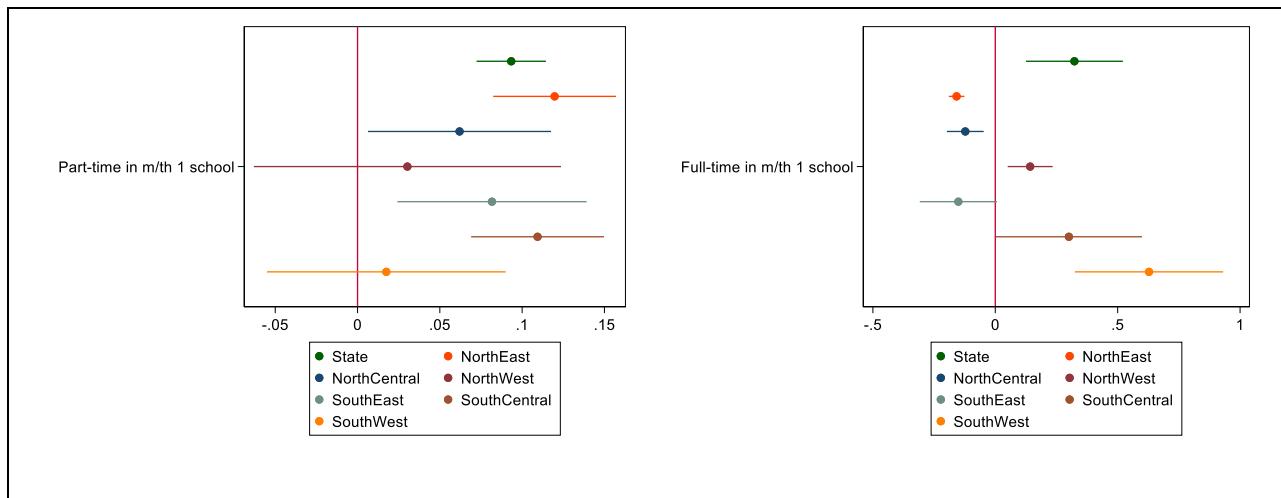
Note. Red cells with a plus sign (+) denote statistically significant ( $p < 0.05$ ), positive covariates; Green cells with a minus sign (-) denote statistically significant ( $p < 0.05$ ), negative covariates.

## Teachers' personal factors

Results show that teachers who were employed in one school and holding positions in other schools, however part-time or full-time, are significantly more likely to turn over relative to their full-time and single-position colleagues within the same school, district, county, region, and in the state. Nevertheless, different patterns emerge when it comes to the examination of turnover

in specific forms. On one hand, the turnover patterns of these multiple-position teachers are similar as they are both more likely to switch to another school district in the state. On the other, whereas part-time/multiple-position teachers are not more or less likely to either move out of the state or to leave the teaching profession, significantly lower probabilities of these turnover forms are found among full-time/multiple-position teachers, relative to their full-time and single-position colleagues. Furthermore, different patterns are found among different Kansas regions (Figure 2). While part-time/multiple-position teachers are significantly more likely to turn over in Eastern and Central Kansas, their colleagues of the same employment status are not more or less likely to do so in the Western regions. Even more contradictory, whereas Northwestern, Southcentral, and Southwestern full-time/multiple-position teachers are significantly more likely to turn over, teachers of this same work status are significantly less likely to make similar decisions in the North East and North Central, relative to full-time/single-position teachers in the respective region.

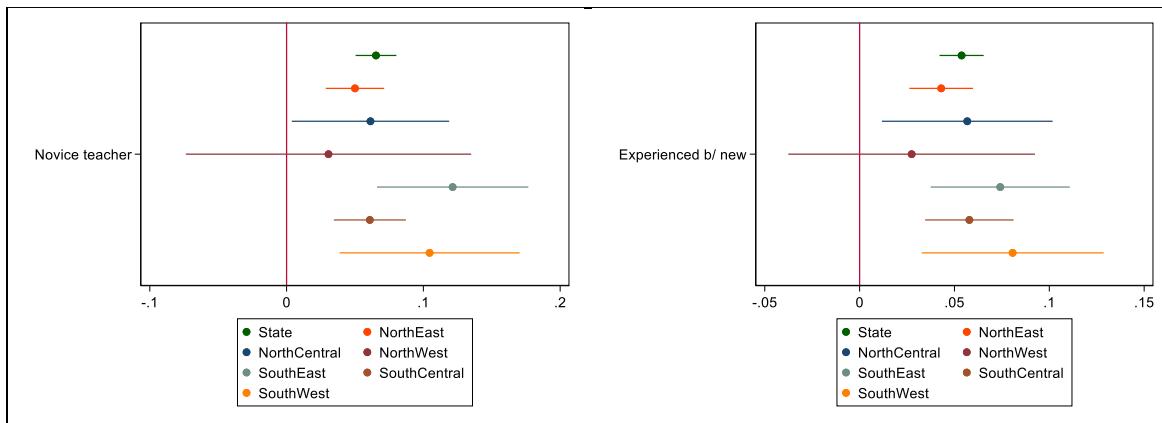
**Figure 2. Employment status and teacher turnover by Kansas regions**



*Note.* The middle point of each bar indicates the coefficient estimate shown in the result tables. The tails of the bars show the 95 percent confidence intervals of the respective estimates.  
Reference group: Full-time and single-position teachers.

In terms of career experience, findings suggest consistently and significantly higher likelihood of turning over among teachers who are either new to the teaching profession or to their school districts, relative to their counterparts who are experienced in either categories within the same school, district, county, region, and in the state. Regarding specific forms of turnover, while being similar in most comparisons, experienced-but-new teachers are significantly more likely to leave the teaching profession yet novice teachers are not more or less likely to do so. In addition, these patterns of turnover with respect to both types of teachers' experience are also found significant across all regions except Northwestern Kansas (Figure 3).

**Figure 3. Teaching experience and teacher turnover by Kansas regions**

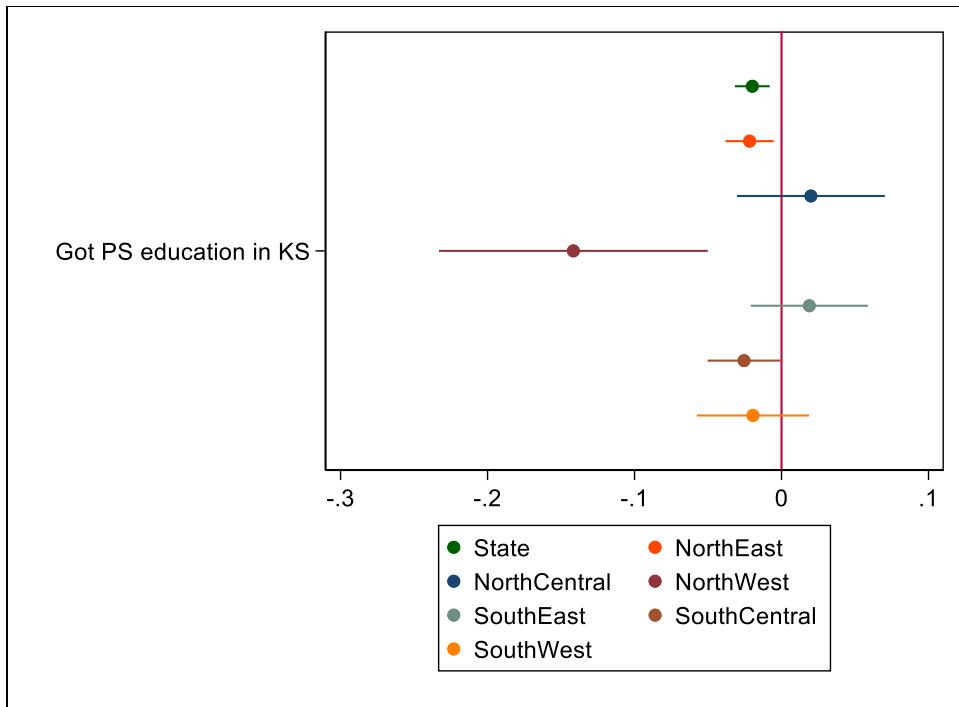


*Note.* The middle point of each bar indicates the coefficient estimate shown in the result tables. The tails of the bars show the 95 percent confidence intervals of the respective estimates.  
Reference group: Experienced teachers.

Pertaining to academic backgrounds, most comparisons show that teachers with master's degrees are significantly more likely to turn over than their fellows with bachelor's degrees or lower, including all the within models, the state model, and such regional models as South East and South Central. The results also suggest consistently and significantly lower probabilities of turning over by teachers who earned their post-secondary education in Kansas, compared to their counterparts endorsed by an out-of-state university within the same school, district, region, and in the state. Moreover, these findings also hold statistically significant in three regional models

including the North East, North West, and the South Central (Figure 4). Furthermore, teachers graduated from a Kansas's university are found significantly less likely to move out of the state, and not more or less likely to leave the teaching profession.

**Figure 4. Kansas graduates and teacher turnover by Kansas regions**



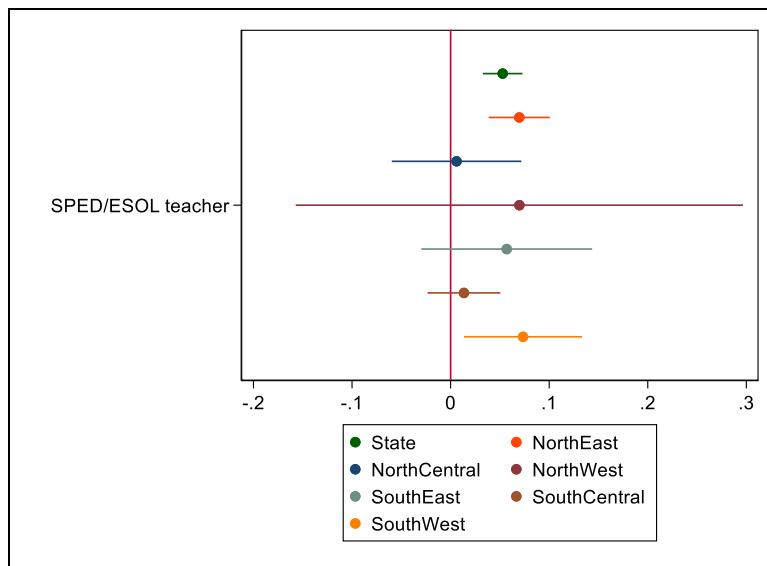
*Note.* The middle point of each bar indicates the coefficient estimate shown in the result tables. The tails of the bars show the 95 percent confidence intervals of the respective estimates.

