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National Center for Research on Education Access and Choice

School Choice and Competition for Teachers: Evidence from Michigan

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Technical Report

Published December 20, 2022

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Abstract

Charter schools and inter-district public school choice are a growing part of the public school system. Theoretically, competition for students might lead to competition for effective and diverse teaching faculties. This study assesses how competition from school choice relates to the distribution of teacher characteristics across school contexts, exploiting within-school temporal variation in exposure to competition from school choice – both charter schooling and inter-district school choice. I also test whether the relationship between school choice and teacher characteristics differs between charter schools and traditional public schools, or in areas with less restrictive collective bargaining agreements. Using student- and teacher-level data from 2012-13 to 2018-19, I find that growth in choice-based competition was associated with changes in the teacher workforce that were primarily positive (e.g., an increase in teacher experience and the proportion of teachers with at least a master's degree) and primarily occurring in charter schools, with very little indication of larger systemic effects in the TPS sector.

Acknowledgments

The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305C180025 to The Administrators of the Tulane Educational Fund. The opinions expressed are those of the author and do not represent views of the Institute or the U.S. Department of Education. This research result used data structured and maintained by the MERI-Michigan Education Data Center (MEDC). MEDC data is modified for analysis purposes using rules governed by MEDC and are not identical to those data collected and maintained by the Michigan Department of Education (MDE) and/or Michigan's Center for Educational Performance and Information (CEPI). Results, information and opinions solely represent the analysis, information and opinions of the author(s) and are not endorsed by, or reflect the views or positions of, grantors, MDE and CEPI or any employee thereof.

I. Introduction

Charter schools and inter-district public school choice are a growing part of the public school system. As of 2018, 47 states plus the District of Columbia had policies governing open enrollment between districts (Education Commission of the States, 2018), and as of the fall of the 2018-19 school year, there were nearly 3.3 million students enrolled in charter schools, representing approximately 7% of public school students in the country (National Center for Education Statistics, 2021).

Much of the research concerning charter schools focuses on the students who attend them, the impacts of charter attendance, and the effect—often the competitive effect—of charter growth on traditional public revenues and students (see for examples and reviews: Angrist et al., 2013; Arsen & Ni, 2012; Bettinger, 2015; Betts & Tang, 2008; Bulkley & Fisler, 2002; Cohodes & Parham, 2021; Epple et al., 2016; Gill, 2016; Han & Keefe, 2020; Jabbar et al., 2022; Jones, 2018; Ni, 2009; Winters, 2012; Zimmer & Buddin, 2009; Zimmer et al., 2012). Comparably less evidence exists on teachers employed in the charter sector, although some have argued since the early days of charter operation that as competition for students grows between traditional public and charter schools, both sectors will compete for teachers as well (Hoxby, 2003). In particular, it is possible that increased competition for students could increase the demand for high quality teachers and stimulate efforts to remove low-performing ones.

Similarly, some have argued that the competition for students induced by open-enrollment and inter-district school choice programs might also lead to efforts to recruit and retain high quality teachers (Cannata, 2008). The potential competitive effects of inter-district school choice on the distribution of teachers have been understudied, but some differences have been noted about the teachers working in districts that do and do not participate in such

programs. According to the 2003-04 Schools and Staffing Survey Data, districts that participate in inter-district choice tend to have more experienced teachers and more teachers that attended a highly selective college, than TPS districts that do not offer choice options (Cannata, 2008).

The relationship between competition from school choice and teacher quality/characteristics is currently understudied, and there are theoretical reasons to expect that this relationship might differ across various school contexts. For example, the teacher labor markets for TPSs and charter schools are often viewed as distinct or segmented (Cannata, 2011; Cohodes & Parham, 2021; Gulosino et al., 2019; Jabbar et al., 2019). Within a segmented system, wages, working conditions, and job stability would tend to differ across the sectors, and mobility between the two sectors would tend to be limited (Reich et al., 1973). Specifically, the two sectors are often described as distinct with respect to teacher characteristics (Podgursky & Ballou, 2001; Stuit & Smith, 2012), compensation (Hoxby, 2002; Podgursky & Ballou, 2001; Podgursky & Springer, 2007), and the extent to which they are governed by collective bargaining agreements (CBAs) that stipulate personnel matters related not only to compensation but staffing, retention, and dismissal (Hoxby, 2002; Podgursky & Ballou, 2001).

With segmented markets, we would not expect strong competition for teacher labor between the two sectors, but there still may be competition from within sector. For example, as charter share grows in a given geographic area (e.g., a TPS district's boundaries), charters may compete with each other for the best teachers, more so than they compete with TPSs. Similarly, as inter-district school choice grows, this may drive competitive effects primarily within the TPS sector, rather than across sectors. However, given the potential for segmented teacher labor markets, we might expect the markets to be more similar, and as a result, less segmented, in geographic areas where traditional public and charter schools operate under similar working

conditions, staffing systems, evaluation regimes, and compensation structures—for example, where traditional school districts have weaker or non-existent CBAs. As a result, there exist some school systems where charter-TPS competition for teachers may be more intense, due to growing proportions of students learning in charter schools, as well as changing labor market conditions that are making the sectors more similar, which might affect the distribution of teachers across school contexts as well. Such cases provide important opportunities to learn more about the distribution of teachers within such contexts, which has implications for school quality and student learning.

The objective in this paper is to test how within-school changes over time in exposure to competition through school choice (both charter schooling and inter-district school choice), relates to changes in teacher characteristics within the state of Michigan, a state in which charter schools have grown rapidly in number, especially in large urban areas, and where considerable variation can be found in local labor markets. While much of the existing competitive effects literature focuses on how traditional public schools respond to school choice, this study explicitly recognizes that competition goes in multiple directions across sectors, with charters and TPSs potentially competing both across and within sectors, due to the existence of both charter schooling and inter district school choice.

A contribution of this study over prior work is the ability to incorporate multiple factors related to the competition for labor: the prevalence of charter schooling, the prevalence of inter-district school choice, and – as a possible moderator variable – variation in labor market conditions within the TPS sector. Specifically, I measure variation in labor market conditions as the extent to which CBAs dictate district personnel decisions—a concept referred to as CBA restrictiveness (Strunk, 2011). In areas with less restrictive CBAs, the TPS sector theoretically

operates more similarly to charter schools at least in terms of the way in which personnel decisions are governed, and as a result, we may expect more market fluidity and less segmentation, contributing to possibly larger competitive effects. While the use of competition measures such as the share of students in charters is well established in the literature (e.g., Betts, 2009; Bohte, 2004; Sass, 2006; Zimmer & Buddin, 2009), to my knowledge, I am the first to test whether CBA policies moderate competitive effects of school choice. In particular, this study asks:

1) *What is the competitive effect of school choice (both charter and inter-district public school choice) on public school teacher characteristics?*
2) *Are these effects larger in traditional public schools or charter schools?*
3) *To what extent, if any, is the effect of school choice competition moderated by local CBA restrictiveness (as a proxy for the degree of market fluidity)?*

I focus in particular on a set of traditional indicators like teaching experience and degree attainment, which are typically valued by traditional TPS pay scales, as well as a measure of teacher racial/ethnic diversity, which is also important for student outcomes, particularly for students of color. Unfortunately, direct student-teacher links were not available in the data, so a value-added measure of teacher effectiveness is not included.

The findings indicate that growth in competition from school choice was associated with changes in the teacher workforce that were primarily beneficial (e.g., an increase in teacher experience and the proportion of teachers with at least a master's degree) and primarily occurring in charter schools, with very little indication of larger systemic effects in the TPS sector.

II. Literature Review and Theoretical Framework

Teacher labor market segmentation

Prior research has established that charter schools attract a different set of teachers than TPSs—at least in terms of typical metrics of teacher background. Teachers in charter schools are less likely to be traditionally certified (Burian-Fitzgerald & Harris, 2004; Podgursky & Ballou, 2001; Stuit & Smith, 2012) and are more likely to have a bachelor's degree as their highest degree (Epple et al., 2016), but they also tend to have undergraduate degrees from more selective institutions and majors (Baker & Dickerson, 2006; Burian-Fitzgerald & Harris, 2004; Podgursky, 2006), particularly in states that do not require teachers in charters to be certified (Baker & Dickerson, 2006).

Charter schools also tend to employ less experienced teachers (Burian-Fitzgerald & Harris, 2004; Dynarski et al., 2018; Epple et al., 2016) for a variety of reasons. Relatedly, teachers who transfer from TPS to charters tend to be less experienced (Carruthers, 2012), and charter schools tend to have higher mobility and turnover rates (Bruhn et al., 2020; Carruthers, 2012; Cowen & Winters, 2013; Dynarski et al., 2018; Epple et al., 2016; Gulosino et al., 2019; Jackson, 2012), including in Michigan (Anderson & Nagel, 2020). Teacher turnover may be higher in charter schools for many reasons. Fewer employment protections, like tenure (Podgursky & Ballou, 2001) may make teaching in charter schools less desirable in the long run (Miron & Applegate, 2007). Further, charters often serve student bodies disproportionately composed of minority students (Booker et al., 2005; Bifulco & Ladd, 2006, Witte et al., 2007; Hoxby et al., 2009), and such schools are already at risk for greater teacher attrition (Feng, 2009; Feng, 2014; Hanushek et al., 2004; Imazeki, 2005; Scafidi et al., 2007).

Charter schools also tend to employ a more racially and ethnically diverse set of teachers (Anderson & Nagel, 2020; Epple et al., 2016), which may be reflective of the concentration of charter schools in urban areas and overrepresentation of non-White students within the sector.

There is a substantial and growing body of evidence showing the benefits of a racially and ethnically diverse teacher workforce, particularly for students from similar racial/ethnic backgrounds (e.g., Dee, 2004; Egalite & Kisida, 2018; Egalite et al., 2015; Gershenson et al., 2016; Gershenson et al., 2018; Harbatkin, 2021; Lindsay & Hart, 2017; Yarnell & Bohrnstedt, 2018). As a result, teacher racial/ethnic diversity should be considered a measure of teacher quality (Gershenson et al., 2021), and is an important outcome to consider in choice contexts.

Teachers working in the two public school sectors teach in different organizational contexts. In general, relative to traditional public schools, charter schools operate with fewer personnel-related regulations such as negotiated salary schedules or employment protections. As a result, charters might be able to experiment with innovative staffing and organizational policies (Stuit & Smith, 2012). In most TPS districts, personnel decisions around compensation, layoffs, and dismissal are dictated almost entirely by CBAs (e.g., Strunk, 2011; Strunk et al., 2018). While charter school faculties may be able to unionize in some states (Podgursky & Ballou, 2001), charter schools are generally not unionized or constrained by CBAs, and such schools may have more flexibility to remove low performing teachers as a result (Ballou & Podgursky, 1997; Podgursky & Ballou, 2001). Charters are also more likely to pay teachers based on merit or performance (Dynarski et al., 2018; Gross & DeArmond, 2010; Podgursky & Ballou, 2001), college quality (Hoxby, 2002) or subject area needs or skills (Hoxby, 2002; Podgursky & Ballou, 2001), rather than solely on degree attainment and salary.

This evidence tends to suggest that the teacher labor market is segmented (Cannata, 2011; Gulosino et al., 2019). Within a segmented system, wages, working conditions, and job stability generally differ across the sectors, and mobility between the two sectors tends to be limited (Piore, 1972; Reich et al., 1973). If the markets are indeed segmented, we would not expect

strong competition for teacher labor between the charter and TPS sectors. Qualitative data from 123 teachers in San Antonio (which is 25% charter), Detroit (53% charter), and New Orleans (91% charter) indicates that barriers to mobility between the two sectors include structural barriers (e.g., salary and benefit differentials, including pay scales that do not reward teachers for prior experience outside of the district, certification requirements in TPSs, and different hiring timelines) and informal personal barriers such as teachers' perceptions, experiences, and beliefs (Jabbar et al., 2019).

Notably, Jabbar et al. (2019) find a relationship between the extent and type of market segmentation and charter school market share. In San Antonio (low charter share), labor market segmentation fit the traditional model in which the TPS sector was the primary sector with greater stability, higher pay, and better working conditions. In New Orleans (very high charter share), there appeared to be segmentation *within* the charter sector, or a form of *nested segmentation.* In Detroit, which is roughly half TPS and half charter, charter schools were viewed as the secondary market, but so was the local TPS district, Detroit Public Schools, which was struggling with instability and financial troubles. The primary (i.e., preferred) market in Detroit was the suburbs. Thus, the Jabbar et al. (2019) study suggests that the magnitude of the differences between the TPS and charter sectors may differ based on charter concentration in the area.

Further, we might expect the markets to be more similar and less segmented in geographic areas where traditional public and charter schools operate under similar working conditions, staffing systems, evaluation regimes, and compensation structures—for example, where traditional school districts have weaker or non-existent CBAs. As a result, there exist some school systems where charter-TPS competition for teachers may be more intense than

others, due to growing proportions of students learning in charter schools, as well as changing labor market conditions that are making the sectors more similar.

Competition for teachers

Advocates of school choice have long insisted that TPSs facing increases in competitive pressures may realize improvements in the distribution of teacher quality. Changes in teacher quality in response to competition may come through several mechanisms related to teacher recruitment, selection, development, retention, and removal. Hoxby (2003) argues that increased competition – which in turn affects TPS funding based on student enrollment – may incentivize TPS districts to allocate their resources towards recruiting and retaining higher quality teachers, perhaps through increased salaries.

The competitive effects on teacher quality depend, in part, on the value that parents place on academic quality generally or teacher quality specifically. On self-report surveys, parents do indicate valuing academic quality (Kleitz et al., 2000; Schneider et al., 1998), but these studies are limited by potential social desirability bias, and the use of survey-based measures that may not reflect the real-world choices and trade-offs that families face. Other studies focus on the revealed preferences of parents, as opposed to survey measures, and indicate that location and racial/socioeconomic composition are much more important than achievement or value-added. For example, Schneider and Buckley (2002) study the search patterns parents use as they navigate internet-based information about Washington, D.C. public schools (both charter and TPS), on DCSchoolSearch.com. Assuming that search patterns reveal parental preferences, and assuming that what parents look at first is what they value the most, the authors concluded that student body demographics are of primary importance, and test scores are relatively important, but there is little importance placed on teacher characteristics (Schneider & Buckley, 2002).

Jacob and Lefgren (2007) analyze requests for individual teachers, and their findings suggest that typically, parents place less value on teachers' ability to raise standardized math or reading achievement, and instead, tend to request teachers that principals describe as popular with students. However, there was notable heterogeneity within this study: while they find that parents in low-income and minority schools were less likely to request a specific teacher, they also find that in low-income and minority schools, parents value student achievement, rather than principal reports of student satisfaction with the teacher.

Hanushek and Rivkin (2003) find that increased competition (among public schools) is associated with higher teacher quality, particularly for schools serving more low-income students, although Jackson (2012), using data from 1995-2005, finds minimal effects overall, but that difficult-to-staff schools may have a harder time maintaining teacher quality and hiring effective teachers when experiencing competition from charter schools.

Since the time of Jackson's (2012) study, charter schools have increased substantially in North Carolina, and a more recent analysis by Sorensen and Holt (2021) uses North Carolina data from 2006 to 2016 to assess the effects of charter school entry on the composition of the teacher workforce in that state. They find that charter openings, overall, result in increases in teacher experience and teachers with advanced degrees in TPSs, without this translating into increases in average teacher effectiveness. They also find that the entry of charters serving predominantly White students leads to loss of veteran teachers in nearby TPS, and an increase in reliance on less experienced teachers with fewer advanced degrees.

While there is a growing literature base related to charter schools, there is very little known about the competitive effects of inter-district choice on teacher characteristics and teacher quality, but to the extent that schools face competition for students (and funding), we might

expect this to spur competition for teachers as well (Cannata, 2008). Theoretically, in both charters and TPS districts, the ability to compete for high quality teachers is directly affected by the fiscal impact of these choice policies. Reduced funding due to declining enrollment may dampen their ability to compete for teachers (due to lower revenues), while simultaneously serving as an incentive to compete for teachers in order to attract more students, and thus recover the lost funding.