Reference group: Teachers who earned their post-secondary education from universities out of Kansas.

With respect to teaching categories, only science teachers in the North West are found significantly more likely to turnover relative to teachers of other disciplines in the same region, no other significant estimate is found in this regard. In the matter of educator types, the results indicate that SPED/ESOL teachers are more likely to turn over than their secondary-school counterparts, significantly across all within models, the state model, and two regional models including the North East and South West (Figure 5). On the other hand, while being found significantly more likely to transfer within their districts, SPED/ESOL teachers are not more or less likely to turn over in other major forms, specially moving out of the state or leaving the

profession. By contrast, elementary-school teachers are found less likely to turn over relative to secondary-school teachers. Such findings are significant in most state models and the South East's regional model. Finally, elementary-school teachers are also found significantly less likely to transfer within their districts, but not more or less likely to turn over as other types of movers and leavers.

**Figure 5. SPED/ESOL teacher turnover by Kansas regions**



*Note.* The middle point of each bar indicates the coefficient estimate shown in the result tables. The tails of the bars show the 95 percent confidence intervals of the respective estimates.

Reference group: Secondary teachers.

## School characteristics

In terms of school urbanicity, the results show that teachers working in suburban schools are not more or less likely to turn over than their colleagues in urban schools. More specifically, while they are found significantly more likely to transfer within their districts, the likelihood of them leaving the teaching profession is significantly lower than that of urban-school teachers. Regarding rural-school teachers, only the North East's regional model finds that they are significantly more likely to turn over than their counterparts working in urban schools.

With respect to school levels, school structure, and school types, the results suggest that teachers working in elementary schools are not more or less likely to turn over than their colleagues working in secondary schools. By contrast, higher probabilities of turnover are found among teachers teaching in schools that were reconstituted, relative to their counterparts in non-reconstituted schools in the state. This result is also found significant in the regional analysis in the North East. Fortunately, when the turnover forms of these teachers are examined specifically, it turns out that they are more likely to switch to another school district in the state but significantly less likely to relocate themselves out of Kansas. Moreover, teachers working in public-charter schools and public-magnet schools are found less likely to turn over than those working in non-charter and non-magnet schools. These teachers are also found significantly less likely to move out of the state, to leave the teaching profession, and to turn over in the overall form in most regional models where their characteristics are examined. Furthermore, significantly higher turnover rates among virtual-school teachers are found in state models, yet lower turnover probability of these teachers are suggested by the Northeastern analysis. These teachers are also more likely to switch among schools within the state but significantly less likely to leave the teaching profession. Lastly and noticeably, in virtually all comparisons, teachers employed by alternative schools are significantly less likely to turn over than their fellows recruited by regular schools across the state and the Southwestern region.

With regard to school's economic status, teachers working in schools that are eligible for Title-I programs are not more or less likely to turn over than teachers employed by Title-I non-eligible schools in the state. However, when the regional groups are examined, it is suggested that Northcentral and Northwestern teachers teaching in such schools are significantly more likely to turn over than their colleagues in the same region. Noticeably, teachers working in

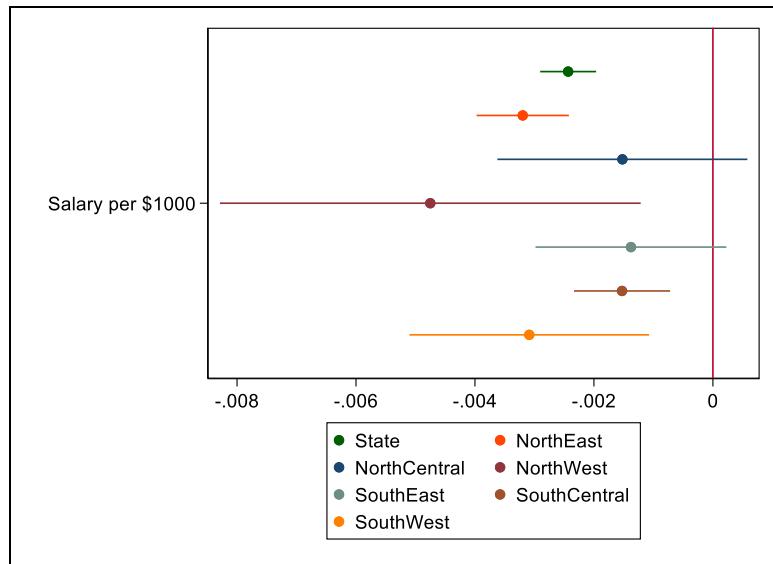
schools that are eligible for school-wide Title I program are found significantly less likely to relocate themselves out of the state, relative to their counterparts in non-eligible schools. By contrast, teachers working in schools that are eligible for NSLP are significantly more likely to turn over than their colleagues working in NSLP non-eligible schools within the same district, county, region, and in the state. Specially, they are found significantly more likely to switch to a school within the state, yet significantly less likely to move out of Kansas. In terms of regional patterns, teachers employed by NSLP eligible schools are also found significantly more likely to turn over than those working in non-eligible schools in the South Central.

Finally, regarding student body's characteristics, teachers working in schools serving higher percent of FRPL eligible students are found significantly more likely to turn over, relative to their colleagues working in school with fewer eligible students within the same county, region, and in the state. Specially, though being found more likely to switch to another school district in the state, these teachers are significantly less likely to leave the profession. Lastly, significantly higher turnover rates are found among teachers working in schools that serve higher percent of minority students within the same region and the state. However, when it comes to the regional analyses, these results are only significant to Northeastern and Southcentral teachers.

## **External factors**

In terms of the external factors, teachers' salary is found to significantly reduce the likelihood of their turnover in all but North Central's and the South East's regional models. Moreover, the predicted magnitudes of salary's effects are quite similar and fairly small (less than 1 percentage point) across the state and all regional analyses (Figure 6).

**Figure 6. Teacher salary and teacher turnover by Kansas regions**



*Note.* The middle point of each bar indicates the coefficient estimate shown in the result tables. The tails of the bars show the 95 percent confidence intervals of the respective estimates.

Regarding regional factors, teachers working in the Northcentral, Northwestern, and Southeastern areas are found significantly less likely to turn over relative to their colleagues in the North East. On the other hand, no statistically significant estimate is found with respect to teacher turnover and top-vacant areas (e.g. Wichita City, Dodge City, Kansas City), relative to those working in other areas of the same region. Lastly, compared to Northeastern teachers, all except Southwestern teachers are significantly less likely to switch to another school district in the state, whereas teachers working in the North Central, South East, and South Central are significantly more likely to relocate themselves out of Kansas.

### Connections to prior literature and Implications

The synthesis of significant estimates has revealed a number of findings that are worth further discussion, including turnover of part-time teachers, especially those with multiple positions in more than one schools; turnover of veteran teachers who are new to their current school districts; turnover of teachers graduated from a university in Kansas; teacher turnover and

the current teacher shortage in the state; teacher turnover, school economics, and student body's characteristics; and, relationship between teacher turnover and teacher salary.

## **Teacher turnover, employment status, and teaching experience**

Firstly, the results suggest that teachers' employment status is influential to their mobility decisions, especially to those employed by more than one schools in comparison to their full-time and single-position colleagues. Whereas full-time and multiple-position teachers do not account for a large portion of Kansas educator workforce (less than 0.1 percent, Appendix Table 2), the group of part-time and multiple-position educators occupies a considerable fraction of total Kansas public-school teachers (about 6.0 percent, Appendix Table 2). Though part-time and single-position employment status does not significantly contribute to the overall turnover of the state, teachers of this characteristic are significantly more likely to switch to another school out of Kansas. To explain this point, it could be the case that part-time teachers, especially those working in multiple places, have more opportunities to look at the working conditions in other schools and compare to their own, thus tend to make switching decisions more likely than full-time and single-position personnel. Though part-time teachers are not more or less likely to leave the teaching profession, their decisions of switching from school to school can still have certain consequences to the school and students as the literature suggested (e.g. Ronfeldt et al., 2013).

Regarding teaching experience, findings on novice teachers are consistent with the current literature about teacher attrition (e.g. Borman & Dowling, 2008; Nguyen et al., 2020). However, the results show that not only novice teachers but also veteran teachers but are new to their current school districts are significantly more likely to turn over than their colleagues who are experienced in both the teaching profession and the work in the district. Moreover, these teachers are significantly more likely to either switch to another school district in Kansas, move

out of the state, or leave the teaching profession. Implied from this, there are three reasons why the attrition of these teachers is important to the stability of the teacher workforce in the state. Firstly, this group of experienced-but-new teachers occupies a considerable amount of total Kansas public-school teachers (16 percent, Appendix Table 2). Secondly, the attrition of this group of teachers can turn to be a chain reaction. From their mobility statistics, in-state switching is the highest-portion form of their turnover either in comparison in the state as a whole or in each of the specific regions (Table 6). When these teachers switch to another school district in the state, they become new to that school district, and since then continue to be at higher risk of switching schools. Lastly, whereas most studies in the literature suggest more care for young and novice teachers (e.g. Nguyen et al., 2020), the factors associated with veteran teachers' turnover are usually overlooked.

**Table 6. Experienced-but-new teachers' mobility in Kansas**

	State average	North East	North Central	North West	South East	South Central	South West
Stayer	.8234009	.8301581	.8385269	.8295455	.827051	.8171806	.7731629
In-district transferer	.037942	.0425618	.01983	.0113636	.0199557	.0447871	.0255591
In-state switcher	.0603894	.0531009	.0679887	.0227273	.0687361	.0668135	.0798722
Out-of-state switcher	.007946	.0064856	.0084986	.0113636	.0133038	.0066079	.0159744
To private school	.0005959	0	0	0	0	.0022026	0
Leaver	.0164879	.0190515	.0084986	.0113636	.0088692	.0161527	.0191693
Retired	.0081446	.0072963	.0226629	.0227273	.0088692	.0044053	.0095847
Leave of absence	.0009932	.0012161	0	0	0	.0014684	0
Terminated/Reduced	.0081446	.0048642	.0084986	.0340909	.0066519	.010279	.0191693
Leadership	.003377	.0020268	.0113314	0	.0022173	.0036711	.0063898
Health or Decease	.0029797	.0028375	.0028329	.0113636	0	.0029369	.0063898
Military	.0001986	.0004054	0	0	0	0	0
Academic Study	.0009932	.0016214	0	0	0	.0007342	0
Unknown exit reason(s)	.0284068	.0283745	.0113314	.0454545	.0443459	.0227606	.0447284
Observations	5034	2467	353	88	451	1362	313

### **Turnover of Kansas graduates and non-Kansas graduates**

Apart from the personal factors that contribute to the increase of turnover rates, findings also feature Kansan educational backgrounds as a factor that significantly contributes to the

reduction of teacher turnover across the state and a number of specific regions. Specially, these teachers are significantly less likely to relocate themselves out of the state. This finding is consistent with the study by Jones (2018) which suggests that teachers working in the same place where they have been raised and educated are less likely to turn over. In this vein, Kansas graduates could find the workplace, the local areas, and the students whom they work with more emotionally tied to themselves (Jones, 2018). Anecdotally, preservice teachers in Kansas's universities are taking courses tailor-made for the teaching job in the state including, but not limited to, knowledge about the state's current education system and state standards. Moreover, since these teachers would also have their student teaching in Kansas's schools, they could have better chances to experience the school structure in the state. As Wright & Nassar (1991) pointed out, university preparations and student teaching experiences are important for the job of a teacher, those with Kansan educational backgrounds could find less adversities in their career in Kansas, thus being less likely to turn over.

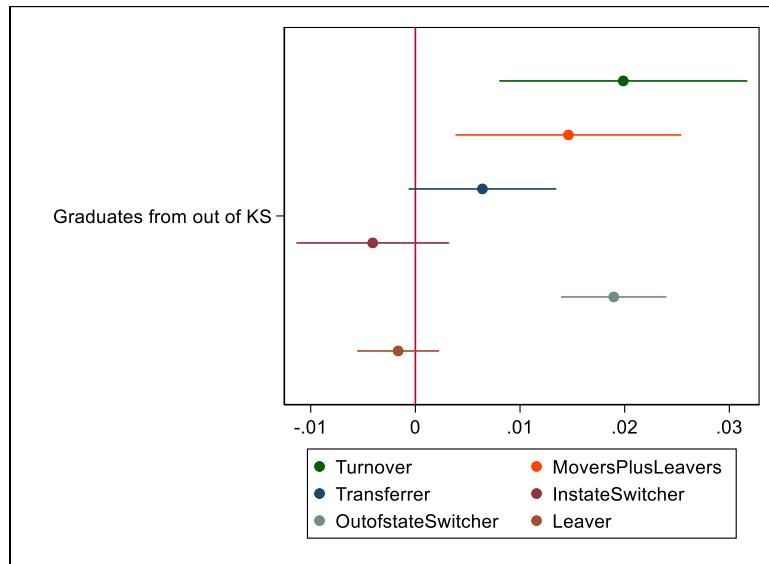
Whereas Kansas graduates being significantly less likely to turn over is good news to the education system of the state, on another perspective, this result yields the needs of more care for teachers who graduated from universities out of Kansas. To ensure the robustness of this prediction, I had replaced the variable of Kansas graduates by its opposite and replicated the analysis models. Accordingly, teachers who earned their post-secondary education from out of the state are significantly more likely to turn over overall, and specially, significantly more likely to relocate themselves out of Kansas (Figure 7). Though this group of teachers is not the majority in the current Kansas educator workforce (about 22 percent<sup>6</sup>), their attrition would still be a problem to the schools within the system. Furthermore, since the state lately has been more open

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<sup>6</sup> This number is worked out by the percent of Kansas graduates, Table 2.

for teachers from out of state (Kansas Association of School Boards, 2020), the factors associated with their attrition should be considered more seriously.

**Figure 7. Specific turnover forms by teachers from out-of-state universities**



*Note.* The middle point of each bar indicates the coefficient estimate shown in the result tables. The tails of the bars show the 95 percent confidence intervals of the respective estimates.

Reference group: Teachers who earned their post-secondary education from a Kansas university.

## Turnover and the current teacher shortage in Kansas

With regard to the current shortage among Kansas educator workforce, the state's task force on teacher supply and vacancy listed out six top-vacant areas including Wichita City, Dodge City, Kansas City, Garden, Liberal, and Goddard (Kansas State Department of Education, 2016). However, only teachers working in Kansas City are found marginally more likely to turn over than their colleagues in the Northeastern region, no other significant estimate is found with respect to teachers in the rest top-vacant areas.

In addition to the areas with teacher shortage, a more recent report by the state's educational administration has listed out five top-vacant professional fields including special education, elementary education, English language arts, sciences, and mathematics (Kansas State Department of Education, 2019a). On the one hand, English, science, and math teachers are

found not more or less likely to turn over than teachers of other disciplines across nearly all comparisons. Moreover, the results also suggest that science teachers are significantly less likely to turn over in the Northwestern region. Similarly, the likelihood of turning over by elementary-school teachers are either significantly lower or insignificant in comparison to their secondary-school counterparts. Nevertheless, SPED/ESOL teachers are found more likely to turn over than secondary-school teachers. Such estimates hold significant in all state models with or without fixed effects and two regional models including North East and South West. Furthermore, the coefficient plot of these teachers' turnover illustrates that the significant estimates in the other regions, such as the South East, could be due to the lack of statistical power (Figure 5). Given that special education is the sector with the highest number of teacher vacancies (Kansas State Department of Education, 2019a), there should be more care for teachers of this field, especially emotional and professional support (Ewy, 2007), to help retain them where they are needed.

### **School's economic status and student body's characteristics**

In terms of the characteristics of the school and its student body, findings suggest consistently that teachers working in schools with financial disadvantages are at high risks of turning over, even after control for teacher salary. In particular, whereas teachers working in schools that are eligible for NSLP are significantly more likely to turn over in the state as a whole, higher turnover rates are also found among teachers employed by schools that are eligible for Title-I programs in a number of regional analyses. Similarly, in many comparisons, teachers teaching in schools serving more FRPL eligible students or minority students are also more likely to turn over. Indeed, lower levels of school economics are usually correlated with higher percent of low socio-economic and minority students (Darling-Hammond, 2010). More severe, these schools and students from which teachers turn over are ones that need them the most

(Darling-Hammond, 2010). As such, these results significantly yield the needs of more special care for teachers, schools, and students of financially disadvantaged conditions.

From another perspective, Nguyen et al. (2020) suggested that teachers would be more likely to stay in schools serving higher percent of disadvantaged students if they feel supported and satisfied with their working conditions. As an example, Northup (2018) characterized the working conditions in Title-I schools by higher levels of workload and stress, less instructional focus, conflicted schedules, less professional support, and especially, unfair equity. In addition to materialistic issues, such conditions are what likely to cause frustrations among teachers, leading to higher turnover and turnover as chain reactions across the school (Northup, 2018). Therefore, it is possible that the non-physical working conditions within the school such as positive school climate, strong relationships, comprehensive communications, better professional support, and more appropriate working schedule can keep teachers in schools where they are needed (Nguyen et al., 2020). Such implications would continue to be discussed in later sections.

### **Teacher turnover in rural areas and areas with diverse urbanicity**

In addition to the factors of the teachers themselves and the school, the characteristics of the local areas are also found significant to teacher turnover. This is evident by the different patterns of teacher mobility among the regions. Results suggest that Northcentral, Northwestern, and Southeastern teachers are less likely to turn over than Northeastern teachers. Moreover, teachers working in rural schools in the North East are more likely to turn over than their colleagues in urban areas. Yet rural-school teachers in the South Central, where the distribution of teachers with respect to school urbanicity is not so different from that of the North East, are not more or less likely to make similar decisions.

Taking a closer look, descriptive statistics (Appendix Table 5) show that the portion of rural-school teachers in the North East is about 40 percent, whereas such portions in regions including the North Central, North West, South East, and South West are nearly 100 percent. Moreover, while the portions of White teachers in the Northwestern and Northcentral regions are respectively about 98 and 99 percent, the average portions of White students in their respective schools are about 83 and 86 percent. As Redding (2019) suggested, racial/ethnic matches between teachers and students are likely to result in higher academic and behavioral outcomes among students. And since well-behave and well-achieving students could be a motivation for Kansas teachers to stay in their schools (Friesen, 2016), the cases of Northwestern, Northcentral, and Southeastern teachers could be explained by their demographic congruence with their students. However, this explanation does not fit the patterns in the South Central and South West, where teachers working in rural schools are not more or less likely to turn over. Indeed, the distribution of school urbanicity in the South Central does not completely skew toward rural areas, and the average percent of minority students in the school that a Southwestern teacher works with is about 62 percent. As such, questions regarding different patterns of turnover with respect to school urbanicity in Kansas still remain.

Another noticeable finding in relevance to rural schools is that science teachers in the North West are found significantly less likely to turn over than their colleagues of other disciplines in the same region. Given that the North West is almost filled with 100 percent rural-school teachers, and Northwestern teachers in general are less likely to turn over than Northeastern teachers, these findings suggest that there are other factors of the North West that keep its teachers remain in-position. Suggested by Abel (2019), the family-based climate of rural communities could be conveyed into the school's culture. Such climates are characterized by

close human relations, emotionally better living conditions, and highly suitable for the job of STEM teachers, including physical sciences and agriculture (Abel, 2019; Reilly & Welton, 1980). Together with the discussion regarding teacher mobility and school urbanicity among regions, this suggests that the factors of the local areas could not only influence teacher attrition, but also contribute to the reduction of attrition in certain ways. In a broader sense, this implies that the characteristics of the local areas, if being elicited in an appropriate way, could help retain teachers in schools, especially those in geographically isolated regions (Nguyen, 2021).

### **A final note: Teacher turnover and teacher salary**

The last significant finding regarding external factors is about teacher salary. In particular, after control for teachers' personal factors, school characteristics, and regional factors, salary is still significant to the reduction of teacher turnover across the state, and of all forms. At the first glance, it may seem compelling that merely salary increases can reduce teacher turnover. However, the predicted effect magnitudes of salary are much smaller than those of other statistically significant factors. Indeed, to Northcentral and Southeastern teachers, a thousand dollar increase in their salary is not significant to their decision of turning over. Similarly, to the teachers that moved out of the state at the end of the school year 2018-2019, the predicted effects of salary are almost practically insignificant. Suggested by the literature, Kansas teachers could choose to stay where they are because of emotional ties and family responsibilities despite low salaries (e.g. Clagg, 2003; Friesen, 2016; Green et al. 2005). In the same vein of the discussion about teachers working in schools with budgetary difficulties or schools located in less-advantaged geographical regions, these findings one more time emphasize on the possible role of non-materialistic incentives within and beyond the school in teacher retention.