While we may expect competitive pressures would induce districts to shift towards improving quality, several studies suggest that charter schooling actually reduces instructional expenditures, which is largely comprised of teacher salaries (Arsen & Ni, 2012; Bruno, 2019; Buerger & Harris, 2021; Cook 2018). In some cases, the declines in instructional expenditures were driven by decreases in per-teacher salaries (Buerger & Harris, 2021), and in others, increased student-teacher ratios (Bruno, 2019) or decreases in the number of teachers employed (Cook, 2018).

While charters tend to employ relatively novice teachers, they also generally have a more intensive feedback system and structure for new teachers, relative to TPS (Cohodes & Parham, 2021), which may result in more effective teaching. It has been suggested that one way charters can be effective is by limiting the potential negative influence of individual teachers by relying on highly structured curricula and co-planning (Cohodes et al., 2021), with this systematic approach being noted particularly within CMO-run charters (Steinberg & Yang, 2020). Further, No Excuses model schools, in particular, may use frequent observations and assessments to help guide instruction (Cohodes & Parham, 2021).

Related to teacher retention and removal, it is well-established that teacher attrition is higher in charter schools than in TPSs (Bruhn et al., 2020; Carruthers, 2012; Cowen & Winters,

2013; Dynarski et al., 2018; Epple et al., 2016; Gulosino et al., 2019; Jackson, 2012). The extent to which this translates into teacher quality gains is dependent on the types of teachers removed and retained, respectively. There is a body of evidence suggesting that the least effective teachers exit the profession at higher rates (Cowens & Winters, 2013; Feng & Sass, 2017; Goldhaber et al., 2011; Hanushek & Rivkin, 2010; Krieg, 2006), although the most effective are also found to exit at higher rates than those with average effectiveness (Feng & Sass, 2017).

It is also not yet clear in the literature whether charter schools are better at retaining higher quality teachers. In some cases, as in Florida (Cowen & Winters, 2013) and New Orleans (Barrett et al., 2022), low-performing teachers in charter schools are more likely to exit, relative to low-performing teachers in TPSs. In other words, at least in these contexts, charter schools are better than TPSs at retaining their high-performing teachers. However, Barrett et al. (2022) find that replacement teachers in the highly market-based New Orleans context tended to be of lower quality than replacement teachers in surrounding traditional districts, such that average teacher quality overall is essentially unchanged.

In addition to these two studies (Barrett et al., 2022; Cowen & Winters, 2013) suggesting that charter schools are better at retaining higher value-added teachers, evidence from Massachusetts indicates that teachers in charter schools at both ends of the value-added distribution are more likely to exit their schools, and that this pattern varies little by charter quality (Bruhn et al., 2020). In that case, the lower performing teachers in charter schools were more likely to exit public school teaching entirely, while the higher performers tended to simply switch to TPSs, suggesting that charters may serve the entire public sector by removing low performers from the profession and serving as a sort of training ground for those intending to stay. This latest evidence suggests that earlier concerns in more limited charter markets that

charters would pull more effective teachers away from TPS (e.g., Baker & Dickerson, 2006; Burian-Fitzgerald & Harris, 2004; Carruthers, 2012; Podgursky & Ballou, 2001), may not hold.

In this paper, I consider the competitive effects on teacher characteristics and quality in the state of Michigan, testing whether and how competition from two kinds of public school choice (charters, and inter-district choice) affects the teacher workforce, whether the effects differ by sector, and whether CBA strength moderates these effects.

III. Michigan Context

Michigan is a particularly appropriate context to study this issue given the state's robust charter sector and inter-district school choice availability (Michigan Department of Education, 2013). Charter schools, known in the state as public school academies (PSAs), were authorized in Michigan starting in 1993. Currently, there are no strict caps on the number of charter schools, and as of 2018-19, there were 373 charter schools serving approximately 150,000 students statewide. Michigan's charter schools can be authorized[1] by public universities, community colleges, local school boards, and intermediate school districts/regional educational service agencies (ISDs).[2] Approximately four out of every five charter schools are operated by a for-profit company (known as an education service provider, or ESP)—making Michigan among the highest for-profit sectors in the country (Miron & Gulosino, 2013).

To teach in a Michigan charter school, teachers must be certified to teach in the state's public schools, with some exceptions such as university faculty who teach in schools authorized by their institution. Collective bargaining is allowed, but as of fall 2017, teaching faculties in

[1] Authorization is distinct from operation. Authorizers decide who can open new charter schools, oversee performance, and make decisions about whether to close the school or allow a school to remain open at the end of its contract.

[2] Intermediate school districts (ISDs), sometimes referred to as Regional Education Service Agencies (RESAs) are government agencies, typically organized at the county level, that assists a group of local school districts with programs and services. For simplicity, in this paper, I refer to ISDs and RESAs interchangeably as ISDs.

fewer than ten Michigan charter schools had voted to unionize (Higgins, 2017). Teachers may be hired directly by the authorizer or by the management organization contracting with the authorizer to run the school. The vast majority of teachers working in Michigan's charter schools do not participate in the state's public school employee retirement system, although teachers in charters authorized and operated by a local TPS district generally participate, as would teachers in charters whose charter school board elect to participate.[3] Teacher tenure is typically not an option in Michigan charters.

Meanwhile, teachers in charters are subject to the same teacher evaluation laws as those in TPSs in the state. Teacher evaluation requirements were part of a broader set of reforms enacted since 2011 that had implications for employment protections for teachers working in TPS districts, particularly tenure, layoff policies, and collective bargaining. Specifically, the Michigan legislature implemented Public Acts 100-103 in July 2011 (State of Michigan, 2011). The first set of reforms (Public Acts 100-102) reduced employment protections by lengthening the time to tenure from four to five years and tying tenure and layoff decisions to teacher evaluation. Student achievement was to be included as a "significant" determinant of performance ratings, and teachers with three consecutive ratings lower than effective were to be dismissed. However, the immediate effect of these policies was likely limited by a lack of rigorous evaluation until the process was clarified further by Public Act 173 of 2015 (State of Michigan, 2015).[4]

[3] Michigan Office of Retirement Services https://www.michigan.gov/orsschools/0,4653,7-206-36450_36455---,00.html Accessed 7/9/2018

[4] Although all districts were required to evaluate teachers beginning with the 2011-12 school year, there was substantial variation in implementation across districts in terms of timing and rigor. Public Act 173 of 2015 clarified evaluation requirements to ensure the process was more "rigorous, transparent, and fair," and required school districts and charter schools to train all teachers, administrators, evaluators, and observers on the observation tools beginning in the 2016-17 school year (State of Michigan, 2015).

In sum, while Michigan teachers in both public school sectors share the same general licensure requirements and the requirement for annual performance-based evaluation (technically since 2011, but later strengthened by Public Act 173 of 2015),[5] other features of the labor market (e.g., lack of tenure, lack of collective bargaining, and less access to the public retirement system) represent very different employment conditions.

Charter schools are not the only form of school choice in the state. School districts in Michigan have faced inter-district competition since "Schools of Choice" (SoC) legislation was first implemented in 1996-1997 (Michigan Department of Education, 2013). Under Section 105 of the State School Aid Act, nonresident parents may choose to enroll their child in a participating local district within the same intermediate school district (ISD) – which generally corresponds to a county, and under Section 105C, nonresident parents may choose to enroll their child in a district outside of their ISD as well, as long as the ISD of the choice district shares a border with the family's ISD of residence. Districts are allowed but not required to receive new students through either or both of these sections, and participating districts are allowed to determine their own provisions such as caps on nonresident enrollment, the grades, schools, or programs eligible, and the timelines for enrollment. If districts participate, state funding follows the pupils into the next district. This last piece – the funding mechanism – is particularly relevant for the current study, as it implies a possible competitive effect as districts face competition for students from other nearby districts.

[5] While Public Acts 100-103 implemented a high stakes performance-based teacher evaluation system and tied promotion and layoff decisions to evaluation measures, it was not until 2016-17 that schools were required to use "rigorous, transparent, and fair" evaluation process and train all its teachers, administrators, evaluators, and observers on the observation tools (as legislated in Public Act 173 of 2015). See https://www.legislature.mi.gov/documents/2015-2016/publicact/pdf/2015-PA-0173.pdf Accessed 7/9/2018

IV. Data and Methods

I use two primary sources of data, supplemented with publicly available data as needed: 1) administrative data provided by the Michigan Department of Education and Center for Educational Performance and Information and 2) a dataset of CBA restrictiveness measures. The administrative data include seven years (2012-13 to 2018-19) of de-identified information about students and teachers in Michigan's public schools, including both charter schools (PSAs), and traditional public schools (TPSs) run by a Local Education Agency (LEA).[6]

I use the student- and teacher-level data to create variables at the school-level related to student composition and teacher composition. Observable teacher characteristics include race/ethnicity, years of teaching experience[7] and degree level[8]. Observable characteristics of students include race/ethnicity, limited English proficiency, economic disadvantage status,[9] grade level, and school attended. In total, the data represent roughly 1.5 million students and 84,000 teachers per year, working in 3,699 schools and 547 districts over the seven year panel. These include roughly 146,000 students and roughly 8,700 teachers in charter schools on average, per year.

[6] I exclude schools operated by an ISD or at the state level, which tend to be early child education centers, adult education centers, juvenile justice centers or other alternative schools, virtual schools, etc. and therefore are more niche schools that may not "compete" for students in the same way as district/LEA-run schools or charter-run schools.

[7] Years of teaching experience is based on a hire date observable in the administrative data, which is district specific. For teachers observed teaching in multiple districts within the panel, I include experience across all districts, but for some teachers who had experience in different districts prior to the beginning of the panel (2012-13), I may be underestimating their cumulative experience across multiple districts. In the administrative data, charter schools (or networks) are typically their own district. Further, because the hire date is based on employment in the district in any role, I may be overestimating the district experience *as a teacher.*

[8] Information on degree level is employer-reported, and there may be situations in which a higher degree level is not reported. As a result, this measure is not perfectly reliable, and the degree level may be underestimated in reported statistics.

[9] Economic disadvantage status = 1 if a student is identified as at least one of the following: eligible for free-and reduced-price lunch, homeless, migrant student, in foster care, or receiving either Temporary Assistance for Needy Families (TANF) or Supplemental Nutrition Assistance Program (SNAP) benefits.

I use the student-level data to construct measures of competitive pressure at the geographic district-by-year level, where a geographic district is defined by the geographic boundaries of the local education agency and includes charter schools physically located within those boundaries. For each geographic district-year combination, I calculate the share of students attending school within the geographic district that are in charter schools, to serve as a measure of charter-based competition, as well as the share of students attending school in each geographic district that are using inter-district school choice (SoC) to do so. For the preferred specifications, these two variables are summed, to obtain the percent of students enrolled in the geographic district using either type of choice, but additional models include these two percentages separately.

I also calculate two measures of choice-related student outflows from the district: the share of residents of the geographic district that leave the geographic district to attend a charter (in a different geographic district) and the share of residents that leave the district to attend another TPS district. For the preferred specifications, these are summed to obtain the percent of residents using either type of choice to attend school outside the geographic district, but additional models include these two percentages separately.

While much of the existing literature on competitive effects only captures the effect of competition on traditional public schools, these measures explicitly recognize and allow for the fact that charters also face competition – both from each other and from TPSs, particularly given the SOC policy. Additionally, all types of schools (charter and TPS) are included in the analysis, rather than just TPS schools as is common in the competitive effects literature, and all schools in the same geographic district are assumed to be treated based on the degree of competition within that geographic district.

The second major source of data includes measures of CBA restrictiveness generated from a set of district CBAs negotiated after March 2013.[10] These measures were generated using a Partial Independence Item Response (PIIR) model developed by Reardon and Raudenbush (2006) and refined by Strunk and Reardon (2010) to measure latent levels of contract restrictiveness expressed in CBA content. These measures have served as proxies of the strength of teachers' unions in in an extensive set of literature (e.g., Marianno & Strunk, 2018; Strunk et al., 2018; Strunk & Grissom, 2010). Higher restrictiveness measures indicate greater levels of employment protections for teachers and less autonomy for district leaders in personnel-related decision making. In general, charter schools in Michigan are not unionized and do not have CBAs, so for the purposes of this study a less restrictive contract in a TPS district reflects more similar employment conditions to a charter school.

For each of the key research questions, I describe the analytical approach here:

Research Question 1:

I use a two-way fixed effects approach to predict school-by-year teacher characteristics using within-school variation in exposure to competition over time:

$$Y_{sgt} = \beta_0 + \beta_1 competition_{gt} + \boldsymbol{S_{st}\gamma} + \boldsymbol{\delta_s} + \boldsymbol{\gamma_t} + \epsilon_{sgt} \quad (1)$$

Where Y_{sgt} is one of several school-by-year measures of teacher characteristics for school *s,* located in geographic district, *g,* in year *t*. The teacher-related outcomes include the percent of teachers who are non-White, average teaching experience in years, and the percent with a master's degree or higher. There is a growing body of evidence indicating that students of color in particular benefit from having a teacher of the same race (e.g., Dee, 2004; Egalite et al., 2015;

[10] A suite of state policy reforms prohibited CBAs bargained after July 2011 from governing teacher evaluation, transfer, and reassignment, performance-based compensation, classroom observations, the length of the school year, and discipline (State of Michigan, 2011). Given the recency of the data used here (2012-13 and later), I focus primarily on the post-reform measures of collective bargaining strength.

Gershenson et al., 2016; Gershenson et al., 2018; Lindsay & Hart, 2017; Yarnell & Bohrnstedt, 2018). Teacher experience is an important observable proxy of teacher quality, as teachers generally become more effective with experience both in terms of contributions to student test scores (Clotfelter et al., 2010; Goldhaber, 2007; Harris & Sass, 2011; Papay & Kraft, 2015; Rivkin et al., 2005) as well as attendance and behavior (Gershenson, 2016; Ladd & Sorenson, 2017). Degree attainment is not a strong predictor of value-added measures of teacher effectiveness (Buddin & Zamarro, 2009; Clotfelter et al., 2010; Goldhaber, 2002; Harris & Sass, 2011), but is an easily observable characteristic financially rewarded on typical district pay scales.

I test the results using alternative measures of competition from choice, indicated by $competition_{gt}$. The preferred specifications include the summary variables (i.e., the share of students enrolled in the geographic district attending a charter or using inter-district school choice to enroll in the local TPS district and the share of students residing in the geographic district who attend a charter outside the district boundaries or use inter-district school choice to attend a school outside the district). Alternative specifications split each of these into separate measures for competition from charters versus competition from SoC.

The vector $\boldsymbol{S_{st}}$ is a set of school-by-year observable characteristics that vary over time (percent of students who are Black, percent of students who are Hispanic/Latinx, percent of students who are from an other non-White racial/ethnic group, with percent White as the reference category, percent of students who are economically disadvantaged, and percent of students who are Limited English proficient), $\boldsymbol{\delta_s}$ is a vector of school fixed effects to account for time-invariant school characteristics, and $\boldsymbol{\gamma_t}$ is a vector of academic year fixed effects. The inclusion of school observable characteristics and school fixed effects reduces the influence of

confounding factors unique to a particular school setting. Academic year fixed effects account for state-wide changes in trend or temporal shocks. Standard errors, clustered at the geographic district level, are represented by ε_{sgt}.

For the teacher racial/ethnic diversity outcome in particular, it may be the case that competition for more non-White teachers will only have effects on teacher characteristics in schools with a non-trivial share of non-White students. As a result, I include a set of additional models to test whether schools with a greater share of non-White students respond to competition differentially, with respect to this outcome. To do so, I modify Equation (1) by including an interaction between school percent non-White and the competition measures.

Research Question 2:

Research question 2 asks whether the competitive effects estimated in research question 1 are larger in charters or TPSs. To test this, I modify Equation (1) to include interaction effects between a charter school indicator and the competition measures. The coefficients on these interaction terms indicate whether the relationship between competition and teacher-related outcomes differs in charter schools, relative to TPSs.

Research Question 3:

Research question 3 asks whether the competitive effects estimated in research question 1 are moderated by local CBA restrictiveness. I hypothesized that the teacher labor markets may be less segmented, more fluid, and more subject to competitive pressures, when the TPS district is operating with relative administrative flexibility, similar to charters. To test this, I modify Equation (1) to include interactions between an indicator of high CBA restrictiveness (at or above the median) and $competition_{gt}$. The coefficients on these interaction terms indicate

whether the relationship between competition and teacher-related outcomes differs in areas with more restrictive CBAs, relative to those with less restrictive CBAs.

The two-way fixed effects (TWFE) approach, similar to a difference-in-differences analysis, relies on assumptions of parallel pre-trends, and applications of the TWFE can include continuous treatments that occur at different times, as in the present study. However, with these complicated designs, it is important to understand whether past treatments affect the current outcome (de Chaisemartin & D'Haultfoeuille, 2022), while simultaneously testing for non-parallel pre-trends or other confounding factors. Assessing delayed effects, and testing for potentially problematic pre-trends can be done using a distributed-lag model (Monarrez et al., 2022). In addition, the parallel trends assumption can be relaxed through accounting for district-specific linear time trends in addition to the school and year fixed effects. Therefore, I estimate three sets of models: a standard TWFE, a standard TWFE with district-specific time trends, and a distributed-lag model.

The distributed-lag model is as follows:

$$Y_{sgt} = \alpha + \sum_{l=-2}^{3} \beta_l competition_{gt+l} + \boldsymbol{S_{st}\gamma} + \boldsymbol{\delta_s} + \epsilon_{sgt} \qquad (2)$$

Where β_l represents the effect of a set of lags and leads of competition measures, on current teacher characteristics. The lags (e.g., the measures of competition from prior school years) test whether competition has a lagged effect on these teacher characteristics, while the leads (e.g., future measures of competition from choice) test whether there may be problematic differences in pre-trends. Theoretically, future competition from choice should not have a direct effect on current outcomes, so any evidence of this would suggest differential pre-trends. Given that the panel is only seven years long, I cannot expand the set of lag and leads beyond *t-2* to *t+3*, as indicated in equation 2. Further, using the full set of lags and leads reduces the sample size considerably, so I

test the sensitivity of the results to an alternative set of current and leading variables (*t-1* to *t+3*), that allows for inclusion of a larger sample.[11]

Summary Statistics

Descriptive statistics testing for sector (i.e., charter and TPS) differences in the characteristics of students, teachers, schools, and districts are in Table 1. Comparisons are made for all charters and TPSs, for those within geographic districts with at least one charter school, and for those within high (top quartile) charter competition. Table 1 shows that charter schools tend to be smaller, and that they tend to serve a greater share of Black students and economically disadvantaged students. When comparing TPS and charter schools overall, charter schools serve more LEP students and more Hispanic students, but when the sample is restricted to areas with higher charter concentration, these patterns are reversed.

Teachers working in charters and TPSs also differ, particularly with respect to race, teaching experience, and degree attainment. Teachers in charter schools are less likely to be White, and about 28-33 percentage points less likely to have at least a master's degree. Teachers in charters tend to have roughly 5 years of experience, on average, relative to 13-14 for teachers in TPSs. When focusing in on areas where charters exist or are in higher concentration, the teacher racial diversity gap is smaller, and the student racial and economic disadvantage gaps are smaller. This suggests that charters are more similar to their nearby schools, however, there are still significant differences in teachers working in the charter and traditional public sectors even within similar geographic areas.

Table 1 also indicates – unsurprisingly – that charter schools tend to be located in areas with more competition from charters as measured by charter share. Charters tend to be located in

[11] Additional tests of lagged effects were conducted using just the current and lagged variables (e.g., from *t-3* to *t*, from *t-4* to *t*, and from *t-5* to *t*).

geographic districts with less use of SoC by non-residents to attend the local TPS district. When comparing within the geographic districts with at least one charter school, charters are also disproportionately located in district with higher use of SoC to leave the local district. In other words, charter schools tend to be located in geographic districts where the net effect of SoC is students leaving to attend other districts. In all three comparisons, charter schools tend to be located within the geographic boundaries of TPS districts with less restrictive CBAs. Charter schools are more likely to be located in cities and less likely to be located in suburbs, towns, or rural areas.

Table 2 shows the same characteristics but comparing across areas with high- and low-use of inter-district school choice (SoC), separately, by sector. Among TPSs, schools in higher SoC-use areas tend to be smaller and are more likely to be rural areas and less likely to be in cities. Within geographic districts gaining a lot of non-resident students through SoC, the TPSs serve more White students, fewer economically disadvantaged students, and fewer LEP students than TPSs with less enrollment gains through SoC. On the other hand, schools in geographic districts losing more enrollment through SoC tend to serve more Black and economically disadvantaged students. The TPSs within geographic districts with more SoC use - both inflows and outflows - tend to employ fewer female teachers, fewer with at least a master's degree, and slightly less experienced teachers than districts with less movement through SoC. When comparing within the TPS sector, CBA restrictiveness tends to be lower in areas with more SoC use.

Among charter schools, as with TPSs, student demographics in the charter schools located in high/low SoC geographic districts indicate that schools in geographic districts losing more students through SoC tend to serve more Black and economically disadvantaged students,

while schools in geographic districts gaining more students through SoC tend to serve more White and non-economically disadvantaged students. Among teachers in charters, those in geographic districts gaining more students through SoC are more likely to be White and less likely to have at least a master's degree if they are in geographic districts gaining more students through SoC, while those in geographic districts losing more students through SoC are more likely to be Black.

In summary, there are differences in student characteristics and teacher characteristics across sector (Charter v. TPS) and related to the degree of SoC use in the area. The results suggest that charters are serving more low-income, non-White, urban populations, and that teachers in charters are more racially and ethnically diverse, with fewer higher degrees and less experience. Notably, when comparing within areas with high charter concentrations, many of the sector differences in these characteristics are diminished (i.e., charters are more similar to the TPS schools near where charters tend to locate). Related to the use of SoC, geographic districts gaining students through SoC tend to be serving more observably advantaged and White students, while geographic districts losing students through SoC tend to be serving more observably disadvantaged and Black students. Teachers in TPSs in areas with more SoC use tend to have less experience and are less likely to have at least a master's degree.

V. Results

Research Question 1:

First, I set out to determine how within-school changes over time in competition from school choice are related to average teacher characteristics. The preferred specifications are in Table 3. There is little indication that changes in exposure to competition, overtime, are related to differences in teacher qualifications, on the whole. There is suggestive evidence, significant at

the 90% confidence level, that as the share of students enrolled in the geographic district using either type of choice increases, the share of teachers with a master's degree increases (see columns 16 and 18).

Alternative specifications split these competition measures into competition from charter and competition from SoC. The results, in Online Appendix Table A, suggest that the estimated effect on the share with a master's degree is no longer significant, although the positive coefficients on both the charter- and SoC shares indicates that these outcomes were related to growth in both types of school choice, rather than only one of these types. Additionally, these models show that as the share of residents leaving for charter schools outside the district increases, the average years of teaching experience in the district increases, which might reflect that due to lower student enrollments, if and when teachers leave, they are not replaced with less experienced teachers.

It is also possible that competition from school choice has a lagged or delayed effect on teacher characteristics. Interpretation of the lags (i.e., the competition measures in years prior to year *t*) in the distributed-lag model shown in Table 4 generally do not suggest this is the case, except that the share of residents using choice to leave the district in the prior year was associated with a decline in the percent of non-White teachers (see Column 4).[12] Further, the lack of significant coefficients on the leads (i.e., the competition measures in future years), supports the parallel trends assumption.

It is also hypothesized that competitive effects on teacher racial/ethnic diversity are most likely to occur in geographic districts serving a more racially diverse student body. Accordingly,

[12] Additional tests of lagged effects were conducted using just the current and lagged variables (e.g., from *t-3* to *t*, from *t-4* to *t*, and from *t-5* to *t*), and the results continue to suggest that there are not significant effects, even 3 to 5 years later. Results available from the author by request.

I tested whether there was a significant interaction between the competition measures and the school's percentage of students who are non-White. The results, in Table 5, support these findings. In schools with more non-White students, as the share of students enrolled in the geographic district who are using choice increases, the share of teachers in that school who are non-White decreases. This effect is only significant in Panel B with district-specific linear time trends, but Panel A suggests the same finding as well. The distributed-lag model (see Appendix Table B) does not indicate statistically significant delayed effects, and generally supports the parallel trends assumption, except for a marginally significant coefficient on a future competition measure in Column 2.

Research Question 2:

Table 6 shows the results of the models testing whether the relationship between choice-based competition and teacher characteristics is different in charter and TPSs. The results are generally null for the share of teachers that are non-White. Table 6 indicates that for charter schools only, as the share of residents using choice to leave the geographic district increases, the share of teachers with at least a master's degree increases, as does average years of experience.

Online Appendix Table C splits the competition measures into the competition due to charter schools and due to SoC separately. These results suggest that the relationships shown in Table 6 are still primarily only experienced by charters, and are primarily driven by competition through SoC. The exception is that within charters, as the share of residents leaving the geographic district to attend an outside charter increases, the share of teachers with at least a master's degree increases.

The corresponding distributed-lag models in Table 7 generally do not indicate that there are lagged or delayed effects of competition on teacher characteristics, as the coefficients in

Years prior to *t* are not statistically significant.[13] There is marginally significant evidence that there may be reverse causality or another confounding factors for the teacher race outcome, as indicated by the coefficient on Share of Enrollment Using Choice in Year t+3 (see Column 2).

Further, Table 5 indicated that there are competition is associated with increased teacher diversity in schools serving a greater share of non-White students. To test for differences by sector, a three-way interaction (e.g., Charter X Competition X School Pct. Non-White) was added to an alternative model specification. There are not statistically significant differences in this effect by sector, although the sign and magnitude of the coefficients on the three-way interactions suggests that these effects are greater within the charter sector. These results are available in Appendix Table D.

Research Question 3:

I hypothesized that competitive effects might be moderated by the degree to which district CBAs restrict administrative decision making. Specifically, areas with more restrictive CBAs have relatively different personnel policies, and thus, may have more segmented labor markets where the effects of competition across sectors may be less salient. The results of the test for these interaction effects are in Table 8. For areas with CBA restrictiveness below the median (where we might expect the TPS and charter teacher labor markets to be relatively similar and perhaps more competitive), as the share of students enrolled in the geographic district using choice increases, the share of teachers with at least a master's degree increases. This supports the hypothesis that competition may be more salient where the markets operate under more similar governance and labor market conditions. However, the competitive effects on years

[13] Additional tests of lagged effects were conducted using just the current and lagged variables (e.g., from *t-3* to *t*, from *t-4* to *t*, and from *t-5* to *t*), and the results provide only suggestive evidence of delayed effects, primarily for charter schools, but the findings are not consistent across model specifications. Results available from the author by request.

of experience are more positive and significant only in geographic districts where the TPS has a relatively restrictive CBA, which does not support this hypothesis. Rather, this could reflect that more restrictive CBAs tend to include provisions like last-in-first-out (LIFO) policies to remove the least experienced teachers first when layoffs are necessary. Student enrollment declines due to SoC would be more likely to increase average teaching experience in areas where this is the case, than in areas where there may be more flexibility to retain less experienced teachers instead. Combined, these findings suggest that the mechanisms for competitive effects may differ based on the teacher characteristic of interest.

Appendix Table E splits the competitive effects into those related to charter schooling, and those related to inter-district school choice (SoC). The coefficients are generally not statistically significant, but the sign and magnitude suggest that the increase in teaching experience related to use of Choice by residents to leave the district (previously shown in Table 8) is driven by both charters and SoC (see Columns 7-8 and 19-20 in Online Appendix Table E). Similarly, the increase in the share of teachers with at least a master's degree in areas with less restrictive CBAs appears to be driven by both types of public school choice (see Columns 9-10 and 21-22).

Further, the distributed-lag models shown in Table 9 do not suggest delayed effects, as none of the coefficients on the measures of competition from choice in the past are statistically significant.[14] The lack of significance of the future competition measures supports the parallel trends assumption.

[14] Additional tests of lagged effects were conducted using just the current and lagged variables (e.g., from *t-3* to *t*, from *t-4* to *t*, and from *t-5* to *t*), and the results generally suggest there are not delayed effects with one exception. As use of choice increases, teaching experience decreases two years later in geographic districts with low CBA restrictiveness and increases two years later in geographic districts with high CBA restrictiveness. Results available from the author by request.

VI. Discussion

In this paper, I set out to test whether competition from school choice – both charter schooling and inter-district school choice – may have affected the characteristics of teachers in Michigan's public schools. A contribution of this study, over much of the existing competitive effects literature focusing only on TPS reactions to charter schooling, is the recognition that – in a state with a robust charter school sector and inter-district school choice, competition can go in multiple directions both across and within sectors.

Basic descriptive statistics demonstrate important differences by sector and by the magnitude of competition. Charters are serving more low-income, non-White, urban populations, and teachers in that sector tend to be more racially and ethnically diverse, with fewer advanced degrees and less experience. Notably, when comparing within areas with high charter concentrations, many of the sector differences in these characteristics are diminished (i.e., charters are more similar to the TPS schools near where charters tend to locate). Geographic districts gaining students through SoC tend to be serving more economically advantaged students and White students, while geographic districts losing students through SoC tend to be serving more observably disadvantaged and Black students. Teachers in TPSs in areas with more SoC use tend to have less experience and are less likely to have at least a master's degree.

To isolate the relationship between choice-based competition and teacher characteristics, apart from other school factors such as geography, resources, policy, and demographics, I estimate competitive effects using a two way fixed effects approach exploiting within-school temporal changes in exposure to competition. On average – when not differentiating by sector or the degree of restrictiveness of the local TPS district's CBA - there is little statistically significant evidence of competitive effects on teacher characteristics.

Teacher diversity is increasingly recognized as an important aspect of teacher quality, and one in which charter schools in particular seem to have a competitive advantage. Therefore, whether choice induces efforts to recruit or retain a more diverse student body is an important empirical question. There are competitive effects on teacher racial diversity within schools serving more non-White students. Specifically, schools that serve more non-White students are more likely to employ more non-White teachers as the share of students enrolled in the geographic district using choice increase. Investigations into whether this differed by sector provide suggestive evidence (not statistically significant), that these effects may be larger and more positive in charter schools.

Further, when testing for differences across the sectors, there is evidence that charter schools in particular are experiencing effects of competition on the share of teachers with at least a master's degree and the average years of experience. Notably, these competitive effects are also primarily driven by competition through SoC. In other words, as the use of SoC increase, charter schools tend to employ more experienced and higher educated teachers, but TPSs are not responding in the same way. The competitive effects on teacher experience suggest that in environments with competitive pressures due to SoC, charter schools may have responded by trying to retain teachers. Further, the competitive effects on teacher degree level might indicate that competition was inducing charter schools to recruit and retain teachers with higher degrees (or encourage their current staff to obtain them). This may in part be because higher degrees are an observable characteristic that is recognized and rewarded in the TPS sector's pay scales, and because it is easily communicable to families choosing where to send their students. Unfortunately, level of degree attained is not highly correlated with teacher value-added (Buddin & Zamarro, 2009; Clotfelter et al., 2010; Goldhaber, 2002; Harris & Sass, 2011), so it is possible

this represents a misallocation of effort towards an easily observable – but less important – qualification, as opposed to meaningful instruction.

It was also hypothesized that the teacher labor markets in the two public school sectors may be less segmented, and therefore competition more salient, in areas where the local TPS district's CBA is less restrictive. Some findings supported this hypothesis, while others provided evidence against it. Competitive effects on the share of teachers with at least a master's degree were only positive and significant in low-restrictiveness areas, supporting the hypothesis that competition may be more salient in less restrictive areas. However, competition was leading to increased teacher experience only in areas where the local TPS had a more restrictive CBA. More restrictive TPS districts may have LIFO or other policies that prioritize retaining teachers with more experience and letting less experienced teachers go, if there are declines in enrollment and necessary teacher layoffs as a result. In such an environment, we would expect average teacher experience to increase if competition was leading to declines in student enrollment.

Overall, the findings indicate some benefits of competition in terms of observable characteristics of teachers, but these effects are limited to certain types of schools and schooling contexts. In many cases, only charters – not TPSs – are responding to competition, even when that competition is increasingly coming from inter-district school choice. This suggests that the competition between TPS districts may still not be salient enough to be driving differences in the composition of the teacher workforce.