## **Recommendations for teacher policies and further research**

Based on the study's findings and suggestions by the literature, the following recommendations are made to schools and districts for sustaining their teacher workforce.

Firstly, school and district administrators should pay more attention to their part-time teachers, especially those having multiple positions in more than one school. Moreover, not only novice teachers but also veteran teachers but are new to the district should receive more care and support for their jobs. Furthermore, to special education teachers, higher quality and frequency of emotional and professional support should be provided. Additionally, continuing to strengthen teacher preparation programs in the state and providing more support to teachers graduated from out-of-state universities are strongly recommended.

Secondly, there should be more equitable and efficient allocation of resources among schools, especially schools with budgetary difficulties, schools serving more low socio-economic and minority students, and schools located in less-advantaged geographical areas. Moreover, improving working conditions within the school is strongly recommended. This could be done by providing more and with higher quality professional support across the school, enhancing teacher-student relationship, more comprehensive administrator-teacher communication, and arranging appropriate school schedules to balance the work and personal life of teachers.

Thirdly, school and district administrators could elicit and make use of the advantages of rural areas regarding community climate and human relations to sustain their teacher workforce. In specific to STEM teachers in such regions, since rural areas per se facilitates scientific field trips and out-door learning activities, this could be elicited to enhance the overall quality of STEM education and teacher retention. Lastly, all three recommendations with respect to

teachers' personal factors, school characteristics, and external factors could be systemically implemented to achieve a higher overall result.

In addition to the recommendations pertaining to teacher policies, the study also suggests a number of questions that can be tackled by further research. First, there are a number of factors that have been found significant to Kansas teacher turnover in earlier studies (e.g. younger ages, Nguyen, 2020b) but are no longer found significant by this study. This implies that the patterns of teacher mobility in Kansas have possibly changed overtime. Therefore, a study that analyzes longitudinal data could provide more insights to this phenomenon in Kansas. Second, there are a number of external factors that have not been accounted for by the current study, such as levels of administrative support in the school or external factors of the local areas (e.g. unemployment rates, economic status, etc.), future analyses accounting for these influences would be promising with closer estimates of factors associated with Kansas teacher turnover. Thirdly, the secondary analysis of this study has suggested that there are unique patterns of turnover among different Kansas geographical regions, qualitative or mixed-method studies that examine these specific groups of teachers can give more insights to the understanding of teacher attrition in Kansas. Ideas for such examinations may include the turnover of general teachers and rural-school teachers in the North East and the South Central, the attrition of STEM teachers in rural areas, and teacher mobility in the Southwestern region.

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## Appendix

**Appendix Table 1. Variable description**

<b>Teacher mobility description</b>	
Stayer	Returning to the current teaching position in the following school year.
In-district transferrer	Transferring to a teaching position in the same district and not returning to the current teaching position in the following school year.
In-state switcher	Switching to a teaching position in another school district and not returning to the current teaching position in the following school year.
Out-of-state switcher	Switching to a teaching position in another state and not returning to the current teaching position in the following school year.
To private school	Switching to a teaching position in a private school and not returning to the current teaching position in the following school year.
Leaver	Leaving the teaching profession and not returning to the current teaching position in the following school year.
Retired	Retiring from the current teaching position and not returning in the following school year.
Leave of absence	Temporary leaving the current teaching position and not returning in the following school year.
Terminated/Reduced	Leaving the current teaching position due to termination or reduction in force and not returning in the following school year.
Leadership	Accepting an administrative position and not returning to the current teaching position in the following school year.
Health or Decease	Deceased or being unable to work because of illness and not returning to the current teaching position in the following school year.
Military	Accepting a position in the military and not returning to the current teaching position in the following school year.
Academic Study	Leaving the current teaching position for academic study and/or professional development and not returning in the following school year.
Unknown exit reason(s)	Leaving the current teaching position without providing reasons or relocating and not returning to the current teaching position in the following school year.
<b>Dependent variable description</b>	
Female	= 1 if the teacher is female; = 0 if the teacher is male.
Under 30 years old	= 1 if the teacher is under 30 years old; = 0 if the teacher is 30 years old or older.
Above 60 years old	= 1 if the teacher is above 60 years old; = 0 if the teacher is under 60 years old.
White	= 1 if the teacher is White; = 0 if the teacher is not White.
Asian	= 1 if the teacher is Asian; = 0 if the teacher is not Asian.
Black	= 1 if the teacher is Black; = 0 if the teacher is not Black.
Hispanic	= 1 if the teacher is Hispanic; = 0 if the teacher is not Hispanic.
Other races/ethnicities	= 1 if the teacher is either Native American, Native Hawaiian, or multi-racial;

	= 0 if the teacher is neither Native American, Native Hawaiian, nor multi-racial.
Part-time in 1 school	= 1 if the teacher works part-time in the current school and does not hold position(s) in other school(s); = 0 if the teacher either works full-time in the current school or holds position(s) in other school(s).
Full-time in m/th 1 school	= 1 if the teacher works full-time in the current school and holds position(s) in other school(s); = 0 if the teacher either works part-time in the current school or does not hold position(s) in other school(s)
Part-time in m/th 1 school	= 1 if the teacher works part-time in the current school and holds position(s) in other school(s); = 0 if the teacher either works full-time in the current school or does not hold position(s) in other school(s)
Full-time in 1 school	= 1 if the teacher works full-time in the current school and does not hold position(s) in other school(s). = 0 if the teacher either works part-time in the current school or hold position(s) in other school(s).
Experienced teacher	= 1 if the teacher has 5 or more years of experience in the teaching profession and 5 or more years of experience in the current school district; = 0 if the teacher has either less than 5 years of experience in the teaching profession or less than 5 years in the current school district.
Experienced b/ new	= 1 if the teacher has 5 or more years of experience in the teaching profession and less than 5 years of experience in the current school district; = 0 if the teacher has either less than 5 years of experience in the teaching profession or 5 or more years of experience in the current school district.
Novice teacher	= 1 if the teacher has less than 5 years of experience in the teaching profession and less than 5 years of experience in the current school district; = 0 if the teacher has either 5 or more years of experience in the teaching profession or 5 or more years of experience in the current school district.
Has master degree(s)	= 1 if the teacher has master degree(s); = 0 if the teacher does not hold a master degree.
Has doctoral degree(s)	= 1 if the teacher has doctoral degree(s); = 0 if the teacher does not hold a doctoral degree.
Very selective university	= 1 if the teacher is endorsed by a university ranked 3 <sup>rd</sup> in Barron's Admissions Competitiveness Index; = 0 if the teacher is endorsed by a university ranked 4 <sup>rd</sup> or lower in Barron's Admissions Competitiveness Index.
Most selective university	= 1 if the teacher is endorsed by a university ranked 2 <sup>nd</sup> or higher in Barron's Admissions Competitiveness Index; = 0 if the teacher is endorsed by a university ranked 3 <sup>rd</sup> or lower in Barron's Admissions Competitiveness Index.
Got PS education in KS	= 1 if the teacher is endorsed by a university in Kansas; = 0 if the teacher is endorsed by a university out of Kansas.
English Language Arts	= 1 if the teacher's teaching courses are categorized in English Language Arts; = 0 if the teacher's teaching courses are not categorized in English Language Arts.
Life & Physical Sciences	= 1 if the teacher's teaching courses are categorized in Life & Physical Sciences;

	= 0 if the teacher's teaching courses are not categorized in Life & Physical Sciences.
Mathematics	= 1 if the teacher's teaching courses are categorized in Mathematics; = 0 if the teacher's teaching courses are not categorized in Mathematics.
SPED/ESOL teacher	= 1 if the teacher is categorized in Special Education or English as a Second Language (SPED/ESOL) educator type by KSDE's KEDCS; = 0 if the teacher is not categorized in SPED/ESOL educator type by KSDE's KEDCS.
EC/PreK/Elementary teacher	= 1 if the teacher is categorized in Early Childhood, or Pre-kindergarten, or Elementary (EC/PreK/Elementary) educator type by KSDE's KEDCS; = 0 if the teacher is not categorized in EC/PreK/Elementary educator type by KSDE's KEDCS.
Secondary teacher	= 1 if the teacher is categorized in Middle School or Secondary educator type by KSDE's KEDCS; = 0 if the teacher is categorized in neither Middle School nor Secondary educator type by KSDE's KEDCS.
Other educator types	= 1 if the teacher is categorized in educator types including Career and Technical Education, School Specialist, School Support, Leadership/Administration, and Migrant Educator by KSDE's KEDCS; = 0 if the teacher is not categorized in educator types including Career and Technical Education, School Specialist, School Support, Leadership/Administration, and Migrant Educator by KSDE's KEDCS.
Urban School	= 1 if the school's geographical location is classified as City, Large/Midsize/Small (locale code 2018-2019: 11, 12, 13) by NCES; = 0 if the school's geographical location is classified as Suburban, Large/Midsize/Small; or Town, Fringe/Distant/Remote; or Rural, Fringe /Distant/Remote by NCES.
Suburban School	= 1 if the school's geographical location is classified as Suburban, Large/Midsize/Small (locale code 2018-2019: 21, 22, 23) by NCES; = 0 if the school's geographical location is classified as City, Large/Midsize/Small, or Town, Fringe/Distant/Remote; or Rural, Fringe /Distant/Remote by NCES.
Rural School	= 1 if the school's geographical location is classified as Town, Fringe/Distant/Remote, or Rural, Fringe/Distant/Remote (locale code 2018-2019: 31, 32, 33, 41, 42, 43) by NCES; = 0 if the school's geographical location is classified as City, Large/Midsize/Small, or Town, Fringe/Distant/Remote; or Rural, Fringe /Distant/Remote by NCES.
Reconstitution	= 1 if the school is flagged with reconstituted status by NCES; = 0 if the school is not flagged with reconstituted status by NCES.
Targeted Assist. Title I	= 1 if the school is eligible for Targeted-assistant Title I program (status code: TGELOBNOPROG, TGEGBTGPROG by NCES); = 0 if the school is either eligible for School-wide Title I or not eligible for Title I programs.
School-wide Title I	= 1 if the school is eligible for School-wide Title I program (status code: SWELIGNOPROG, SWELIGSWPROG, SWELIGTGPROG by NCES); = 0 if the school is either eligible for Targeted Assistance Title I or not eligible for Title I programs.
None Title-I School	= 1 if the school is not eligible for Title I programs (status code: NOTTITLE1ELIG by NCES);