In summary, while there is some evidence of limited competitive effects, these results may be disappointing to those hoping that school choice will induce competition in ways that improve teacher quality and learning across the public school sector. Proponents argue that a key benefit of charters is that they have more flexibility to be innovative and can apply competitive

pressure on TPS systems to improve. At least in terms of the limited outcomes tested here, there does not seem to be substantial competitive effects on TPS teacher characteristics. Rather, in response to competition, charter schools were increasingly relying on an imperfect but easily observable measurable indicator of quality (degree attainment). In this case, rather than a tide lifting all boats (Hoxby, 2003), a possible interpretation is one of institutional isomorphism (DiMaggio and Powell, 1983), in which there are pressures to resemble other pre-existing units in the environment. These isomorphic pressures have been discussed in the literature in relation to charter schooling (Bulkley, 1999; Huerta & Zuckerman, 2009; Renzulli et al., 2015), and raise doubts about early framing of charter schools as "laboratories of innovation" (Kahlenberg & Potter, 2015).

There are several limitations of this study that could be addressed through continued work in this area. There are potential concerns that charter and SoC growth was not exogenous. When plausibly exogenous shocks to supply are available (e.g., a removal of a cap on charter growth, as in Sorensen and Holt (2021)), these shocks can be used in an instrumental variables framework, but Michigan has effectively operated without a cap throughout this time period. While the use of district-specific linear trends and the distributed-lag tests support causal interpretation in the majority of cases, it raises concerns in others, so these results should be interpreted with caution.

Ideally, the teacher characteristics included here would also include a value-added measure of teacher effectiveness, but due to data limitations, teachers and students cannot be directly linked, and value-added measures were not estimable. Administrative data – particularly for degree attainment and teaching experience – are imperfect measures. Degree attainment may be underestimated and teaching experience may be overestimated (due to prior work experience

in the district as something other than a teacher) or underestimated (due to prior teaching experience in a prior district in years prior to the beginning of the panel). These, and other limitations of quantitative analyses using administrative data would benefit from qualitative or mixed-methods to help confirm the results and aid interpretation of the findings. Future work could also focus on teacher moves between schools, districts, and sectors in response to these competitive forces, but that was outside the scope of this study, which was focused on the composition of teaching faculties at the school level.

In summary, the limited findings indicate that a relatively high degree of labor market segmentation remains, and that even when competitive pressures exist, charter schools – as opposed to TPSs – appear to be in the unique position to respond, likely due to the greater administrative flexibility provided to charters.

References

Anderson, K. P., & Nagel, J. (2020). Crossing Over? Mobility of Early Career Charter and Traditional Public School Teachers during an Era of Reform. *Journal of School Choice*, 1-34.

Angrist, J. D., Pathak, P. A., & Walters, C. R. (2013). Explaining charter school effectiveness. *American Economic Journal: Applied Economics, 5*(4), 1-27.

Arsen, D., & Ni, Y. (2012). The effects of charter school competition on school district resource allocation. *Educational Administration Quarterly, 48*(1), 3-38.

Baker, B., & Dickerson, J. (2006). Charter schools, teacher labor market deregulation, and teacher quality: Evidence from the Schools and Staffing Survey. *Educational Policy, 20* (5), 752-778.

Ballou, D. & Podgursky, M. J. (1997). *Teacher pay and teacher quality*.Upjohn Institute for Employment Research.

Barrett, N., Carlson, D., Harris, D. N., & Lincove, J. A. (2022). When the walls come down: Evidence on charter schools' ability to keep their best teachers without unions and certification rules. *Educational Evaluation and Policy Analysis*, *44*(2), 01623737211047265.

Bettinger, E. P. (2005). The effect of charter schools on charter students and public schools. *Economics of Education Review, 24*(2), 133-147.

Betts, J. R. (2009). The competitive effects of charter schools on traditional public schools. In M. Berends, M. G. Springer, D. Ballou, & H. Walberg (Eds.), *Handbook of research on school choice* (pp. 195-208).

Betts, J. R., & Tang, Y. E. (2008). Charter schools and student achievement: A review of the evidence. In R. Lake (Ed.), *Hopes, fears, and reality: A balanced look at American charter schools in 2008* (pp. 1-8).

Bifulco, R., & Ladd, H. F. (2006). The impacts of charter schools on student achievement: Evidence from North Carolina. *Education Finance and Policy, 1*(1), 50– 90.

Bohte, J. (2004). Examining the impact of charter schools on performance in traditional public schools. *Policy Studies Journal, 32*(4), 501– 20.

Booker, K., Zimmer, R., & Buddin, R. (2005). *The effect of charter schools on school peer composition.* RAND Working Paper No. WR-306-EDU. Retrieved 11/6/19 from: https://www.rand.org/pubs/working_papers/WR306.html

Bruhn, J., Imberman, S., & Winters, M. (2020). *Regulatory arbitrage in teacher hiring and retention: Evidence from Massachusetts charter schools.* (EdWorkingPaper: 20-264). https://doi.org/10.26300/83ff-gd98

Bruno, P. (2019). Charter competition and district finances: Evidence from California. *Journal of Education Finance, 44*(4), 361-384.

Buddin, R., & Zamarro, G. (2009). Teacher qualifications and student achievement in urban elementary schools. *Journal of Urban Economics, 66,* 103-115.

Buerger, C., & Harris, D. N. (2021). The impact of government contracting out on spending: The case of public education in New Orleans. *The American Review of Public Administration*, *51*(2), 139-154.

Bulkley, K. (1999). Charter school authorizers: A new governance mechanism?. *Educational Policy, 13*(5), 674-697.

Bulkley, K., & Fisler, J. (2002). *A review of the research on charter schools*. CPRE Web Paper Series WP-01. Consortium for Policy Research in Education.

Burian-Fitzgerald, M., & Harris, D. (2004). *Teacher recruitment and teacher quality? Are charter schools different?* Policy Report Number 20. Education Policy Center, Michigan State University

Cannata, M. (2008). *Teacher qualifications and work environments across school choice types. Education* and the Public Interest Center and Education Policy Research Unit. https://nepc.colorado.edu/sites/default/files/CHOICE-06-Cannata2.pdf

Cannata, M. A. (2011). Charter schools and the teacher job search. *Journal of School Choice, 5*, 111–133.

Carruthers, C. K. (2012). The qualifications and classroom performance of teachers moving to charter schools. *Education Finance and Policy, 7*(3), 233-268.

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2010). Teacher credentials and student achievement in high school: A cross-subject analysis with fixed effects. *Journal of Human Resources, 45*(3), 655–81.

Cohodes, S. R., & Parham, K. S. (2021). *Charter Schools' Effectiveness, Mechanisms, and Competitive Influence.* NBER Working Paper No. 28477.

Cohodes, S. R., Setren, E. M., & Walters, C. R. (2021). Can successful schools replicate? Scaling up Boston's charter school sector. *American Economic Journal: Economic Policy, 13*(1): 138-167.

Cook, J. B. (2018). The effect of charter competition on unionized district revenues and resource allocation. *Journal of Public Economics, 158,* 48-62.

Cowen, J. M., & Winters, M. A. (2013). Do charters retain teachers differently? Evidence from elementary schools in Florida. *Education Finance and Policy, 8*(1), 14-42.

De Chaisemartin, C., & D'Haultfoeuille, X. (2022). *Two-way fixed effects and differences-in-differences with heterogeneous treatment effects: A survey* (No. w29691). National Bureau of Economic Research.

Dee, T. S. (2004). Teachers, race, and student achievement in a randomized experiment. *Review of Economics and Statistics, 86*(1), 195-210.

DiMaggio, P., & Powell, W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review, 48,* 147-160

Dynarski, S., Hubbard, D., Jacob, B., & Robles, S. (2018). *Estimating the effects of a large for-profit charter school operator.* NBER Working Paper 24428. Retrieved 11/6/19 from: http://www.nber.org/papers/w24428

Education Commission of the States. (October 2018). *50-State Comparison: Open Enrollment Policies (2018 Update).* Retrieved 11/7/19 from: https://www.ecs.org/open-enrollment-policies/

Egalite, A. J., & Kisida, B. (2018). The effects of teacher match on students' academic perceptions and attitudes. *Educational Evaluation and Policy Analysis, 40*(1), 59-81.

Egalite, A. J., Kisida, B., & Winters, M. A. (2015). Representation in the classroom: The effect of own-race teachers on student achievement. *Economics of Education Review, 45*, 44-52.

Epple, D., Romano, R., & Zimmer, R. (2016). Charter schools: A survey of research on their characteristics and effectiveness. In E. A. Hanushek, S. Machin, L. Woessmann (Eds.), *Handbook of the Economics of Education*, Vol. 5.

Feng, L. (2009). Opportunity wages, classroom characteristics, and teacher mobility. *Southern Economic Journal*, 1165-1190.

Feng, L. (2014). Teacher placement, mobility, and occupational choices after teaching. *Education Economics, 22*(1), 24-47.

Feng, L., & Sass, T. R. (2017). Teacher quality and teacher mobility. *Education Finance and Policy, 12*(3), 396-418.

Gershenson, S. (2016). Linking teacher quality, student attendance, and student achievement. *Education Finance and Policy, 11*, 125–149.

Gershenson, S., Hansen, M., & Lindsay, C. A. (2021). *Teacher diversity and student success.* Harvard Education Press.

Gershenson, S., Hart, C. M., Hyman, J., Lindsay, C., Papageorge, N. W. (2018). *The Long-run Impacts of Same-race Teachers.* NBER Working Paper 25254. http://www.nber.org/papers/w25254

Gershenson, S., Holt, S. B., & Papageorge, N. W. (2016). Who believes in me? The effect of student–teacher demographic match on teacher expectations. *Economics of Education Review, 52*, 209-224.

Gill, B. P. (2016). The effect of charter schools on students in traditional public schools: A review of the evidence. *Education Next,* 1-4.

Goldhaber, D. (2002). Mystery of good teaching: the evidence shows that good teachers make a clear difference in student achievement. The problem is that we don't really know what makes a good teacher. (Feature). *Education Next, 2*(1), 50-55.

Goldhaber, D. (2007). Everyone's doing it, but what does teacher testing tell us about teacher effectiveness? *Journal of Human Resources, 42*(4), 765-794.

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

Gross, B., & DeArmond, M. (2010). How do charter schools compete for teachers? A local perspective. *Journal of School Choice, 4*(3), 254-277.

Gulosino, C., Ni, Y., & Rorrer, A. K. (2019). Newly hired teacher mobility in charter schools and traditional public schools: An application of segmented labor market theory. *American Journal of Education, 125*(4), 547-592.

Han, E. S., & Keefe, J. (2020). The impact of charter school competition on student achievement of traditional public schools after 25 years: Evidence from national district-level panel data. *Journal of School Choice, 14*(3), 429-467.

Hanushek, E. A, & Rivkin, S. G. (2003). Does public school competition affect teacher quality? In C. Hoxby (Ed.), *The Economic Analysis of School Choice.* University of Chicago Press.

Hanushek, E. A., & Rivkin, S. G. (2010). *Constrained job matching: Does teacher job search harm disadvantaged urban schools?* (No. w15816). National Bureau of Economic Research.

Hanushek, E. A., Kain, J. F., & Rivkin, S. G. (2004). Why public schools lose teachers. *Journal of Human Resources, 39*(2), 326–54.

Harbatkin, E. (2021). Does student-teacher race match affect course grades?. *Economics of Education Review, 81*, 102081.

Harris, D., & Sass, T. (2011). Teacher training, teacher quality, and student achievement. *Journal of Public Economics, 9*(7-8), 798-812.

Higgins, L. (October 16, 2017). Detroit charter school teachers vote to unionize. *Detroit Free Press.* Retrieved 1/30/2018 from

https://www.freep.com/story/news/education/2017/10/16/detroit-charter-school-teachers-unionize/767771001/

Hoxby, C. M. (2002). Would school choice change the teaching profession? *Journal of Human Resources, 37*(4), 846–91.

Hoxby, C. M. (2003). School choice and school productivity. Could school choice be a tide that lifts all boats?. In C. M. Hoxby (Ed.) *The economics of school choice* (pp. 287-342). University of Chicago Press.

Hoxby, C. M., Murarka, S., & Kang, J. (2009). *How New York City's charter schools affect achievement.* New York City Charter Schools Evaluation Project.

Huerta, L. A., & Zuckerman, A. (2009). An institutional theory analysis of charter schools: Addressing institutional challenges to scale. *Peabody Journal of Education, 84*(3), 414-431.

Imazeki, J. (2005). Teacher salaries and teacher attrition. *Economics of Education Review, 24*(4), 431-449.

Jabbar, H., Castro, A., & Germain, E. (2019). To Switch or Not to Switch? The Influence of School Choice and Labor Market Segmentation on Teachers' Job Searches. *Educational Evaluation and Policy Analysis, 41*(3), 375-399.

Jabbar, H., Fong, C. J., Germain, E., Li, D., Sanchez, J., Sun, W. L., & Devall, M. (2022). The competitive effects of school choice on student achievement: A systematic review. *Educational Policy*, 0895904819874756.

Jackson, C. K. (2012). School competition and teacher labor markets: Evidence from charter school entry in North Carolina. *Journal of Public Economics, 96*(5-6), 431-448.

Jacob, B. A., & Lefgren, L. (2007). What do parents value in education? An empirical investigation of parents' revealed preferences for teachers. *The Quarterly Journal of Economics*, *122*(4), 1603-1637.

Jones, P. A. (2018). The influence of charter school competition on public school district revenues across the U.S. *Journal of Education Finance, 43*(4), 327-359.

Kahlenberg, R. D., & Potter, H. (2015). Restoring Shanker's Vision for Charter Schools. *American Educator, 38*(4), 4.

Kleitz, B., Weiher, G. R., Tedin, K., & Matland, R. (2000). Choice, charter schools, and household preferences. *Social Science Quarterly*, 846-854.

Krieg, J. M. (2006). Teacher quality and attrition. *Economics of Education Review, 25*(1), 13-27.

Ladd, H. F., & Sorensen, L. C. (2017). Returns to teacher experience: Student achievement and motivation in middle school. *Education Finance and Policy, 12,* 241–279.

Lindsay, C. A., & Hart, C. M. (2017). Exposure to same-race teachers and student disciplinary outcomes for Black students in North Carolina. *Educational Evaluation and Policy Analysis, 39*(3), 485-510.

Marianno, B. D., & Strunk, K. O. (2018). The bad end of the bargain?: Revisiting the relationship between collective bargaining agreements and student achievement. *Economics of Education Review, 65,* 93–106.

Michigan Department of Education. (July 19 2013). Section 105/105C – Schools of Choice Definitions. https://www.michigan.gov/documents/mde/Schools_of_Choice_Definitions_Rev_427882_7.pdf

Miron, G., & Applegate, B. (2007). *Teacher attrition in charter schools*. Great Lakes Center for Education Research and Practice. Retrieved 6/28/2018 from http://greatlakescenter.org/docs/Research/Miron_Attrition.pdf

Miron, G., & Gulosino, C. (2013). *Profiles of for-profit and nonprofit education management organizations: Fourteenth Edition—2011-2012*. Boulder, CO: National Education Policy Center. Retrieved 1/24/2018 from http://nepc.colorado.edu/publication/EMO-profiles-11-12

Monarrez, T., Kisida, B., & Chingos, M. M. (2022). The Effect of Charter Schools on School Segregation. *American Economic Journal: Economic Policy, 14*(1), 301-340.

National Center for Education Statistics. (2021). *Public Charter School Enrollment*. Retrieved from: https://nces.ed.gov/programs/coe/indicator/cgb

Ni, Y. (2009). The impact of charter schools on the efficiency of traditional public schools: Evidence from Michigan. *Economics of Education Review, 28*(5), 571-584.

Papay, J. P., & Kraft, M. A. (2015). Productivity returns to experience in the teacher labor market: Methodological challenges and new evidence on long-term career improvement. *Journal of Public Economics, 130*, 105-119.

Piore, M. J. (1972). *Notes for a theory of labor market stratification.* Retrieved from: https://dspace.mit.edu/bitstream/handle/1721.1/64001/notesfortheoryof00pior.pdf

Podgursky, M. (2006). *Teams versus bureaucracies: Personnel policy, wage-setting, and teacher quality in traditional public, charter, and private schools.* Education Working Paper Archive.

Podgursky, M., & Ballou, D. (2001). *Personnel Policy in Charter Schools*. Thomas B. Fordham Institute. Retrieved from: https://eric.ed.gov/?id=ED456567.