	= 0 if the school is eligible for either Targeted Assistance Title I or School-wide Title I programs.
National School Lunch	= 1 if the school is eligible for National School Lunch Program (status code: NSLPPRO1, NSLPPRO2, NSLPPRO3, NSLPCEO, NSLPWOPRO by NCES); = 0 if the school is not eligible for National School Lunch Program.
Charter School	= 1 if the school is classified as charter school by NCES; = 0 if the school is classified non-charter by NCES.
Magnet School	= 1 if the school is classified as magnet school by NCES; = 0 if the school is classified as non-magnet by NCES.
Virtual School	= 1 if the school is classified as virtual school by NCES; = 0 if the school is not classified as virtual school.
EC/PreK/Ele School	= 1 if the school's building level is classified as Day Care, Early Childhood, or Elementary by KSDE's KEDCS; = 0 if the school's building level is neither classified as Day Care, Early Childhood, or Elementary by KSDE's KEDCS.
Secondary School	= 1 if the school's building level is classified as Middle School, Junior High School, or High School by KSDE's KEDCS; = 1 if the school's building level is neither classified as Middle School, Junior High School, or High School by KSDE's KEDCS.
Other level School	= 1 if the school's building level is classified as other types (e.g. Public School Administered, Post High School, Juvenile Detention Center, Special School, Off Site Community Based, etc.) by KSDE's KEDCS; = 0 if the school's building level is classified as Day Care, Early Childhood, or Elementary; or Middle School, Junior High School, or High School by KSDE's KEDCS.
Alternative School	= 1 if the school is classified as Alternative Education School by NCES; = 1 if the school is classified as Regular School by NCES.
Regular School	= 1 if the school is classified as Regular School by NCES; = 0 if the school is classified as Alternative Education School by NCES.
Total FTEs per 10.0	= School's total FTEs divided by 10.0.
School enrollment per 1k	= School's total number of students divided by 1000.
% female students	= Percent of female students among all students in the school.
% FRPL eligibility	= Percent of free or reduced-price lunch eligible students among all students in the school.
% minority students	= Total percent of Asian, Black, Hispanic students and students of other races and ethnicities among all students in the school.
Salary per \$1000	= Total amount of base contact salary plus supplemental and fringe of the teacher in 2018 dollars divided by 1000.
North East	= 1 if the school is located in the northeastern region of Kansas; = 0 if the school is located in another geographical region of Kansas.
North Central	= 1 if the school is located in the northcentral region of Kansas; = 0 if the school is located in another geographical region of Kansas.
North West	= 1 if the school is located in the northwestern region of Kansas; = 0 if the school is located in another geographical region of Kansas.
South East	= 1 if the school is located in the southeastern region of Kansas; = 0 if the school is located in another geographical region of Kansas.
South Central	= 1 if the school is located in the southcentral region of Kansas; = 0 if the school is located in another geographical region of Kansas.
South West	= 1 if the school is located in the southwestern region of Kansas;

	= 0 if the school is located in another geographical region of Kansas.
Kansas City	= 1 if the school is located in Kansas City, Wyandotte County, Northeastern Kansas; = 0 if the school is located in another city/area in Northeastern Kansas.
Wichita City	= 1 if the school is located in Wichita City, Sedgwick County, Southcentral Kansas; = 0 if the school is located in another city/area in Southcentral Kansas.
Goddard	= 1 if the school is located in Goddard, Sedgwick County, Southcentral Kansas; = 0 if the school is located in another city/area in Southcentral Kansas.
Dodge City	= 1 if the school is located in Dodge City, Ford County, Southwestern Kansas; = 0 if the school is located in another city/area in Southwestern Kansas.
Garden City	= 1 if the school is located in Garden City, Finney County, Southwestern Kansas; = 0 if the school is located in another city/area in Southwestern Kansas.
Liberal	= 1 if the school is located in Liberal, Seward County, Southwestern Kansas; = 0 if the school is located in another city/area in Southwestern Kansas.
<b>Error/outlier control</b>	
Flagged experience	= 1 if the teacher's total years of experience is negative, greater than age, equals zero while the teacher is not classified as first-year teacher by KSDE's KEDCS, greater than zero but the teacher is classified as first-year teacher by KSDE's KEDCS, inconsecutive/inconsistent with the numbers of years of experience in KSDE's KEDCS data from earlier years; or the number of years working in the current school district is negative; greater than total number of years of experience equals zero but the teacher is classified as a returning staff, greater than zero but the teacher is reported to enter the current school district in the current school year, inconsecutive/inconsistent with the numbers of years working in the current school district in KSDE's KEDCS data from earlier years = 0 if the above criteria are satisfied.
Flagged salary	= 1 if the teacher's salary is either lower than the 2.5 <sup>th</sup> percentile or higher than the 97.5 <sup>th</sup> percentile in comparison to other teachers in the data set; = 0 if the teacher's salary is between the 2.5 <sup>th</sup> percentile and the 97.5 <sup>th</sup> percentile in comparison to other teachers in the data set. Note: The flags are marked based on 1.0 FTE to ensure the reliability of the measurement. For instance, if a part-time teacher with 0.1 FTE is receiving \$5,500 annually, their observation would <i>not</i> be flagged even if this value is lower than the 2.5 <sup>th</sup> percentile of the set.
Flagged total FTEs	= 1 if the school's total FTEs is lower than the 5 <sup>th</sup> percentile in comparison to other schools in the data set; = 0 if the school's total FTEs is at or higher than the 5 <sup>th</sup> percentile in comparison to other schools in the data set.
Flagged enrollment	= 1 if the school's total number of students is lower than the 5 <sup>th</sup> percentile in comparison to other schools in the data set;

	= 0 if the school's total number of students at or higher than the 5 <sup>th</sup> percentile in comparison to other schools in the data set.
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*Note.* Dashed lines separate variables within the same group of comparison.

**Appendix Table 2. Descriptive statistics**

	<i>N</i>	Mean	S.D.	Min	Max
<b>Teacher mobility</b>					
Stayer	31446	.8572155	.3498585	0	1
In-district transferer	31446	.0347262	.1830884	0	1
In-state switcher	31446	.0408955	.1980513	0	1
Out-of-state switcher	31446	.0071551	.0842861	0	1
To private school	31446	.0002862	.0169154	0	1
Leaver	31446	.011162	.1050607	0	1
Retired	31446	.0195255	.1383651	0	1
Leave of absence	31446	.0006678	.0258338	0	1
Terminated/Reduced	31446	.0073141	.0852107	0	1
Leadership	31446	.0013356	.0365223	0	1
Health or Decease	31446	.0013674	.036954	0	1
Military	31446	.0001272	.0112779	0	1
Academic Study	31446	.000477	.0218357	0	1
Unknown exit reason(s)	31446	.0177447	.1320242	0	1
<b>Personal factors</b>					
Female	31446	.7616867	.4260585	0	1
Under 30 years old	31446	.1162946	.320583	0	1
Above 60 years old	31446	.1592571	.3659215	0	1
White	31446	.9255549	.262498	0	1
Asian	31446	.0054697	.073756	0	1
Black	31446	.0156459	.124103	0	1
Hispanic	31446	.0262355	.1598373	0	1
Other races/ethnicities	31446	.0270941	.1623601	0	1
Part-time in 1 school	31446	.0951472	.2934229	0	1
Full-time in m/th 1 school	31446	.0006678	.0258338	0	1
Part-time in m/th 1 school	31446	.0591808	.2359666	0	1
Full-time in 1 school	31446	.8450041	.3619065	0	1
Experienced teacher	31446	.6120015	.487302	0	1
Experienced b/ new	31446	.160084	.3666897	0	1
Novice teacher	31446	.2279145	.4194938	0	1
Has master degree(s)	31446	.3232208	.4677136	0	1
Has doctoral degree(s)	31446	.0039433	.0626725	0	1
Very selective university	31446	.1895631	.3919615	0	1
Most selective university	31446	.0739363	.2616713	0	1
Got PS education in KS	31446	.7815302	.4132144	0	1
English Language Arts	31446	.1238949	.3294669	0	1
Life & Physical Sciences	31446	.0712968	.2573241	0	1
Mathematics	31446	.1045284	.3059497	0	1
SPED/ESOL teacher	31446	.1048782	.3064013	0	1
EC/PreK/Ele teacher	31446	.4263817	.4945585	0	1
Secondary teacher	31446	.4687083	.4990278	0	1
Other educator types	31446	.0000318	.0056392	0	1
<b>School characteristics</b>					
Urban School	31446	.2689372	.4434143	0	1
Suburban School	31446	.1555683	.3624513	0	1
Rural School	31446	.5754945	.4942756	0	1
Charter School	31446	.0023532	.0484539	0	1

Magnet School	31446	.0311009	.1735933	0	1
Virtual School	31446	.0037843	.0614008	0	1
Reconstitution	31446	.0049927	.0704835	0	1
Targeted Assist. Title I	31446	.1872098	.3900861	0	1
School-wide Title I	31446	.6257712	.4839308	0	1
None Title-I School	31446	.187019	.389933	0	1
National School Lunch	31446	.9961839	.0616573	0	1
EC/PreK/Ele School	31446	.5036889	.4999943	0	1
Secondary School	31446	.4931311	.4999608	0	1
Other level School	31446	.0031801	.0563031	0	1
Alternative School	31446	.0000954	.0097671	0	1
Regular School	31446	.9999046	.0097671	0	1
Total FTEs per 10.0	31446	4.038352	2.919068	.1	15.051
School enrollment per 1k	31446	.5931232	.4754431	.02	3.268
% female students	31446	.485146	.0339689	.0555556	.9848485
% FRL eligibility	31446	.4866216	.2387725	0	.9748603
% minority students	31446	.355755	.2549055	0	.9778598
<b>External factors</b>					
Salary per \$1000	31446	55.51586	12.14506	.001	144.797
North East	31446	.475132	.4993891	0	1
North Central	31446	.0650321	.2465864	0	1
North West	31446	.0170769	.1295601	0	1
South East	31446	.0770527	.2666793	0	1
South Central	31446	.2956179	.4563273	0	1
South West	31446	.0700884	.2553	0	1
Kansas City	31446	.055969	.2298654	0	1
Wichita City	31446	.1092985	.3120183	0	1
Goddard	31446	.0089042	.0939423	0	1
Dodge City	31446	.012911	.1128926	0	1
Garden City	31446	.0148509	.1209577	0	1
Liberal	31446	.0086179	.0924335	0	1

**Appendix Table 3. Primary analysis results**

	(1.1) W/in-school model	(1.2) W/in-district model	(1.3) W/in-county model	(1.4) W/in-region model	(1.0) State model
Female	-0.006 (0.005)	-0.004 (0.005)	-0.004 (0.005)	-0.004 (0.005)	-0.004 (0.005)
Under 30 years old	0.009 (0.009)	0.007 (0.009)	0.008 (0.009)	0.008 (0.009)	0.008 (0.009)
Above 60 years old	0.080** (0.007)	0.080** (0.006)	0.081** (0.006)	0.082** (0.006)	0.082** (0.006)
Asian	-0.007 (0.026)	-0.009 (0.025)	-0.008 (0.025)	-0.007 (0.025)	-0.007 (0.025)
Black	-0.023 (0.018)	-0.011 (0.016)	-0.009 (0.016)	-0.006 (0.016)	-0.006 (0.016)
Hispanic	0.005 (0.013)	0.005 (0.012)	0.004 (0.012)	0.002 (0.012)	0.002 (0.012)
Other races/ethnicities	0.037* (0.019)	0.038* (0.018)	0.034* (0.016)	0.042* (0.017)	0.042* (0.017)
Part-time in 1 school	0.007 (0.010)	-0.002 (0.010)	-0.002 (0.009)	0.003 (0.009)	0.003 (0.009)
Full-time in m/th 1 school	0.277** (0.105)	0.299** (0.103)	0.304** (0.101)	0.323** (0.101)	0.323** (0.101)
Part-time in m/th 1 school	0.100** (0.011)	0.095** (0.011)	0.095** (0.011)	0.093** (0.011)	0.093** (0.011)
Experienced b/ new	0.050** (0.006)	0.053** (0.006)	0.053** (0.006)	0.054** (0.006)	0.054** (0.006)
Novice teacher	0.058** (0.008)	0.063** (0.008)	0.064** (0.008)	0.065** (0.008)	0.065** (0.008)
Has master degree(s)	0.021** (0.005)	0.020** (0.005)	0.020** (0.005)	0.020** (0.005)	0.020** (0.005)
Has doctoral degree(s)	0.059+ (0.035)	0.063+ (0.036)	0.060+ (0.036)	0.058 (0.036)	0.058 (0.036)
Very selective university	-0.003 (0.005)	-0.004 (0.005)	-0.004 (0.005)	-0.002 (0.005)	-0.002 (0.005)
Most selective university	-0.007 (0.009)	-0.005 (0.009)	-0.004 (0.009)	-0.003 (0.009)	-0.003 (0.009)
Got PS education in KS	-0.022** (0.006)	-0.022** (0.006)	-0.021** (0.006)	-0.020** (0.006)	-0.020** (0.006)
English Language Arts	0.003 (0.007)	0.003 (0.007)	0.002 (0.006)	0.004 (0.006)	0.004 (0.006)
Life & Physical Sciences	0.002 (0.008)	0.004 (0.008)	0.004 (0.007)	0.006 (0.008)	0.006 (0.008)
Mathematics	0.000 (0.007)	0.003 (0.007)	0.003 (0.007)	0.003 (0.007)	0.003 (0.007)
SPED/ESOL teacher	0.050** (0.010)	0.048** (0.010)	0.050** (0.010)	0.053** (0.010)	0.053** (0.010)
EC/PreK/Ele teacher	-0.022+ (0.012)	-0.027* (0.011)	-0.029* (0.012)	-0.026* (0.012)	-0.026* (0.012)
Other educator types	-0.064** (0.014)	-0.094** (0.023)	-0.093** (0.024)	-0.128** (0.017)	-0.128** (0.017)

Suburban School	0.013 (0.011)	0.008 (0.009)	0.009 (0.008)	0.009 (0.008)
Rural School	0.003 (0.010)	0.010 (0.009)	0.016 <sup>+</sup> (0.009)	0.016 <sup>+</sup> (0.009)
Reconstitution	0.096** (0.021)	0.091** (0.020)	0.100** (0.016)	0.100** (0.016)
Charter School	-0.028 (0.022)	-0.014 (0.016)	-0.013 (0.017)	-0.013 (0.017)
Magnet School	-0.043** (0.014)	-0.042** (0.013)	-0.038** (0.013)	-0.038** (0.013)
Virtual School	0.157 (0.120)	0.205* (0.097)	0.140** (0.054)	0.140** (0.054)
Alternative School	-0.323** (0.061)	-0.343** (0.055)	-0.316** (0.046)	-0.316** (0.046)
Targeted Assist. Title I	0.004 (0.009)	0.008 (0.008)	0.009 (0.008)	0.009 (0.008)
School-wide Title I	-0.005 (0.010)	-0.009 (0.009)	-0.004 (0.010)	-0.004 (0.010)
National School Lunch	0.261* (0.120)	0.282** (0.098)	0.217** (0.056)	0.217** (0.056)
EC/PreK/Ele School	0.008 (0.011)	0.011 (0.012)	0.010 (0.012)	0.010 (0.012)
Other level School	-0.055 (0.052)	-0.065 (0.051)	-0.050 (0.051)	-0.050 (0.051)
Total FTEs per 10.0	-0.007 <sup>+</sup> (0.003)	-0.004 (0.003)	-0.003 (0.003)	-0.003 (0.003)
School enrollment per 1k	0.007 (0.020)	-0.007 (0.017)	-0.010 (0.019)	-0.010 (0.019)
% female students	0.061 (0.075)	0.047 (0.071)	0.057 (0.074)	0.057 (0.074)
% FRL eligibility	0.034 (0.035)	0.052* (0.026)	0.048* (0.024)	0.048* (0.024)
% minority students	0.052 (0.036)	0.047 <sup>+</sup> (0.026)	0.076** (0.021)	0.076** (0.021)
Salary per \$1000	-0.002** (0.000)	-0.002** (0.000)	-0.002** (0.000)	-0.002** (0.000)
North Central				-0.028** (0.010)
North West				-0.046** (0.017)
South East				-0.021* (0.010)
South Central				-0.008 (0.007)
South West				-0.020 (0.013)
Flagged experience	0.015 (0.024)	0.006 (0.023)	0.006 (0.023)	0.006 (0.024)
Flagged salary	0.067** (0.014)	0.069** (0.013)	0.066** (0.013)	0.061** (0.013)
Flagged total FTEs		0.022	0.057	0.043

	(0.042)	(0.049)	(0.052)	(0.052)
Flagged enrollment	0.004	-0.004	-0.018	-0.018
	(0.038)	(0.033)	(0.035)	(0.035)
Constant	0.240** (0.018)	-0.064 (0.132)	-0.086 (0.110)	-0.049 (0.078)
Observations	31173	31173	31173	31173

*Note.* School-level clustered standard errors are in parentheses. +  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$

Reference groups: Male; 30-60 years old; White; Full-time in only one school; Having 5 or more years of experience in the teaching profession and the current school district; Having bachelor degree(s) or lower; Endorsed by universities ranked 4<sup>th</sup> or lower in Barron's Index; Endorsed by universities not in Kansas; Teaching courses other than English Language Arts, Life & Physical Sciences, and Mathematics; Secondary educator type; Urban school; Not charter school; Not reconstituted school; Non-title-I school; Not magnet school; School ineligible for NLSP; Not virtual school; Secondary school; and, School in Northeastern Kansas.

**Appendix Table 4. Secondary analysis: Specific forms of teacher turnover**

	(2.0) Mover + Leaver	(2.1) In-district transferrer	(2.2) In-state switcher	(2.3) Out-of-state switcher	(2.4) Leaver
Female	-0.000 (0.004)	0.003 (0.003)	-0.002 (0.003)	0.001 (0.001)	-0.003 (0.002)
Under 30 years old	0.011 (0.009)	-0.005 (0.005)	0.012 (0.007)	0.005 (0.004)	0.000 (0.004)
Above 60 years old	-0.019** (0.004)	-0.009** (0.003)	-0.012** (0.002)	-0.003* (0.001)	0.003 (0.002)
Asian	-0.005 (0.023)	0.001 (0.017)	-0.002 (0.016)	-0.007 (0.007)	0.002 (0.010)
Black	-0.008 (0.015)	0.010 (0.012)	-0.024** (0.007)	0.002 (0.006)	-0.001 (0.005)
Hispanic	0.004 (0.012)	0.014 (0.009)	-0.002 (0.008)	-0.003 (0.004)	-0.006+ (0.003)
Other races/ethnicities	0.045** (0.016)	0.021+ (0.011)	0.023* (0.011)	-0.000 (0.003)	0.009+ (0.005)
Part-time in 1 school	0.008 (0.008)	0.010+ (0.006)	-0.009+ (0.005)	0.008* (0.003)	0.001 (0.003)
Full-time in m/th 1 school	0.343** (0.118)	-0.020** (0.006)	0.389** (0.120)	-0.006* (0.003)	-0.015** (0.005)
Part-time in m/th 1 school	0.098** (0.010)	0.087** (0.009)	0.022** (0.007)	0.001 (0.003)	0.006 (0.004)
Experienced b/ new	0.049** (0.005)	0.010** (0.004)	0.035** (0.004)	0.004* (0.002)	0.006* (0.002)
Novice teacher	0.059** (0.007)	0.012* (0.005)	0.045** (0.005)	0.010** (0.003)	0.002 (0.003)
Has master degree(s)	0.013** (0.004)	0.004 (0.003)	0.007* (0.003)	0.003* (0.001)	0.001 (0.001)
Has doctoral degree(s)	0.019 (0.030)	-0.006 (0.023)	0.019 (0.019)	-0.006** (0.002)	0.014 (0.014)
Very selective university	-0.008+ (0.004)	-0.007* (0.003)	-0.005 (0.003)	0.000 (0.001)	0.003 (0.002)
Most selective university	-0.004 (0.008)	0.002 (0.006)	-0.005 (0.005)	-0.007* (0.004)	0.004 (0.003)
Got PS education in KS	-0.015** (0.005)	-0.006+ (0.004)	0.004 (0.004)	-0.019** (0.003)	0.002 (0.002)
English Language Arts	0.003 (0.006)	0.002 (0.004)	-0.002 (0.004)	-0.000 (0.002)	0.003 (0.002)
Life & Physical Sciences	0.004 (0.007)	0.002 (0.004)	0.003 (0.005)	0.001 (0.002)	-0.001 (0.003)
Mathematics	0.002 (0.006)	0.002 (0.004)	-0.001 (0.004)	-0.001 (0.002)	0.001 (0.003)
SPED/ESOL teacher	0.040** (0.009)	0.032** (0.007)	0.007 (0.006)	0.006 (0.004)	0.003 (0.004)
EC/PreK/Ele teacher	-0.025* (0.011)	-0.020* (0.008)	-0.008 (0.007)	0.003 (0.003)	-0.004 (0.004)
Other educator types	-0.092** (0.008)	-0.015 (0.007)	-0.042** (0.006)	-0.018** (0.005)	-0.027** (0.005)