Podgursky, M., & Springer, M. (2007). Teacher performance pay: A review. *Journal of Policy Analysis and Management, 26*(4), 909-949.

Reardon, S. F., & Raudenbush, S.W. (2006). A partial independence item response model for surveys with filter questions. *Sociological Methodology 36*, 257–300.

Reich, M., Gordon, D. M., & Edwards, R. C. (1973). A theory of labor market segmentation. The *American Economic Review, 63,* 359–365.

Renzulli, L. A., Barr, A. B., & Paino, M. (2015). Innovative education? A test of specialist mimicry or generalist assimilation in trends in charter school specialization over time. *Sociology of Education, 88*(1), 83-102.

Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica, 73*(2), 417-458.

Sass, T.R. (2006). Charter schools and student achievement in Florida. *Education Finance and Policy, 1*(1), 91– 122.

Scafidi, B., Sjoquist, D. L., & Stinebrickner, T. R. (2007). Race, poverty, and teacher mobility. *Economics of Education Review, 26*(2), 145-159.

Schneider, M., & Buckley, J. (2002). What do parents want from schools? Evidence from the Internet. *Educational Evaluation and Policy Analysis*, *24*(2), 133-144.

Schneider, M., Marschall, M., Teske, P., & Roch, C. (1998). School choice and culture wars in the classroom: What different parents seek from education. *Social Science Quarterly*, 489-501.

Sorensen, L. C., & Holt, S. B. (2021). Sorting it out: The effects of charter expansion on teacher and student composition at traditional public schools. *Economics of Education Review, 82*, 102095.

State of Michigan. (2011). 96th Regular Session of 2011 Public Acts 4, 100-103. Retrieved 10/30/18 from https://www.legislature.mi.gov/documents/2011-2012/publicact/htm/2011-PA-0004.htm http://www.legislature.mi.gov/(S(shpnxyzelc5gk4bdylhw3wuz))/documents/2011-2012/publicact/pdf/2011-PA-0100.pdf; http://www.legislature.mi.gov/(S(z1qtzld2isehc0wpzfqeppzt))/documents/2011-2012/publicact/pdf/2011-PA-0101.pdf ; https://www.legislature.mi.gov/documents/2011-2012/publicact/htm/2011-PA-0102.htm ; http://www.legislature.mi.gov/(S(f4zpymrzyn3defdbjquqjzwy))/documents/2011-2012/publicact/pdf/2011-pa-0103.pdf

State of Michigan. (2015). 98th Regular Session of 2015 Public Act 173. Retrieved 9/25/18 from https://www.legislature.mi.gov/documents/2015-2016/publicact/pdf/2015-PA-0173.pdf

Steinberg, M. P., & Yang, H. (2020). *Teacher effectiveness and improvement in charter and traditional public schools.* Thomas B. Fordham Institute.

Strunk, K. O. (2011). Are teachers unions really to blame? *Education Finance and Policy, 6*(3),

354–98.

Strunk, K. O., Cowen, J., & Goldhaber, D., Marianno, B., Kilbride, T. & Theobald, R. (2018). It is in the contract: How the policies set in teachers' unions' collective bargaining agreements vary across states and districts." *Educational Policy, 32*(3), 280-310.

Strunk, K. O., & Grissom, J. A. (2010). Do strong unions shape district policies?: Collective bargaining, teacher contract restrictiveness, and the political power of teachers' unions. *Educational Evaluation and Policy Analysis, 32*(3), 389–406. https://doi.org/10.3102/0162373710376665

Strunk, K. O., & Reardon, S. F. (2010). Measuring the Strength of Teachers' Unions: An Empirical Application of the Partial Independence Item Response Approach. *Journal of Educational and Behavioral Statistics, 35*(6), 629–670. https://doi.org/10.3102/1076998609359790

Stuit, D. A., & Smith, T. M. (2012). Explaining the gap in charter and traditional public school teacher turnover rates. *Economics of Education Review, 31*(2), 268-279.

Winters, M. A. (2012). Measuring the effect of charter schools on public school student achievement in an urban environment: Evidence from New York City. *Economics of Education review, 31*(2), 293-301.

Witte, J., Weimer, D., Shober, A., & Schlomer, P. (2007). The performance of charter schools in Wisconsin. *Journal of Policy Analysis and Management, 26*(3), 557-573.

Yarnell, L. M., & Bohrnstedt, G. W. (2018). Student-teacher racial match and its association with Black student achievement: An exploration using multilevel structural equation modeling. *American Educational Research Journal, 55*(2), 287-324.

Zimmer, R., & Buddin, R. (2009). Is charter school competition in California improving the performance of traditional public schools?. *Public Administration Review, 69*(5), 831-845.

Zimmer, R., Gill, B., Booker, K., Lavertu, S., & Witte, J. (2012). Examining charter student achievement effects across seven states. *Economics of Education Review, 31*(2), 213-224.

Table 1: Average school-by-year characteristics, comparing by degree of charter presence

	All TPS and Charter Schools			Schools Within Geo. Dist. With at Least One Charter			Schools Within Geo. Dist. in the Top Quartile of Student Share in Charters		
	TPS	Charter	Diff.	TPS	Charter	Diff.	TPS	Charter	Diff.
Number of school-year observations	20559	2556		8876	2556		3978	1803	
Student Characteristics									
Avg. Num. of Students	460.4	399.0	-61.4 ***	512.5	399.0	-113.5 ***	456.9	451.4	-5.5
Pct. Female	47.8%	48.4%	0.6% ***	47.5%	48.4%	0.9% ***	47.0%	48.7%	1.8% ***
Pct. White	70.8%	34.9%	-35.9% ***	56.8%	34.9%	-21.9% ***	39.8%	24.0%	-15.8% ***
Pct. Black	14.4%	49.5%	35.0% ***	25.5%	49.5%	24.0% ***	41.5%	60.6%	19.1% ***
Pct. Hispanic	7.5%	8.4%	0.9% ***	8.7%	8.4%	-0.3%	11.1%	9.0%	-2.1% ***
Pct. Other Race	7.3%	7.2%	-0.1%	9.0%	7.2%	-1.7% ***	7.7%	6.3%	-1.3% ***
Pct. Econ. Dis.	53.5%	76.1%	22.6% ***	58.3%	76.1%	17.8% ***	73.1%	82.4%	9.3% ***
Pct. LEP	5.6%	8.6%	3.0% ***	9.1%	8.6%	-0.5%	11.5%	9.9%	-1.6% ***
Geographic District Level Measures									
Pct. Enrollees Attending a Charter School	7.2%	27.8%	20.6% ***	16.8%	27.8%	11.1% ***	28.7%	36.1%	7.4% ***
Pct. Enrollees Using SoC	9.5%	4.6%	-4.9% ***	5.5%	4.6%	-0.9% ***	4.6%	3.7%	-0.9% ***
Pct. Res. Attending Outside Charter School	3.1%	7.6%	4.6% ***	4.8%	7.6%	2.9% ***	7.7%	9.8%	2.1% ***
Pct. Res. Using SoC to Attend Outside TPS	9.0%	8.9%	-0.1%	7.7%	8.9%	1.2% ***	10.4%	10.0%	-0.4%
CBA Restrictiveness	0.16	0.13	-0.02 **	0.30	0.13	-0.17 ***	0.20	0.06	-0.14 ***
Teacher Characteristics									
Avg. Num. of Teachers	25.55	23.81	-1.74 ***	28.51	23.81	-4.70 ***	25.78	26.36	0.58
Avg. Years Teaching Experience	13.42	5.02	-8.40 ***	13.76	5.02	-8.74 ***	13.81	4.97	-8.84 ***
Pct. Female	74.7%	76.0%	1.2% ***	77.3%	76.0%	-1.3% ***	76.8%	76.0%	-0.8% *
Pct. White	91.7%	78.1%	-13.6% ***	85.9%	78.1%	-7.8% ***	76.9%	72.8%	-4.0% ***
Pct. Black	4.5%	15.5%	11.0% ***	9.0%	15.5%	6.4% ***	16.9%	20.0%	3.1% ***
Pct. Hispanic	1.1%	1.8%	0.7% ***	1.5%	1.8%	0.2% **	2.0%	1.9%	0.0%
Pct. Other Race	2.7%	4.6%	1.9% ***	3.5%	4.6%	1.1% ***	4.3%	5.2%	0.9% ***
Pct. with Masters or Higher	59.4%	31.3%	-28.1% ***	64.7%	31.3%	-33.5% ***	62.0%	33.4%	-28.6% ***
School Locale									
Pct. in Cities	19.9%	54.7%	34.7% ***	42.1%	54.7%	12.6% ***	56.8%	64.8%	8.0% ***
Pct. In Suburbs	38.5%	32.0%	-6.4% ***	41.7%	32.0%	-9.7% ***	32.6%	27.5%	-5.1% ***
Pct. in Towns	15.3%	7.1%	-8.1% ***	9.9%	7.1%	-2.7% ***	3.9%	2.9%	-1.0% *
Pct. Rural	26.3%	6.2%	-20.1% ***	6.3%	6.2%	-0.1%	6.7%	4.8%	-1.9% ***

Note. Comparing school-by-year observations across seven years from 2012-13 to 2018-19. Econ. Dis. = Economically Disadvantaged, as indicated by having at least one of the following: free-and-reduced price lunch eligibility, migrant status, foster status, homeless status, or receipt of TANF or SNAP benefits. LEP = Limited English Proficient. SoC = inter-district school choice a.k.a. Schools of Choice. Res. = Residents. TPS = Traditional public school. CBA = Collective Bargaining Agreement. ELA = English Language Arts. Charter schools generally do not have CBA agreements, so the CBA Restrictiveness for charters refers to the restrictiveness of the CBA in the TPS district in which they are geographically located. Similarly, while charter schools technically do not lose or gain students through 105 or 105C Schools of Choice in Michigan, the rates shown here for charter schools refer to the rates in the TPS district in which the charters are geographically located. *** p<0.01, ** p<0.05, * p<0.1

Table 2: Average school-by-year characteristics, comparing schools in geographic areas with high v. low Schools of Choice use (separately by sector)

	TPS: Comparing within Geog. Districts with High/Low Use of SoC As a Share of Enrollment			TPS: Comparing within Geog. Districts with High/Low Use of SoC As a Share of Residents			Charter Schools: Comparing within Geog. Districts with High/Low Use of SoC As a Share of Enrollment			Charter Schools: Comparing within Geog. Districts with High/Low Use of SoC As a Share of Residents		
	Less than Median	At Least Median	Diff.	Less than Median	At Least Median	Diff.	Less than Median	At Least Median	Diff.	Less than Median	At Least Median	Diff.
Number of school-year observations	9689	10870		10279	10280		1855	701		1278	1278	
Student Characteristics												
Avg. Num. of Students	487.5	436.3	-51.2 ***	522.5	398.3	-124.2 ***	413.9	359.4	-54.5 ***	401.8	396.2	-5.6
Pct. Female	47.6%	47.9%	0.3% ***	47.9%	47.7%	-0.2% ***	48.3%	48.4%	0.1%	48.1%	48.6%	0.5%
Pct. White	64.0%	76.8%	12.8% ***	72.5%	69.0%	-3.5% ***	29.2%	50.0%	20.8% ***	38.9%	30.9%	-8.0% ***
Pct. Black	19.3%	10.1%	-9.2% ***	11.8%	17.1%	5.3% ***	55.0%	34.6%	-20.4% ***	44.4%	54.5%	10.1% ***
Pct. Hispanic	8.9%	6.2%	-2.7% ***	7.4%	7.5%	0.1%	9.6%	5.3%	-4.3% ***	8.7%	8.1%	-0.6%
Pct. Other Race	7.8%	6.9%	-0.9% ***	8.3%	6.4%	-1.9% ***	6.2%	10.0%	3.8% ***	8.0%	6.5%	-1.5% ***
Pct. Econ. Dis.	54.8%	52.4%	-2.4% ***	45.2%	61.9%	16.7% ***	79.0%	68.4%	-10.6% ***	72.9%	79.3%	6.3% ***
Pct. LEP	7.7%	3.8%	-3.9% ***	7.0%	4.2%	-2.8% ***	9.6%	6.0%	-3.6% ***	10.3%	6.9%	-3.4% ***
Geographic District Level Measures												
Pct. Enrollees Attending a Charter School	11.1%	3.8%	-7.3% ***	7.2%	7.3%	0.1%	31.3%	18.6%	-12.7% ***	25.4%	30.3%	4.9% ***
Pct. Enrollees Using SoC	1.8%	16.5%	14.7% ***	5.7%	13.4%	7.7% ***	1.6%	12.5%	10.8% ***	3.4%	5.9%	2.5% ***
Pct. Res. Attending Outside Charter School	4.0%	2.2%	-1.8% ***	2.9%	3.3%	0.4% ***	9.0%	4.0%	-5.0% ***	7.6%	7.7%	0.1%
Pct. Res. Using SoC to Attend Outside TPS	5.9%	11.8%	5.9% ***	2.5%	15.5%	13.1% ***	7.8%	12.1%	4.3% ***	3.0%	14.8%	11.8% ***
CBA Restrictiveness	0.21	0.11	-0.10 ***	0.25	0.06	-0.19 ***	0.11	0.18	0.07 ***	0.12	0.15	0.03
Teacher Characteristics												
Avg. Num. of Teachers	27.3	23.9	-3.4 ***	29.0	22.1	-6.9 ***	24.7	21.5	-3.1 ***	24.4	23.2	-1.2 *
Avg. Years Teaching Experience	13.77	13.11	-0.65 ***	13.52	13.32	-0.19 ***	4.95	5.19	0.23 **	5.00	5.03	0.03
Pct. Female	76.2%	73.4%	-2.8% ***	76.1%	73.4%	-2.8% ***	75.8%	76.5%	0.8%	75.8%	76.1%	0.3%
Pct. White	87.8%	95.2%	7.4% ***	92.0%	91.3%	-0.7% ***	74.1%	88.6%	14.4% ***	78.9%	77.3%	-1.5% *
Pct. Black	7.4%	1.8%	-5.6% ***	3.9%	5.1%	1.1% ***	18.8%	6.6%	-12.2% ***	14.2%	16.7%	2.5% ***
Pct. Hispanic	1.3%	0.9%	-0.4% ***	1.1%	1.1%	0.0%	2.0%	1.2%	-0.8% ***	1.8%	1.7%	-0.1%
Pct. Other Race	3.5%	2.1%	-1.4% ***	3.0%	2.5%	-0.4% ***	5.0%	3.6%	-1.5% ***	5.1%	4.2%	-0.9% ***
Pct. with Masters or Higher	62.4%	56.7%	-5.6% ***	63.7%	55.1%	-8.7% ***	32.4%	28.3%	-4.1% ***	31.3%	31.2%	0.0%
School Locale												
Pct. in Cities	33.0%	8.3%	-24.7% ***	23.4%	16.5%	-7.0% ***	68.7%	17.4%	-51.3% ***	58.9%	50.4%	-8.5% ***
Pct. In Suburbs	36.9%	39.8%	2.9% ***	46.6%	30.3%	-16.2% ***	22.5%	57.1%	34.5% ***	28.8%	35.2%	6.4% ***
Pct. in Towns	13.8%	16.6%	2.8% ***	12.8%	17.7%	5.0% ***	5.0%	12.8%	7.9% ***	6.3%	7.9%	1.6%
Pct. Rural	16.3%	35.3%	19.0% ***	17.2%	35.5%	18.3% ***	3.8%	12.7%	8.9% ***	5.9%	6.5%	0.5%

Note. Comparing school-by-year observations across seven years from 2012-13 to 2018-19. Econ. Dis. = Economically Disadvantaged, as indicated by having at least one of the following: free-and-reduced price lunch eligibility, migrant status, foster status, homeless status, or receipt of TANF or SNAP benefits. LEP = Limited English Proficient. SoC = inter-district school choice a.k.a. Schools of Choice. Res. = Residents. TPS = Traditional public school. CBA = Collective Bargaining Agreement. ELA = English Language Arts. Charter schools generally do not have CBA agreements, so the CBA Restrictiveness for charters refers to the restrictiveness of the CBA in the TPS district in which they are geographically located. Similarly, while charter schools technically do not lose or gain students through 105 or 105C Schools of Choice in Michigan, the rates shown here for charter schools refer to the rates in the TPS district in which the charters are geographically located. *** p<0.01, ** p<0.05, * p<0.1