	(0.016)	(0.011)	(0.010)	(0.005)	(0.006)
Suburban School	0.013 <sup>+</sup> (0.007)	0.025 <sup>**</sup> (0.006)	0.000 (0.004)	-0.002 (0.002)	-0.010 <sup>**</sup> (0.002)
Rural School	0.006 (0.007)	0.003 (0.006)	0.003 (0.004)	0.004 <sup>+</sup> (0.002)	-0.004 (0.003)
Reconstitution	0.053 <sup>*</sup> (0.026)	0.003 (0.029)	0.068 <sup>**</sup> (0.016)	-0.008 <sup>**</sup> (0.002)	-0.004 (0.007)
Charter School	-0.041 <sup>+</sup> (0.022)	-0.007 (0.013)	-0.013 (0.022)	-0.012 <sup>**</sup> (0.004)	-0.018 <sup>**</sup> (0.005)
Magnet School	-0.023 (0.014)	-0.008 (0.011)	-0.006 (0.010)	-0.010 <sup>**</sup> (0.004)	-0.003 (0.003)
Virtual School	0.049 (0.050)	-0.012 (0.032)	0.104 <sup>*</sup> (0.046)	-0.018 <sup>+</sup> (0.010)	-0.037 <sup>*</sup> (0.015)
Alternative School	-0.234 <sup>**</sup> (0.041)	-0.067 <sup>**</sup> (0.020)	-0.173 <sup>**</sup> (0.036)	-0.009 <sup>+</sup> (0.005)	-0.008 (0.013)
Targeted Assist. Title I	-0.003 (0.008)	-0.006 (0.006)	0.003 (0.005)	-0.003 (0.002)	0.002 (0.003)
School-wide Title I	-0.015 <sup>+</sup> (0.009)	-0.010 (0.006)	-0.002 (0.006)	-0.006 <sup>*</sup> (0.002)	-0.001 (0.003)
National School Lunch	0.082 (0.052)	0.001 (0.029)	0.118 <sup>**</sup> (0.045)	-0.019 <sup>*</sup> (0.010)	-0.025 <sup>+</sup> (0.015)
EC/PreK/Ele School	0.016 (0.011)	0.028 <sup>**</sup> (0.009)	-0.007 (0.007)	-0.003 (0.003)	0.002 (0.004)
Other level School	-0.021 (0.041)	0.010 (0.042)	-0.033 (0.025)	0.000 (0.011)	0.001 (0.014)
Total FTEs per 10.0	-0.001 (0.003)	0.001 (0.002)	-0.003 (0.002)	-0.000 (0.001)	0.001 (0.001)
School enrollment per 1k	-0.014 (0.016)	-0.016 (0.011)	0.005 (0.011)	-0.001 (0.004)	-0.002 (0.005)
% female students	0.021 (0.067)	-0.008 (0.050)	0.045 (0.048)	0.003 (0.019)	-0.015 (0.022)
% FRL eligibility	0.039 <sup>+</sup> (0.021)	0.005 (0.015)	0.053 <sup>**</sup> (0.013)	0.003 (0.005)	-0.019 <sup>*</sup> (0.008)
% minority students	0.074 <sup>**</sup> (0.018)	0.086 <sup>**</sup> (0.013)	-0.019 (0.012)	0.015 <sup>**</sup> (0.006)	0.004 (0.006)
Salary per \$1000	-0.002 <sup>**</sup> (0.000)	-0.000 (0.000)	-0.001 <sup>**</sup> (0.000)	-0.000 <sup>*</sup> (0.000)	-0.001 <sup>**</sup> (0.000)
North Central	-0.018 <sup>*</sup> (0.008)	-0.005 (0.005)	-0.020 <sup>**</sup> (0.006)	0.005 <sup>*</sup> (0.003)	0.001 (0.004)
North West	-0.047 <sup>**</sup> (0.013)	-0.014 <sup>*</sup> (0.006)	-0.035 <sup>**</sup> (0.009)	0.003 (0.005)	-0.007 (0.006)
South East	-0.021 <sup>*</sup> (0.008)	-0.009 <sup>*</sup> (0.005)	-0.020 <sup>**</sup> (0.006)	0.006 <sup>*</sup> (0.003)	0.001 (0.004)
South Central	-0.003 (0.006)	0.003 (0.004)	-0.011 <sup>**</sup> (0.004)	0.005 <sup>**</sup> (0.002)	0.000 (0.002)
South West	-0.018 (0.012)	-0.029 <sup>**</sup> (0.007)	0.001 (0.009)	0.001 (0.003)	0.006 (0.004)
Flagged experience	0.005 (0.022)	0.011 (0.017)	-0.022 <sup>+</sup> (0.011)	0.008 (0.011)	0.008 (0.009)
Flagged total FTEs	0.032 (0.047)	-0.025 (0.021)	0.076 <sup>+</sup> (0.044)	-0.009 <sup>*</sup> (0.005)	-0.013 (0.011)

Flagged enrollment	0.017 (0.032)	0.003 (0.020)	0.024 (0.028)	-0.004 (0.006)	-0.007 (0.010)
Flagged salary	0.044** (0.013)	0.014 (0.010)	0.016* (0.007)	0.001 (0.004)	0.021** (0.006)
Constant	0.061 (0.072)	0.004 (0.047)	-0.056 (0.056)	0.039* (0.018)	0.103** (0.023)
Observations	29910	28048	28242	27181	27307

Note. School-level clustered standard errors are in parentheses. <sup>+</sup>  $p < 0.10$ , <sup>\*</sup>  $p < 0.05$ , <sup>\*\*</sup>  $p < 0.01$

Reference groups: Male; 30-60 years old; White; Full-time in only one school; Having 5 or more years of experience in the teaching profession and the current school district; Having bachelor degree(s) or lower; Endorsed by universities ranked 4<sup>th</sup> or lower in Barron's Index; Endorsed by universities not in Kansas; Teaching courses other than English Language Arts, Life & Physical Sciences, and Mathematics; Secondary educator type; Urban school; Not charter school; Not reconstituted school; Non-title-I school; Not magnet school; School ineligible for NLSP; Not virtual school; Secondary school; and, School in Northeastern Kansas.

**Appendix Table 5. Descriptive statistics by Kansas regions**

	North East	North Central	North West	South East	South Central	South West
<b>Teacher mobility</b>						
Stayer	.8607188	.8743276	.867784	.8699959	.850796	.8280399
In-district transferer	.0381501	.0171149	.0111732	.0123813	.0413081	.0303993
In-state switcher	.0408942	.0396088	.0316574	.042922	.0378657	.0549002
Out-of-state switcher	.0054883	.007335	.0055866	.0074288	.0087134	.0117967
To private school	.0002008	0	.0018622	0	.0005379	0
Leaver	.0115789	.0146699	.009311	.0094924	.0098967	.0127042
Retired	.0164648	.0273839	.0391061	.0301279	.0175344	.0249546
Leave of absence	.0010039	.000489	0	0	.0005379	0
Termination or Reduction in force	.0032796	.001467	.009311	.0037144	.016136	.0063521
Leadership	.0008701	.002934	.0018622	.0020636	.0011833	.0027223
Health or Decease	.0012717	.000489	.0018622	0	.0019363	.0018149
Military	.0001339	.000489	0	0	.0001076	0
Academic Study	.0006024	.000489	0	0	.0004303	.0004537
Unknown exit reason(s)	.0193427	.0132029	.0204842	.0218737	.0130164	.0258621
<b>Personal factors</b>						
Female	.7735761	.7506112	.7337058	.7404045	.7532272	.7572595
Under 30 years old	.1285055	.1075795	.0968343	.0903838	.1035929	.1284029
Above 60 years old	.1467104	.1853301	.2625698	.1848948	.1547978	.1855717
White	.9426411	.9794621	.9925512	.9579034	.8809165	.896098
Asian	.005689	.002934	0	0	.0070998	.0068058
Black	.0196774	.005379	0	.0037144	.0173193	.0077132
Hispanic	.021016	.005379	.0055866	.0103178	.0314114	.0816697
Other races/ethnicities	.0109765	.006846	.0018622	.0280644	.063253	.0077132
Part-time in 1 school	.0331972	.0518337	.0763501	.0309534	.2361231	.0358439
Full-time in m/th 1 school	.0000669	.000489	.0055866	.0004127	.0009682	.0027223
Part-time in m/th 1 school	.0426344	.1080685	.1433892	.0870821	.0605637	.0689655
Full-time in 1 school	.9241015	.8396088	.7746741	.8815518	.7023451	.8924682
Experienced teacher	.589318	.6366748	.6648045	.6314486	.6395224	.592559
Experienced b/ new	.1651161	.1726161	.1638734	.1861329	.1465146	.1420145
Novice teacher	.2455659	.190709	.1713222	.1824185	.213963	.2654265
Has master degree(s)	.3516498	.2933985	.2253259	.3718531	.2848537	.2903811
Has doctoral degree(s)	.0046851	.002445	0	.0090797	.0020439	.0036298
Very selective university	.2438926	.2713936	.1210428	.1011143	.1192986	.1556261
Most selective university	.1075564	.0342298	.0465549	.0235246	.0460413	.0626134
Got PS education in KS	.7261227	.8792176	.8063315	.8724721	.8429432	.7014519
English Language Arts	.1281708	.1471883	.150838	.1159719	.1032702	.1624319
Life & Physical Sciences	.0738906	.0782396	.0782123	.0755262	.0638985	.0721416
Mathematics	.1096312	.1158924	.1191806	.0994635	.0890706	.126588
SPED/ESOL teacher	.1205408	.0836186	.0391061	.0709864	.0932659	.1206897
EC/PreK/Ele teacher	.4235326	.4259169	.4078212	.4387123	.4276033	.4319419
Secondary teacher	.4559266	.4904645	.5530726	.4903013	.4791308	.4469147
Other educator types	0	0	0	0	0	.0004537
<b>School characteristics</b>						
Urban School	.3582759	0	0	0	.3339071	0
Suburban School	.2410816	0	0	0	.1387694	0