Table 3: Competitive effects on school-by-year teacher characteristics: TWFE and TWFE with district-specific linear time trends

PANEL A	School-by-year percent non-White teachers			School-by-year average teaching experience			School-by-year share of teachers with a master's degree or higher		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Share of Enrollment Using Choice (Charter or SoC)	-0.007		-0.002	-0.085		-0.357	0.057		0.060
	(0.015)		(0.016)	(0.689)		(0.705)	(0.038)		(0.040)
Share of Residents Using Choice to Leave District		-0.031	-0.030		1.655	1.792		0.006	-0.017
		(0.031)	(0.033)		(1.415)	(1.466)		(0.064)	(0.068)
Constant	0.0940***	0.0956***	0.0959***	11.86***	11.71***	11.75***	0.570***	0.577***	0.571***
	(0.009)	(0.010)	(0.010)	(0.410)	(0.413)	(0.422)	(0.024)	(0.024)	(0.024)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
School FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
District-specific Linear Trends									
Observations	22,969	22,969	22,969	22,969	22,969	22,969	22,932	22,932	22,932
Adj. R-squared	0.91	0.91	0.91	0.85	0.85	0.85	0.82	0.82	0.82
Mean of dependent variable	0.10	0.10	0.10	12.49	12.49	12.49	0.56	0.56	0.56

PANEL B	School-by-year percent non-White teachers			School-by-year average teaching experience			School-by-year share of teachers with a master's degree or higher		
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Share of Enrollment Using Choice (Charter or SoC)	0.009		0.014	-0.067		-0.216	0.065*		0.069*
	(0.014)		(0.015)	(0.737)		(0.742)	(0.038)		(0.040)
Share of Residents Using Choice to Leave District		-0.033	-0.038		1.031	1.101		-0.009	-0.031
		(0.030)	(0.031)		(1.407)	(1.434)		(0.065)	(0.068)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
School FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
District-specific Linear Trends	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	22,316	22,316	22,316	22,316	22,316	22,316	22,287	22,287	22,287
Mean of dependent variable	0.10	0.10	0.10	12.59	12.59	12.59	0.57	0.57	0.57

Note. Share of Enrollment Using Choice (Charter or SoC) indicates the percent of students enrolled in the geographic district that are using inter-district school choice (SoC) to do so, or attending a charter. Share of Residents Using Choice to Leave District indicates the percent of resident students of the geographic district who are using inter-district school choice to leave the district or are attending a charter school outside of the district. FE = Fixed effects. Heteroskedastic robust standard errors, clustered at the geographic district level, in parentheses. All models control for school-by-year observable characteristics including percent of students who are Black, percent Hispanic/Latinx, percent other non-White race/ethnicity (with percent White as the reference category), percent of students who are economically disadvantaged, and percent with limited English proficiency. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Competitive effects on school-by-year teacher characteristics: Distributed-lag models

	School-by-year percent non-White teachers				School-by-year average teaching experience				School-by-year share of teachers with a master's degree or higher			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Share of Enrollment Using Choice in Year t-2	0.023				-0.351				-0.017			
	(0.047)				(1.310)				(0.093)			
Share of Enrollment Using Choice in Year t-1	0.018	0.022			-1.160	-0.600			-0.018	-0.060		
	(0.044)	(0.030)			(1.601)	(0.844)			(0.107)	(0.073)		
Share of Enrollment Using Choice in Year t	-0.031	-0.095			2.131	1.927			0.014	0.145*		
	(0.045)	(0.061)			(2.949)	(1.492)			(0.109)	(0.088)		
Share of Enrollment Using Choice in Year t+1	0.019	0.051			0.597	-0.020			-0.042	-0.027		
	(0.044)	(0.043)			(1.494)	(0.993)			(0.121)	(0.094)		
Share of Enrollment Using Choice in Year t+2	-0.015	-0.026			0.713	0.464			-0.103	-0.065		
	(0.029)	(0.019)			(0.728)	(0.577)			(0.099)	(0.068)		
Share of Enrollment Using Choice in Year t+3	-0.008	0.031			-0.106	0.128			-0.059	-0.024		
	(0.056)	(0.023)			(1.072)	(0.557)			(0.071)	(0.042)		
Share of Residents Using Choice to Leave District in Year t-2			0.048				1.169				0.105	
			(0.074)				(2.279)				(0.094)	
Share of Residents Using Choice to Leave District in Year t-1			0.019	-0.086*			2.850	-0.663			-0.080	-0.057
			(0.060)	(0.050)			(2.418)	(2.159)			(0.212)	(0.154)
Share of Residents Using Choice to Leave District in Year t			-0.038	-0.026			-2.349	-2.444			-0.014	0.021
			(0.062)	(0.033)			(3.597)	(1.898)			(0.155)	(0.137)
Share of Residents Using Choice to Leave District in Year t+1			-0.024	-0.041			-2.043	-2.013			0.091	0.120
			(0.097)	(0.039)			(2.629)	(1.576)			(0.163)	(0.175)
Share of Residents Using Choice to Leave District in Year t+2			0.041	0.047			1.011	0.061			-0.066	-0.087
			(0.039)	(0.039)			(1.830)	(1.182)			(0.115)	(0.080)
Share of Residents Using Choice to Leave District in Year t+3			-0.031	0.022			0.421	1.108			0.107	0.048
			(0.100)	(0.040)			(2.887)	(1.255)			(0.236)	(0.096)
Constant	0.107***	0.0791***	0.108***	0.0837***	12.55***	11.90***	12.83***	12.60***	0.604***	0.566***	0.544***	0.554***
	(0.033)	(0.018)	(0.034)	(0.020)	(1.020)	(0.626)	(1.193)	(0.645)	(0.059)	(0.044)	(0.066)	(0.044)
Observations	5,993	9,166	5,993	9,166	5,993	9,166	5,993	9,166	5,987	9,154	5,987	9,154
Adj. R-squared	0.97	0.96	0.97	0.96	0.93	0.92	0.93	0.92	0.92	0.90	0.92	0.90
Mean of dependent variable	0.09	0.09	0.09	0.09	12.74	12.54	12.74	12.54	0.57	0.57	0.57	0.57

Note. Share of Enrollment Using Choice indicates the percent of students enrolled in the geographic district that are using inter-district school choice (SoC) to do so, or attending a charter. Share of Residents Using Choice to Leave District indicates the percent of resident students of the geographic district who are using inter-district school choice to leave the district or are attending a charter school outside of the district. Heteroskedastic robust standard errors, clustered at the geographic district level, in parentheses. All models control for school-by-year observable characteristics including percent of students who are Black, percent Hispanic/Latinx, percent other non-White race/ethnicity (with percent White as the reference category), percent of students who are economically disadvantaged, and percent with limited English proficiency. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Competitive effects on school-by-year teacher racial diversity, with interactions by student racial diversity

PANEL A	School-by-year percent non-White teachers		
	(1)	(2)	(3)
Share of Enrollment Using Choice	-0.040*		-0.036*
	(0.022)		(0.022)
Share of Enrollment Using Choice X Sch. Pct. Non-white Stud.	0.147		0.152
	(0.094)		(0.107)
Share of Residents Using Choice to Leave District		-0.062	-0.043
		(0.040)	(0.038)
Share of Residents Using Choice to Leave District X Sch. Pct. Non-white Stud.		0.082	0.006
		(0.122)	(0.132)
Constant	0.098***	0.098***	0.101***
	(0.010)	(0.010)	(0.010)
Year FE	Y	Y	Y
School FE	Y	Y	Y
District-specific Linear Trends			
Observations	22,751	22,751	22,751
Adj. R-squared	0.913	0.913	0.913
Mean of dependent variable	0.097	0.097	0.097

PANEL B	School-by-year percent non-White teachers		
	(4)	(5)	(6)
Share of Enrollment Using Choice	-0.038*		-0.036*
	(0.020)		(0.019)
Share of Enrollment Using Choice X Sch. Pct. Non-white Stud.	0.160**		0.174*
	(0.079)		(0.089)
Share of Residents Using Choice to Leave District		-0.062*	-0.0418
		(0.037)	(0.034)
Share of Residents Using Choice to Leave District X Sch. Pct. Non-white Stud.		0.073	-0.013
		(0.112)	(0.117)
Year FE	Y	Y	Y
School FE	Y	Y	Y
District-specific Linear Trends	Y	Y	Y
Observations	22,316	22,316	22,316
Mean of dependent variable	0.095	0.095	0.095

Note. Share of Enrollment Using Choice indicates the percent of students enrolled in the geographic district that are using inter-district school choice (SoC) to do so, or attending a charter. Share of Residents Using Choice to Leave District indicates the percent of resident students of the geographic district who are using inter-district school choice to leave the district or are attending a charter school outside of the district. FE = Fixed effects. Heteroskedastic robust standard errors, clustered at the geographic district level, in parentheses. All models control for school-by-year observable characteristics including percent of students who are Black, percent Hispanic/Latinx, percent other non-White race/ethnicity (with percent White as the reference category), percent of students who are economically disadvantaged, and percent with limited English proficiency. *** p<0.01, ** p<0.05, * p<0.1

Table 6: Competitive effects on school-by-year teacher characteristics, with sector differences: TWFE and TWFE with district-specific linear time trends

PANEL A	School-by-year percent non-White teachers			School-by-year average teaching experience			School-by-year share of teachers with a master's degree or higher		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Share of Enrollment Using Choice (Charter or SoC)	-0.009		-0.003	-0.422		-0.504	0.041		0.057
	(0.020)		(0.020)	(0.867)		(0.864)	(0.045)		(0.048)
Charter X Share of Enrollment Using Choice (Charter or SoC)	0.012		-0.001	1.719		0.380	0.081		-0.020
	(0.045)		(0.050)	(1.689)		(1.343)	(0.116)		(0.112)
Share of Residents Using Choice to Leave District		-0.039	-0.038		0.994	1.168		-0.050	-0.070
		(0.033)	(0.034)		(1.686)	(1.712)		(0.073)	(0.076)
Charter X Share of Residents Using Choice to Leave District		0.054	0.056		4.251	4.083		0.358**	0.359**
		(0.078)	(0.087)		(3.022)	(2.719)		(0.151)	(0.142)
Constant	0.094***	0.096***	0.096***	11.84***	11.72***	11.76***	0.569***	0.578***	0.573***
	(0.009)	(0.010)	(0.010)	(0.409)	(0.415)	(0.424)	(0.024)	(0.024)	(0.025)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
School FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
District-specific Linear Trends									
Observations	22,969	22,969	22,969	22,969	22,969	22,969	22,932	22,932	22,932
Adj. R-squared	0.91	0.91	0.91	0.85	0.85	0.85	0.82	0.82	0.82
Mean of dependent variable	0.10	0.10	0.10	12.49	12.49	12.49	0.56	0.56	0.56

PANEL B	School-by-year percent non-White teachers			School-by-year average teaching experience			School-by-year share of teachers with a master's degree or higher		
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Share of Enrollment Using Choice (Charter or SoC)	-0.001		0.007	-0.362		-0.307	0.045		0.063
	(0.016)		(0.016)	(0.796)		(0.796)	(0.041)		(0.044)
Charter X Share of Enrollment Using Choice (Charter or SoC)	0.136		0.101	4.175		1.610	0.278		0.104
	(0.104)		(0.106)	(3.226)		(2.684)	(0.179)		(0.179)
Share of Residents Using Choice to Leave District		-0.048	-0.048		0.311	0.446		-0.058	-0.077
		(0.030)	(0.029)		(1.543)	(1.560)		(0.069)	(0.072)
Charter X Share of Residents Using Choice to Leave District		0.164	0.104		8.087**	7.109**		0.554***	0.495***
		(0.116)	(0.113)		(4.015)	(3.041)		(0.178)	(0.161)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
School FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
District-specific Linear Trends	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	22,316	22,316	22,316	22,316	22,316	22,316	22,287	22,287	22,287
Mean of dependent variable	0.10	0.10	0.10	12.59	12.59	12.59	0.57	0.57	0.57

Note. Share of Enrollment Using Choice (Charter or SoC) indicates the percent of students enrolled in the geographic district that are using inter-district school choice (SoC) to do so, or attending a charter. Share of Residents Using Choice to Leave District indicates the percent of resident students of the geographic district who are using inter-district school choice to leave the district or are attending a charter school outside of the district. FE = Fixed effects. Heteroskedastic robust standard errors, clustered at the geographic district level, in parentheses. All models control for school-by-year observable characteristics including percent of students who are Black, percent Hispanic/Latinx, percent other non-White race/ethnicity (with percent White as the reference category), percent of students who are economically disadvantaged, and percent with limited English proficiency. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Competitive effects on school-by-year teacher characteristics, with sector differences: Distributed-lag models

	School-by-year percent non-White teachers				School-by-year average teaching experience				School-by-year share of teachers with a master's degree or higher			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Share of Enrollment Using Choice in Year t-2	0.021				-0.448				-0.029			
	(0.052)				(1.447)				(0.100)			
Share of Enrollment Using Choice in Year t-1	0.021	0.037			-1.217	-0.888			-0.066	-0.081		
	(0.047)	(0.033)			(1.559)	(0.947)			(0.104)	(0.075)		
Share of Enrollment Using Choice in Year t	-0.041	-0.089			1.748	1.755			0.002	0.135		
	(0.046)	(0.064)			(3.083)	(1.578)			(0.110)	(0.091)		
Share of Enrollment Using Choice in Year t+1	0.013	0.057			0.594	-0.103			-0.041	-0.031		
	(0.044)	(0.045)			(1.603)	(1.069)			(0.132)	(0.101)		
Share of Enrollment Using Choice in Year t+2	-0.009	-0.022			0.632	0.446			-0.104	-0.071		
	(0.033)	(0.020)			(0.833)	(0.665)			(0.116)	(0.079)		
Share of Enrollment Using Choice in Year t+3	0.019	0.033*			0.072	0.186			-0.035	-0.045		
	(0.033)	(0.020)			(1.373)	(0.674)			(0.093)	(0.048)		
Charter X Share of Enrollment Using Choice in Year t-2	0.013				0.278				0.047			
	(0.096)				(2.226)				(0.156)			
Charter X Share of Enrollment Using Choice in Year t-1	-0.070	-0.109			-0.121	1.934			0.748	0.146		
	(0.152)	(0.090)			(4.591)	(1.877)			(0.507)	(0.136)		
Charter X Share of Enrollment Using Choice in Year t	0.124	-0.067			4.794	2.266			0.018	0.127		
	(0.173)	(0.125)			(3.992)	(2.802)			(0.326)	(0.224)		
Charter X Share of Enrollment Using Choice in Year t+1	0.103	-0.071			1.168	1.052			-0.012	0.042		
	(0.173)	(0.156)			(3.058)	(2.367)			(0.299)	(0.179)		
Charter X Share of Enrollment Using Choice in Year t+2	-0.027	-0.043			0.592	0.393			0.008	0.068		
	(0.055)	(0.062)			(1.230)	(1.038)			(0.168)	(0.121)		
Charter X Share of Enrollment Using Choice in Year t+3	-0.102	-0.009			-0.556	-0.270			-0.094	0.110		
	(0.108)	(0.066)			(2.617)	(1.305)			(0.119)	(0.072)		
Share of Resid. Using Choice to Leave Dist. in Year t-2			0.040				2.185				0.126	
			(0.071)				(2.874)				(0.134)	
Share of Resid. Using Choice to Leave Dist. in Year t-1			0.011	-0.084			2.705	-0.850			-0.113	-0.049
			(0.059)	(0.052)			(2.542)	(2.480)			(0.225)	(0.187)
Share of Resid. Using Choice to Leave Dist. in Year t			-0.040	-0.009			-3.023	-2.982			-0.058	0.003
			(0.060)	(0.035)			(3.700)	(2.010)			(0.166)	(0.139)
Share of Resid. Using Choice to Leave Dist. in Year t+1			-0.056	-0.036			-2.376	-2.292			0.039	0.116
			(0.103)	(0.040)			(3.238)	(1.790)			(0.161)	(0.194)
Share of Resid. Using Choice to Leave Dist. in Year t+2			0.048	0.048			0.612	-0.256			-0.078	-0.098
			(0.037)	(0.038)			(2.074)	(1.346)			(0.127)	(0.087)
Share of Resid. Using Choice to Leave Dist. in Year t+3			0.045	0.041			0.009	1.136			0.233	0.049
			(0.102)	(0.041)			(4.305)	(1.548)			(0.298)	(0.116)
Charter X Share of Resid. Using Choice to Leave Dist. in Year t-2			0.006				-3.551				-0.073	
			(0.133)				(3.260)				(0.334)	
Charter X Share of Resid. Using Choice to Leave Dist. in Year t-1			0.099	-0.024			2.032	1.517			0.379	-0.047
			(0.471)	(0.114)			(10.030)	(2.569)			(0.764)	(0.254)
Charter X Share of Resid. Using Choice to Leave Dist. in Year t			-0.189	-0.262			6.518	7.374*			0.202	0.250
			(0.525)	(0.166)			(9.895)	(4.143)			(0.762)	(0.408)
Charter X Share of Resid. Using Choice to Leave Dist. in Year t+1			0.173	-0.007			2.060	1.553			0.152	-0.018
			(0.141)	(0.104)			(5.788)	(3.391)			(0.419)	(0.339)
Charter X Share of Resid. Using Choice to Leave Dist. in Year t+2			-0.081	-0.034			2.825	2.029			0.033	0.073
			(0.100)	(0.110)			(2.573)	(1.642)			(0.269)	(0.221)
Charter X Share of Resid. Using Choice to Leave Dist. in Year t+3			-0.225	-0.122			2.072	0.969			-0.351	0.019
			(0.181)	(0.104)			(4.974)	(1.897)			(0.361)	(0.167)
Constant	0.102***	0.0835***	0.104***	0.0843***	12.38***	11.80***	12.82***	12.57***	0.589***	0.560***	0.534***	0.553***
	(0.032)	(0.019)	(0.035)	(0.021)	(1.008)	(0.619)	(1.228)	(0.653)	(0.061)	(0.043)	(0.068)	(0.044)
Observations	5,993	9,166	5,993	9,166	5,993	9,166	5,993	9,166	5,987	9,154	5,987	9,154
Adj. R-squared	0.97	0.96	0.97	0.96	0.93	0.92	0.93	0.92	0.92	0.90	0.92	0.90
Mean of dependent variable	0.09	0.09	0.09	0.09	12.74	12.54	12.74	12.54	0.57	0.57	0.57	0.57