Rural School	.4006425	1	1	1	.5273236	1
Reconstitution	.010508	0	0	0	0	0
Charter School	.0024764	0	0	.0037144	.0029045	.0004537
Magnet School	.0118466	0	0	.0330169	.0775602	0
Virtual School	.0024095	0	0	0	.0066695	.0095281
Targeted Assist. Title I	.2115655	.2283619	.4599628	.0445728	.1858864	.0798548
School-wide Title I	.4644267	.7511002	.5400372	.9554272	.7146084	.8870236
None Title-I School	.3240078	.0205379	0	0	.0995052	.0331216
National School Lunch	.9975905	1	1	1	.9933305	.9900181
EC/PreK/Ele School	.5048524	.4924205	.4711359	.5018572	.5032272	.5181488
Secondary School	.4922696	.5075795	.5288641	.4981428	.4915017	.4782214
Other level School	.002878	0	0	0	.0052711	.0036298
Alternative School	0	0	0	0	0	.0013612
Regular School	1	1	1	1	1	.9986388
Total FTEs per 10.0	4.64964	2.727042	1.519207	2.623264	3.948803	3.658302
School enrollment per 1k	.6821819	.367557	.194635	.3650681	.5942659	.5416706
% female students	.4845735	.4847427	.4876512	.4847195	.4862473	.4846152
% FRL eligibility	.4049658	.4824928	.4414848	.5859288	.5547447	.6584948
% minority students	.3637446	.1730415	.1443167	.1803686	.3778475	.6222731
<b>External factors</b>						
Salary per \$1000	56.50922	51.6383	49.36589	53.84025	55.82137	54.43165
Kansas City	.1177967	.	.	.	.	.
Wichita City	.	.	.	.	.3697289	.
Goddard	.	.	.	.	.0301205	.
Dodge City	.	.	.	.	.	.1842105
Garden City	.	.	.	.	.	.2118875
Liberal	.	.	.	.	.	.1229583
Observations	14941	2045	537	2423	9296	2204

**Appendix Table 6. Secondary analysis: Teacher turnover in specific Kansas regions**

	(3.1) North East	(3.2) North Central	(3.3) North West	(3.4) South East	(3.5) South Central	(3.6) South West
Female	-0.006 (0.007)	-0.000 (0.021)	-0.040 (0.038)	-0.034* (0.017)	0.007 (0.010)	-0.002 (0.019)
Under 30 years old	0.000 (0.013)	0.091** (0.033)	0.052 (0.078)	-0.024 (0.037)	0.014 (0.015)	-0.006 (0.035)
Above 60 years old	0.082** (0.010)	0.079** (0.022)	0.123** (0.032)	0.118** (0.021)	0.063** (0.012)	0.112** (0.023)
Asian	0.002 (0.037)	0.118 (0.184)			-0.007 (0.041)	-0.109** (0.022)
Black	-0.014 (0.020)	0.150 (0.138)		-0.136** (0.024)	-0.014 (0.031)	0.058 (0.105)
Hispanic	0.021 (0.022)	-0.047 (0.104)	-0.057 (0.092)	0.081 (0.078)	-0.002 (0.019)	-0.023 (0.025)
Other races/ethnicities	0.055+ (0.033)	0.111 (0.098)	-0.191* (0.080)	-0.059+ (0.032)	0.029 (0.022)	0.040 (0.082)
Part-time in 1 school	-0.032 (0.021)	0.070 (0.047)	-0.077 (0.060)	0.062 (0.054)	-0.003 (0.011)	0.054 (0.061)
Full-time in m/th 1 school	-0.158** (0.016)	-0.122** (0.038)	0.143** (0.046)	-0.151+ (0.080)	0.301* (0.152)	0.628** (0.153)
Part-time in m/th 1 school	0.120** (0.019)	0.062* (0.028)	0.030 (0.046)	0.082** (0.029)	0.109** (0.021)	0.017 (0.037)
Experienced b/ new	0.043** (0.009)	0.057* (0.023)	0.027 (0.032)	0.074** (0.019)	0.058** (0.012)	0.081** (0.024)
Novice teacher	0.050** (0.011)	0.061* (0.029)	0.031 (0.052)	0.121** (0.028)	0.061** (0.013)	0.105** (0.033)
Has master degree(s)	0.013+ (0.007)	0.020 (0.017)	0.021 (0.037)	0.035* (0.017)	0.027** (0.009)	0.022 (0.020)
Has doctoral degree(s)	0.080 (0.051)	0.045 (0.146)		0.009 (0.072)	0.041 (0.080)	0.043 (0.172)
Very selective university	-0.010 (0.007)	-0.018 (0.016)	-0.005 (0.044)	0.051* (0.021)	0.011 (0.011)	-0.010 (0.022)
Most selective university	-0.010 (0.011)	-0.008 (0.048)	-0.157* (0.070)	-0.004 (0.041)	0.026 (0.023)	-0.016 (0.034)
Got PS education in KS	-0.022** (0.008)	0.020 (0.025)	-0.142** (0.045)	0.019 (0.020)	-0.026* (0.013)	-0.019 (0.019)
English Language Arts	-0.002 (0.009)	0.014 (0.023)	-0.047 (0.037)	0.002 (0.018)	0.014 (0.012)	0.033 (0.025)
Life & Physical Sciences	-0.003 (0.010)	0.059+ (0.030)	-0.078* (0.038)	-0.031 (0.021)	0.027+ (0.016)	0.012 (0.029)
Mathematics	0.004 (0.010)	0.027 (0.024)	0.051 (0.053)	-0.018 (0.023)	0.005 (0.013)	-0.006 (0.027)
SPED/ESOL teacher	0.070** (0.016)	0.006 (0.033)	0.070 (0.112)	0.057 (0.044)	0.014 (0.019)	0.074* (0.030)
EC/PreK/Ele teacher	-0.025 (0.020)	-0.044 (0.039)	-0.023 (0.053)	-0.085** (0.032)	-0.025 (0.021)	0.029 (0.029)
Other educator types					-0.074 (0.046)	

Suburban School	0.013 (0.009)			0.018 (0.020)		
Rural School	0.032** (0.012)			-0.005 (0.019)		
Reconstitution	0.110** (0.018)					
Charter School	0.034 (0.027)		-0.024 (0.021)	-0.016 (0.011)	-0.343** (0.114)	
Magnet School	-0.039 (0.026)		-0.061** (0.020)	-0.035* (0.017)		
Virtual School	-0.106** (0.033)					
Alternative School					-0.424** (0.084)	
Targeted Assist. Title I	0.005 (0.011)	0.057** (0.018)	0.070* (0.034)	0.012 (0.028)	0.002 (0.017)	-0.072+ (0.044)
School-wide Title I	-0.018 (0.014)	0.048** (0.018)			-0.000 (0.019)	-0.050 (0.046)
National School Lunch					0.117** (0.037)	0.127+ (0.074)
EC/PreK/Ele School	0.016 (0.021)	0.009 (0.038)	-0.029 (0.060)	0.062+ (0.032)	0.019 (0.022)	-0.080** (0.027)
Other level School	-0.115 (0.090)				0.067 (0.061)	-0.094* (0.047)
Total FTEs per 10.0	-0.001 (0.008)	-0.028+ (0.014)	-0.055 (0.064)	-0.011 (0.018)	-0.000 (0.003)	-0.011 (0.017)
School enrollment per 1k	-0.017 (0.049)	0.100 (0.096)	0.332 (0.393)	0.112 (0.116)	-0.024 (0.018)	0.032 (0.092)
% female students	-0.007 (0.123)	-0.507* (0.230)	0.350 (0.296)	0.104 (0.165)	0.200 (0.130)	-0.046 (0.285)
% FRL eligibility	0.048 (0.034)	0.138 (0.095)	0.020 (0.174)	0.136+ (0.080)	0.042 (0.046)	-0.080 (0.133)
% minority students	0.084* (0.033)	0.192+ (0.109)	0.154 (0.183)	-0.102 (0.077)	0.109** (0.042)	0.074 (0.085)
Salary per \$1000	-0.003** (0.000)	-0.002 (0.001)	-0.005** (0.002)	-0.001+ (0.001)	-0.002** (0.000)	-0.003** (0.001)
Kansas City	0.032+ (0.016)					
Wichita City					-0.028 (0.018)	
Goddard					-0.015 (0.024)	
Dodge City						-0.027 (0.038)
Garden City						0.000 (0.038)
Liberal						-0.023 (0.046)
Flagged experience	0.015 (0.038)	-0.149** (0.038)	-0.129+ (0.076)	-0.012 (0.080)	-0.015 (0.035)	0.087 (0.099)
Flagged total FTEs	0.368** (0.274**)	0.155+ (0.138*)	-0.138* (0.079+)	-0.079+ (0.036)	-0.036 (0.274**)	

	(0.124)	(0.084)	(0.062)	(0.048)	(0.067)	(0.077)
Flagged enrollment	-0.037 (0.122)	-0.111* (0.054)	-0.120* (0.049)	0.174* (0.069)	0.048 (0.061)	-0.135** (0.049)
Flagged salary	0.087** (0.020)	0.060 (0.058)	0.076 (0.080)	-0.007 (0.054)	0.041* (0.020)	0.075 (0.057)
Constant	0.247** (0.070)	0.264* (0.133)	0.280 (0.205)	0.012 (0.101)	-0.069 (0.086)	0.278 (0.179)
Observations	14873	2041	531	2414	9128	2186

Note. School-level clustered standard errors are in parentheses. +  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$

Reference groups: Male; 30-60 years old; White; Full-time in only one school; Having 5 or more years of experience in the teaching profession and the current school district; Having bachelor degree(s) or lower; Endorsed by universities ranked 4<sup>th</sup> or lower in Barron's Index; Endorsed by universities not in Kansas; Teaching courses other than English Language Arts, Life & Physical Sciences, and Mathematics; Secondary educator type; Urban school; Not charter school; Not reconstituted school; Non-title-I school; Not magnet school; School ineligible for NLSP; Not virtual school; Secondary school; and, School in other cities/areas of the respective Kansas region.