Note. Share of Enrollment Using Choice indicates the percent of students enrolled in the geographic district that are using inter-district school choice (SoC) to do so, or attending a charter. Share of Residents Using Choice to Leave District indicates the percent of resident students of the geographic district who are using inter-district school choice to leave the district or are attending a charter school outside of the district. Heteroskedastic robust standard errors, clustered at the geographic district level, in parentheses. All models control for school-by-year observable characteristics including percent of students who are Black, percent Hispanic/Latinx, percent other non-White race/ethnicity (with percent White as the reference category), percent of students who are economically disadvantaged, and percent with limited English proficiency. *** p<0.01, ** p<0.05, * p<0.1

Table 8: Competitive effects on school-by-year teacher characteristics; heterogeneity by CBA restrictiveness: TWFE and TWFE with district-specific linear time trends

PANEL A	School-by-year percent non-White teachers			School-by-year average teaching experience			School-by-year share of teachers with a master's degree or higher		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Share of Enrollment Using Choice	0.004		0.006	-0.279		0.173	0.086**		0.094**
	(0.023)		(0.024)	(0.767)		(0.912)	(0.042)		(0.044)
High CBA Rest. X Share of Enrollment Using Choice	-0.016		-0.008	0.001		-1.550	-0.104		-0.120
	(0.033)		(0.036)	(1.357)		(1.471)	(0.076)		(0.085)
Share of Resid. Using Choice to Leave District		-0.022	-0.026		-0.761	-1.024		0.022	-0.034
		(0.039)	(0.043)		(1.880)	(2.096)		(0.095)	(0.101)
High CBA Rest. X Share of Resid. Using Choice to Leave District		-0.031	-0.026		4.320*	5.190**		-0.025	0.056
		(0.064)	(0.071)		(2.233)	(2.519)		(0.117)	(0.130)
Constant	0.091***	0.094***	0.093***	12.03***	11.90***	11.95***	0.569***	0.575***	0.569***
	(0.009)	(0.010)	(0.010)	(0.400)	(0.401)	(0.399)	(0.024)	(0.024)	(0.024)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
School FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
District-specific Linear Trends									
Observations	22,715	22,715	22,715	22,715	22,715	22,715	22,678	22,678	22,678
Adj. R-squared	0.91	0.91	0.91	0.85	0.85	0.85	0.82	0.82	0.82
Mean of dependent variable	0.10	0.10	0.10	12.51	12.51	12.51	0.57	0.57	0.57

PANEL B	School-by-year percent non-White teachers			School-by-year average teaching experience			School-by-year share of teachers with a master's degree or higher		
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Share of Enrollment Using Choice	0.012		0.018	-0.391		0.005	0.089**		0.096**
	(0.021)		(0.022)	(0.747)		(0.878)	(0.042)		(0.044)
High CBA Rest. X Share of Enrollment Using Choice	-0.004		-0.003	0.382		-0.948	-0.114		-0.126
	(0.034)		(0.033)	(1.412)		(1.502)	(0.078)		(0.085)
Share of Resid. Using Choice to Leave District		-0.033	-0.041		-1.104	-1.211		0.017	-0.037
		(0.039)	(0.041)		(1.861)	(2.059)		(0.092)	(0.097)
High CBA Rest. X Share of Resid. Using Choice to Leave District		-0.004	0.000		4.314*	4.828*		-0.038	0.042
		(0.070)	(0.073)		(2.239)	(2.543)		(0.126)	(0.138)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
School FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
District-specific Linear Trends	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	22,128	22,128	22,128	22,128	22,128	22,128	22,099	22,099	22,099
Mean of dependent variable	0.10	0.10	0.10	12.60	12.60	12.60	0.57	0.57	0.57

Note. Share of Enrollment Using Choice indicates the percent of students enrolled in the geographic district that are using inter-district school choice (SoC) to do so, or attending a charter. Share of Resid. Using Choice to Leave District indicates the percent of resident students of the geographic district who are using inter-district school choice to leave the district or are attending a charter school outside of the district. FE = Fixed effects. Heteroskedastic robust standard errors, clustered at the geographic district level, in parentheses. All models control for school-by-year observable characteristics including percent of students who are Black, percent Hispanic/Latinx, percent other non-White race/ethnicity (with percent White as the reference category), percent of students who are economically disadvantaged, and percent with limited English proficiency. *** p<0.01, ** p<0.05, * p<0.1

Table 9: Competitive effects on school-by-year teacher characteristics; heterogeneity by CBA restrictiveness: Distributed lag models

	School-by-year percent non-White teachers				School-by-year average teaching experience				School-by-year share of teachers with a master's degree or higher			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Share of Enrollment Using Choice in Year t-2	0.062				-1.923				0.072			
	(0.046)				(2.961)				(0.109)			
Share of Enrollment Using Choice in Year t-1	0.007	0.011			-1.272	-0.551			-0.048	-0.018		
	(0.041)	(0.026)			(2.123)	(1.742)			(0.108)	(0.098)		
Share of Enrollment Using Choice in Year t	-0.012	-0.039			4.774	0.883			-0.037	0.020		
	(0.064)	(0.038)			(5.396)	(2.542)			(0.182)	(0.084)		
Share of Enrollment Using Choice in Year t+1	0.021	0.038			-0.378	1.326			-0.084	-0.095		
	(0.069)	(0.039)			(2.189)	(1.508)			(0.156)	(0.133)		
Share of Enrollment Using Choice in Year t+2	-0.033	-0.027			-0.128	-0.317			-0.130	-0.093		
	(0.044)	(0.028)			(0.941)	(0.789)			(0.141)	(0.101)		
Share of Enrollment Using Choice in Year t+3	0.017	0.021			1.169	0.357			-0.032	0.012		
	(0.035)	(0.020)			(2.665)	(0.760)			(0.128)	(0.048)		
High CBA Rest. X Share of Enrollment Using Choice in Year t-2	-0.055				2.372				-0.107			
	(0.078)				(3.316)				(0.157)			
High CBA Rest. X Share of Enrollment Using Choice in Year t-1	0.098	0.007			2.624	-0.209			-0.114	-0.034		
	(0.193)	(0.046)			(4.617)	(2.122)			(0.270)	(0.118)		
High CBA Rest. X Share of Enrollment Using Choice in Year t	-0.077	-0.177*			-3.402	1.756			0.043	0.251*		
	(0.086)	(0.104)			(5.199)	(2.909)			(0.216)	(0.136)		
High CBA Rest. X Share of Enrollment Using Choice in Year t+1	-0.019	0.012			2.180	-0.984			-0.002	0.068		
	(0.110)	(0.065)			(2.862)	(1.797)			(0.195)	(0.145)		
High CBA Rest. X Share of Enrollment Using Choice in Year t+2	0.045	-0.016			1.488	1.291			0.122	0.082		
	(0.057)	(0.054)			(1.902)	(1.358)			(0.154)	(0.114)		
High CBA Rest. X Share of Enrollment Using Choice in Year t+3	0.045	0.065			-3.041	-0.024			-0.086	-0.048		
	(0.117)	(0.067)			(3.011)	(1.431)			(0.194)	(0.090)		
Share of Resid. Using Choice to Leave Dist. in Year t-2			0.063				1.787				0.073	
			(0.080)				(3.267)				(0.087)	
Share of Resid. Using Choice to Leave Dist. in Year t-1			0.047	-0.061			4.788	1.218			0.163	0.070
			(0.114)	(0.055)			(5.801)	(2.779)			(0.291)	(0.114)
Share of Resid. Using Choice to Leave Dist. in Year t			-0.103	-0.016			-10.990	-4.563			-0.084	0.010
			(0.112)	(0.054)			(8.539)	(3.897)			(0.217)	(0.243)
Share of Resid. Using Choice to Leave Dist. in Year t+1			-0.127	-0.067			-1.870	-2.732			0.053	-0.073
			(0.140)	(0.062)			(3.935)	(2.741)			(0.155)	(0.138)
Share of Resid. Using Choice to Leave Dist. in Year t+2			0.008	0.027			1.596	0.104			-0.081	-0.112
			(0.059)	(0.044)			(3.201)	(1.905)			(0.186)	(0.114)
Share of Resid. Using Choice to Leave Dist. in Year t+3			0.043	0.002			4.329	2.478			0.174	0.042
			(0.161)	(0.049)			(7.062)	(2.138)			(0.286)	(0.093)
High CBA Rest. X Share of Resid. Using Choice to Leave Dist. in Year t-2			-0.139				-2.760				0.098	
			(0.207)				(5.409)				(0.304)	
High CBA Rest. X Share of Resid. Using Choice to Leave Dist. in Year t-1			0.003	-0.192			0.447	-4.491			-0.072	0.050
			(0.243)	(0.209)			(8.848)	(5.442)			(0.555)	(0.276)
High CBA Rest. X Share of Resid. Using Choice to Leave Dist. in Year t			-0.018	-0.051			11.310	5.427			0.054	0.082
			(0.219)	(0.151)			(9.497)	(5.633)			(0.412)	(0.361)
High CBA Rest. X Share of Resid. Using Choice to Leave Dist. in Year t+1			0.224	0.093			0.524	1.416			-0.147	-0.042
			(0.174)	(0.101)			(5.099)	(3.689)			(0.256)	(0.203)
High CBA Rest. X Share of Resid. Using Choice to Leave Dist. in Year t+2			0.035	0.049			-0.981	0.725			0.054	0.134
			(0.079)	(0.090)			(3.642)	(2.334)			(0.212)	(0.136)
High CBA Rest. X Share of Resid. Using Choice to Leave Dist. in Year t+3			0.141	0.088			-3.443	-1.170			-0.453	0.016
			(0.296)	(0.095)			(8.507)	(2.796)			(0.552)	(0.159)
Constant	0.094***	0.081***	0.098***	0.085***	12.46***	11.94***	12.84***	12.55***	0.603***	0.572***	0.542***	0.560***
	(0.033)	(0.019)	(0.036)	(0.021)	(1.095)	(0.640)	(1.270)	(0.675)	(0.058)	(0.040)	(0.058)	(0.041)
Observations	5,939	9,079	5,939	9,079	5,939	9,079	5,939	9,079	5,933	9,067	5,933	9,067
Adj. R-squared	0.97	0.96	0.97	0.96	0.93	0.92	0.93	0.92	0.92	0.90	0.92	0.90
Mean of dependent variable	0.09	0.09	0.09	0.09	12.76	12.56	12.76	12.56	0.58	0.57	0.58	0.57

Note. Share of Enrollment Using Choice indicates the percent of students enrolled in the geographic district that are using inter-district school choice (SoC) to do so, or attending a charter. Share of Residents Using Choice to Leave Dist. indicates the percent of resident students of the geographic district who are using inter-district school choice to leave the district or are attending a charter school outside of the district. Heteroskedastic robust standard errors, clustered at the geographic district level, in parentheses. All models control for school-by-year observable characteristics including percent of students who are Black, percent Hispanic/Latinx, percent other non-White race/ethnicity (with percent White as the reference category), percent of students who are economically disadvantaged, and percent with limited English proficiency. *** p<0.01, ** p<0.05, * p<0.1

Online Appendix Table A: Competitive effects on school-by-year teacher characteristics

PANEL A	School-by-year percent non-White teachers				School-by-year average teaching experience				School-by-year share of teachers with a master's degree or higher			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Share of Enr. Stud. In Charters	-0.028				-0.542				0.054			
	(0.018)				(0.548)				(0.046)			
Share of Enr. Stud. Using SoC		0.022				0.513				0.043		
		(0.026)				(1.250)				(0.061)		
Share of Resid. Stud. Leaving for Outside Charter			-0.008				6.094**				0.079	
			(0.112)				(2.970)				(0.151)	
Share of Resid. Stud. Using SoC to Leave				-0.036				1.104				-0.005
				(0.030)				(1.473)				(0.072)
Constant	0.095***	0.092***	0.093***	0.095***	11.88***	11.81***	11.66***	11.79***	0.574***	0.575***	0.575***	0.578***
	(0.009)	(0.009)	(0.010)	(0.009)	(0.398)	(0.403)	(0.417)	(0.399)	(0.024)	(0.024)	(0.024)	(0.024)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
School FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
District-specific Linear Trends												
Observations	22,969	22,969	22,969	22,969	22,969	22,969	22,969	22,969	22,932	22,932	22,932	22,932
Adj. R-squared	0.91	0.91	0.91	0.91	0.85	0.85	0.85	0.85	0.82	0.82	0.82	0.82
Mean of Dependent Variable	0.10	0.10	0.10	0.10	12.49	12.49	12.49	12.49	0.56	0.56	0.56	0.56
PANEL B	School-by-year percent non-White teachers				School-by-year average teaching experience				School-by-year share of teachers with a master's degree or higher			
	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Share of Enr. Stud. In Charters	-0.004				-0.422				0.074			
	(0.017)				(0.620)				(0.046)			
Share of Enr. Stud. Using SoC		0.018				0.294				0.038		
		(0.024)				(1.166)				(0.057)		
Share of Resid. Stud. Leaving for Outside Charter			-0.032				7.508**				0.149	
			(0.144)				(3.662)				(0.180)	
Share of Resid. Stud. Using SoC to Leave				-0.034				0.408				-0.025
				(0.028)				(1.408)				(0.070)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
School FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
District-specific Linear Trends	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	22,316	22,316	22,316	22,316	22,316	22,316	22,316	22,316	22,287	22,287	22,287	22,287
Mean of Dependent Variable	0.10	0.10	0.10	0.10	12.59	12.59	12.59	12.59	0.57	0.57	0.57	0.57

Note. SoC = inter-district school choice a.k.a. Schools of Choice. Enr. = Enrolled students. Resid. = Residents. FE = Fixed effects. Heteroskedastic robust standard errors, clustered at the geographic district level, in parentheses. All models control for school-by-year observable characteristics including percent of students who are Black, percent Hispanic/Latinx, percent other non-White race/ethnicity (with percent White as the reference category), percent of students who are economically disadvantaged, and percent with limited English proficiency. *** p<0.01, ** p<0.05, * p<0.

Online Appendix Table B: Competitive effects on school-by-year teacher racial diversity: with interactions by student racial diversity: Distributed lag models

	School-by-year percent non-White teachers			
	(1)	(2)	(3)	(4)
Share of Enrollment Using Choice in Year t-2	0.021			
	(0.052)			
Share of Enrollment Using Choice in Year t-1	0.021	0.037		
	(0.047)	(0.033)		
Share of Enrollment Using Choice in Year t	-0.041	-0.089		
	(0.046)	(0.064)		
Share of Enrollment Using Choice in Year t+1	0.013	0.057		
	(0.044)	(0.045)		
Share of Enrollment Using Choice in Year t+2	-0.009	-0.022		
	(0.033)	(0.020)		
Share of Enrollment Using Choice in Year t+3	0.019	0.033*		
	(0.033)	(0.020)		
Pct. Non-White Stud. X Share of Enrollment Using Choice in Year t-2	0.013			
	(0.096)			
Pct. Non-White Stud. X Share of Enrollment Using Choice in Year t-1	-0.070	-0.109		
	(0.152)	(0.090)		
Pct. Non-White Stud. X Share of Enrollment Using Choice in Year t	0.124	-0.067		
	(0.173)	(0.125)		
Pct. Non-White Stud. X Share of Enrollment Using Choice in Year t+1	0.103	-0.071		
	(0.173)	(0.156)		
Pct. Non-White Stud. X Share of Enrollment Using Choice in Year t+2	-0.027	-0.043		
	(0.055)	(0.062)		
Pct. Non-White Stud. X Share of Enrollment Using Choice in Year t+3	-0.102	-0.009		
	(0.108)	(0.066)		
Share of Resid. Using Choice to Leave District in Year t-2			0.040	
			(0.071)	
Share of Resid. Using Choice to Leave District in Year t-1			0.011	-0.084
			(0.059)	(0.052)
Share of Resid. Using Choice to Leave District in Year t			-0.040	-0.009
			(0.060)	(0.035)
Share of Resid. Using Choice to Leave District in Year t+1			-0.056	-0.036
			(0.103)	(0.040)
Share of Resid. Using Choice to Leave District in Year t+2			0.048	0.048
			(0.037)	(0.038)
Share of Resid. Using Choice to Leave District in Year t+3			0.045	0.041
			(0.102)	(0.041)
Pct. Non-White Stud. X Share of Resid. Using Choice to Leave District in Year t-2			0.006	
			(0.133)	
Pct. Non-White Stud. X Share of Resid. Using Choice to Leave District in Year t-1			0.099	-0.024
			(0.471)	(0.114)
Pct. Non-White Stud. X Share of Resid. Using Choice to Leave District in Year t			-0.189	-0.262
			(0.525)	(0.166)
Pct. Non-White Stud. X Share of Resid. Using Choice to Leave District in Year t+1			0.173	-0.007
			(0.141)	(0.104)
Pct. Non-White Stud. X Share of Resid. Using Choice to Leave District in Year t+2			-0.081	-0.034
			(0.100)	(0.110)
Pct. Non-White Stud. X Share of Resid. Using Choice to Leave District in Year t+3			-0.225	-0.122
			(0.181)	(0.104)
Constant	0.102***	0.084***	0.104***	0.084***
	(0.032)	(0.019)	(0.035)	(0.021)
Observations	5,993	9,166	5,993	9,166
Adj. R-squared	0.97	0.96	0.97	0.96
Mean of dependent variable	0.09	0.09	0.09	0.09

Note. Share of Enrollment Using Choice indicates the percent of students enrolled in the geographic district that are using inter-district school choice (SoC) to do so, or attending a charter. Share of Resid. Using Choice to Leave District indicates the percent of resident students of the geographic district who are using inter-district school choice to leave the district or are attending a charter school outside of the district. Heteroskedastic robust standard errors, clustered at the geographic district level, in parentheses. All models control for school-by-year observable characteristics including percent of students who are Black, percent Hispanic/Latinx, percent other non-White race/ethnicity (with percent White as the reference category), percent of students who are economically disadvantaged, and percent with limited English proficiency. *** p<0.01, ** p<0.05, * p<0.1

Online Appendix Table C: Competitive effects on school-by-year teacher characteristics, with sector differences

PANEL A	School-by-year percent non-White teachers				School-by-year average teaching experience				School-by-year share of teachers with a master's degree or higher			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Share of Enr. Stud. In Charters	-0.031				-0.823				0.064			
	(0.029)				(0.875)				(0.063)			
Charter X Share of Enr. Stud. In Charters	0.007				0.885				-0.029			
	(0.047)				(1.759)				(0.120)			
Share of Enr. Stud. Using SoC		0.014				0.068				0.012		
		(0.028)				(1.320)				(0.062)		
Charter X Share of Enr. Stud. Using SoC		0.131				6.770**				0.471**		
		(0.162)				(2.724)				(0.188)		
Share of Resid. Stud. Leaving for Outside Charter			-0.089				8.182*				0.053	
			(0.150)				(4.941)				(0.213)	
Charter X Share of Resid. Stud. Leaving for Outside Charter			0.197				-5.084				0.065	
			(0.162)				(6.035)				(0.317)	
Share of Resid. Stud. Using SoC to Leave				-0.038				0.426				-0.058
				(0.031)				(1.670)				(0.078)
Charter X Share of Resid. Stud. Using SoC to Leave				0.021				6.053				0.471**
				(0.111)				(4.052)				(0.187)
Constant	0.095***	0.092***	0.094***	0.095***	11.88***	11.81***	11.64***	11.81***	0.574***	0.575***	0.576***	0.580***
	(0.009)	(0.009)	(0.011)	(0.009)	(0.398)	(0.402)	(0.423)	(0.402)	(0.025)	(0.024)	(0.024)	(0.024)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
School FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
District-specific Linear Trends												
Observations	22,969	22,969	22,969	22,969	22,969	22,969	22,969	22,969	22,932	22,932	22,932	22,932
Adj. R-squared	0.91	0.91	0.91	0.91	0.85	0.85	0.85	0.85	0.82	0.82	0.82	0.82
Mean of Dependent Variable	0.10	0.10	0.10	0.10	12.49	12.49	12.49	12.49	0.56	0.56	0.56	0.56

PANEL B	School-by-year percent non-White teachers				School-by-year average teaching experience				School-by-year share of teachers with a master's degree or higher			
	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Share of Enr. Stud. In Charters	-0.013				-0.569				0.068			
	(0.019)				(0.767)				(0.058)			
Charter X Share of Enr. Stud. In Charters	0.086				1.321				0.054			
	(0.099)				(3.541)				(0.185)			
Share of Enr. Stud. Using SoC		0.008				-0.162				0.007		
		(0.025)				(1.212)				(0.057)		
Charter X Share of Enr. Stud. Using SoC		0.209				9.352***				0.630***		
		(0.192)				(3.350)				(0.202)		
Share of Resid. Stud. Leaving for Outside Charter			-0.097				6.731				0.042	
			(0.139)				(4.519)				(0.196)	
Charter X Share of Resid. Stud. Leaving for Outside Charter			0.489				5.892				0.815**	
			(0.343)				(9.407)				(0.374)	
Share of Resid. Stud. Using SoC to Leave				-0.046*				-0.293				-0.071
				(0.027)				(1.530)				(0.074)
Charter X Share of Resid. Stud. Using SoC to Leave				0.151				9.192*				0.595***
				(0.138)				(4.935)				(0.210)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
School FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
District-specific Linear Trends	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	22,316	22,316	22,316	22,316	22,316	22,316	22,316	22,316	22,287	22,287	22,287	22,287
Mean of Dependent Variable	0.10	0.10	0.10	0.10	12.59	12.59	12.59	12.59	0.57	0.57	0.57	0.57

Note. SoC = inter-district school choice a.k.a. Schools of Choice. Enr. = Enrolled students. Resid. = Residents. FE = Fixed effects. Heteroskedastic robust standard errors, clustered at the geographic district level, in parentheses. All models control for school-by-year observable characteristics including percent of students who are Black, percent Hispanic/Latinx, percent other non-White race/ethnicity (with percent White as the reference category), percent of students who are economically disadvantaged, and percent with limited English proficiency. *** p<0.01, ** p<0.05, * p<0.1

Online Appendix Table D: Competitive effects on school-by-year teacher racial diversity, with interactions by student racial diversity, with sector differences

	School-by-year percent non-White		
PANEL A	(1)	(2)	(3)
Charter X Sch. Pct. Non-White	-0.050	-0.037	-0.071
	(0.090)	(0.063)	(0.088)
Share of Enrollment Using Choice	-0.032		-0.032
	(0.023)		(0.024)
Charter X Share of Enrollment Using Choice	-0.027		0.003
	(0.131)		(0.132)
Share of Enrollment Using Choice X Sch. Pct. Non-White	0.095		0.119
	(0.104)		(0.126)
Charter X Share of Enrollment Using Choice X Sch. Pct. Non-White	**0.262**		**0.157**
	(0.286)		**(0.317)**
Share of Residents Using Choice to Leave District		-0.050	-0.033
		(0.039)	(0.038)
Charter X Share of Residents Using Choice to Leave District		-0.112	-0.113
		(0.258)	(0.265)
Share of Residents Using Choice to Leave District X Sch. Pct. Non-White		0.012	-0.048
		(0.116)	(0.139)
Charter X Share of Residents Using Choice to Leave District X Sch. Pct. Non-White		**0.361**	**0.281**
		(0.344)	**(0.365)**
Constant	0.0957***	0.0973***	0.0990***
	(0.010)	(0.009)	(0.010)
Year FE	Y	Y	Y
School FE	Y	Y	Y
District-specific Linear Trends			
Observations	22,751	22,751	22,751
Adj. R-squared	0.91	0.91	0.91
Mean of dependent variable	0.10	0.10	0.10

	School-by-year percent non-White		
PANEL B	(4)	(5)	(6)
Charter X Sch. Pct. Non-White	-0.042	-0.039	-0.063
	(0.082)	(0.058)	(0.082)
Share of Enrollment Using Choice	-0.033*		-0.034*
	(0.020)		(0.020)
Charter X Share of Enrollment Using Choice	0.019		0.044
	(0.120)		(0.121)
Share of Enrollment Using Choice X Sch. Pct. Non-White	0.118		0.149
	(0.085)		(0.101)
Charter X Share of Enrollment Using Choice X Sch. Pct. Non-White	**0.181**		**0.086**
	(0.260)		**(0.282)**
Share of Residents Using Choice to Leave District		-0.052	-0.033
		(0.036)	(0.034)
Charter X Share of Residents Using Choice to Leave District		-0.061	-0.095
		(0.238)	(0.244)
Share of Residents Using Choice to Leave District X Sch. Pct. Non-White		0.009	-0.063
		(0.107)	(0.121)
Charter X Share of Residents Using Choice to Leave District X Sch. Pct. Non-White		**0.290**	**0.259**
		(0.324)	**(0.338)**
Year FE	Y	Y	Y
School FE	Y	Y	Y
District-specific Linear Trends	Y	Y	Y
Observations	22,316	22,316	22,316
Mean of dependent variable	0.10	0.10	0.10

Note. Three-way interactions bolded. Share of Enrollment Using Choice indicates the percent of students enrolled in the geographic district that are using inter-district school choice (SoC) to do so, or attending a charter. Share of Residents Using Choice to Leave District indicates the percent of resident students of the geographic district who are using inter-district school choice to leave the district or are attending a charter school outside of the district. Heteroskedastic robust standard errors, clustered at the geographic district level, in parentheses. All models control for school-by-year observable characteristics including percent of students who are Black, percent Hispanic/Latinx, percent other non-White race/ethnicity (with percent White as the reference category), percent of students who are economically disadvantaged, and percent with limited English proficiency. *** p<0.01, ** p<0.05, * p<0.1

Online Appendix Table E: Competitive effects on school-by-year teacher characteristics; heterogeneity by CBA restrictiveness

PANEL A	School-by-year percent non-White teachers				School-by-year average teaching experience				School-by-year share of teachers with a master's degree or higher			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Share of Enr. Stud. In Charters	-0.022				-0.591				0.079			
	(0.034)				(0.796)				(0.056)			
High CBA Rest. X Share of Enr. Stud. In Charters	0.001				-0.165				-0.077			
	(0.042)				(1.251)				(0.080)			
Share of Enr. Stud. Using SoC		0.033				0.130				0.084		
		(0.038)				(1.260)				(0.067)		
High CBA Rest. X Share of Enr. Stud. Using SoC		-0.032				0.285				-0.136		
		(0.053)				(2.460)				(0.127)		
Share of Resid. Stud. Leaving for Outside Charter			0.035				-0.049				0.339*	
			(0.214)				(3.402)				(0.205)	
High CBA Rest. X Share of Resid. Stud. Leaving for Outside Charter			-0.078				9.116				-0.469	
			(0.266)				(5.879)				(0.347)	
Share of Resid. Stud. Using SoC to Leave				-0.029				-0.977				-0.009
				(0.038)				(2.053)				(0.105)
High CBA Rest. X Share of Resid. Stud. Using SoC to Leave				-0.035				4.542*				0.013
				(0.068)				(2.416)				(0.130)
Constant	0.092***	0.089***	0.091***	0.093***	12.04***	11.98***	11.87***	11.94***	0.572***	0.573***	0.572***	0.576***
	(0.009)	(0.009)	(0.011)	(0.009)	(0.398)	(0.395)	(0.406)	(0.393)	(0.025)	(0.024)	(0.024)	(0.024)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
School FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
District-specific Linear Trends												
Observations	22,715	22,715	22,715	22,715	22,715	22,715	22,715	22,715	22,678	22,678	22,678	22,678
Adj. R-squared	0.91	0.91	0.91	0.91	0.85	0.85	0.85	0.85	0.82	0.82	0.82	0.82
Mean of Dependent Variable	0.10	0.10	0.10	0.10	12.51	12.51	12.51	12.51	0.57	0.57	0.57	0.57

PANEL B	School-by-year percent non-White teachers				School-by-year average teaching experience				School-by-year share of teachers with a master's degree or higher			
	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Share of Enr. Stud. In Charters	-0.005				-0.519				0.077			
	(0.026)				(0.771)				(0.057)			
High CBA Rest. X Share of Enr. Stud. In Charters	0.010				0.010				-0.068			
	(0.039)				(1.293)				(0.083)			
Share of Enr. Stud. Using SoC		0.026				-0.175				0.088		
		(0.035)				(1.196)				(0.063)		
High CBA Rest. X Share of Enr. Stud. Using SoC		-0.016				0.778				-0.153		
		(0.049)				(2.362)				(0.118)		
Share of Resid. Stud. Leaving for Outside Charter			0.056				0.054				0.393*	
			(0.226)				(3.494)				(0.211)	
High CBA Rest. X Share of Resid. Stud. Leaving for Outside Charter			-0.192				10.270				-0.584	
			(0.294)				(6.649)				(0.405)	
Share of Resid. Stud. Using SoC to Leave				-0.041				-1.317				-0.017
				(0.038)				(1.992)				(0.100)
High CBA Rest. X Share of Resid. Stud. Using SoC to Leave				0.007				4.365*				0.003
				(0.075)				(2.373)				(0.137)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
School FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
District-specific Linear Trends	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	22,128	22,128	22,128	22,128	22,128	22,128	22,128	22,128	22,099	22,099	22,099	22,099
Mean of Dependent Variable	0.10	0.10	0.10	0.10	12.60	12.60	12.60	12.60	0.57	0.57	0.57	0.57

Note. SoC = inter-district school choice a.k.a. Schools of Choice. Enr. = Enrolled students. Resid. = Residents. CBA Rest. = Collective Bargaining Agreement Restrictiveness. FE = Fixed effects. Heteroskedastic robust standard errors, clustered at the geographic district level, in parentheses. All models control for school-by-year observable characteristics including percent of students who are Black, percent Hispanic/Latinx, percent other non-White race/ethnicity (with percent White as the reference category), percent of students who are economically disadvantaged, and percent with limited English proficiency. *** p<0.01, ** p<0.05, * p<0.1