

Principals' Perceptions of Competition for Students in Milwaukee Schools

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Abstract: The assumption that choice-driven competition between schools will improve school quality rests upon several assumptions that remain largely unexamined. One is that school choice increases the competitive pressure experienced by school leaders. A second is that schools will seek to become more effective in response to competitive pressure. In this paper, we use responses from a survey of Milwaukee public school principals to examine these assumptions. Our results suggest that there is a substantial amount of variation in how principals experience competitive pressure. Somewhat surprisingly, the extent to which principals perceive competition for students is not related to geographic factors such as the number of nearby schools serving overlapping grades, the average distance to another school, or the distance to the closest school. However, perceptions of competition are related to student achievement as well as to transfer rates out of a school. This study provides evidence that while some schools respond to competition by trying to improve through curricular or instructional changes, a more common approach is to use outreach or advertisement which is may not improve the quality of schooling.

Introduction

Over the past several decades, school choice has become an increasingly common element in proposals for educational reform. Free market theorists and their intellectual heirs have argued that school choice will result in greater competition between schools for students, which in turn will inspire increased levels of effort, efficiency, and innovation across entire school systems (Friedman, 1955; Chubb and Moe, 1990; Henig 1994; Hanushek and Rivkin 2003; Hoxby 2003).

The concept of choice-driven competition between schools for students as a mechanism for systemic school improvement rests upon several assumptions that remain largely unexamined. The first assumption is that school choice increases competitive pressure. If school leaders do not feel pressure - because they feel that their jobs, the jobs of their teachers, and the resources that their schools receive are secure regardless of whether families choose their schools - then they are less likely to respond to choice with efforts to improve their schools. The second assumption is that if schools do feel competition, they will seek to become more effective in

response to that pressure. If information about schools were perfect, then a school's best response to competition would be to improve so as to attract more families. However, if information is not perfect, then schools have the option of responding to competition by providing information - whether accurate or inaccurate - to influence families' choices rather than by improving educational quality. A final assumption is that the preferences of families are largely aligned with observable educational quality. Even if schools feel competitive pressure and information about their offerings are good, family preferences might incentivize schools to make changes that do not correspond with academic improvements (e.g. preferences for sports teams or after school childcare).

Considerable research has sought to estimate the overall effect of competition on student outcomes. This research provides some evidence that competition between public school districts (i.e. "traditional" or "Tiebout" competition) can have positive effects on student learning (Hanushek and Rivkin 2003; Hoxby 2003). Similarly, Figlio and Hart (2010) find evidence of positive (but small) effects of competition created through the introduction of a voucher program. There is much more variation in estimations of the effects of competition generated by the creation of charter schools, with researchers finding both negative and positive effects of varying magnitudes as well as failing to observe any effects at all (Hoxby 2003; Bettinger 2005; Booker et al. 2005; Bifulco and Ladd 2006; Sass 2006; Ni 2007; Imberman 2008).

The lack of consistency in the findings about competitive effects could come from differences in the contexts in which studies are conducted, from a true lack of effect, or from difficulty in accurately estimating the effects. It may well be that choice increases competitive pressures in some contexts but not in others. For example, adults in some schools may not perceive a threat from school choice because they have contracts that provide job stability while

adults in other schools do not have as much job security. Alternatively, adults may feel a threat but respond through efforts to promote a positive perception of their schools instead of making school improvements. Finally, competition may, in fact, affect school improvement, but studies of competition may be measuring competition inaccurately and thus may be missing the existing effect. Competition is not easily observed or measured, and this leads to difficulty in assessing its impact.

While measurement error is a problem in many studies of education, it may be particularly salient in studies of school competition because of the indirect nature of the measures usually employed. Estimates of the effects of competition for students often utilize geographic measures of competition such as the number of schools within a school's district or specified distance (Bettinger 2005; Buddin and Zimmer 2005; Sass 2006; Carr and Ritter 2007), the distance to the nearest school (Holmes, DeSimone, and Rupp 2003; Buddin and Zimmer 2005), or an instrument for the presence of nearby schools (Imberman 2008). Estimates of competitive effects also use transfer rates as measures of the extent of competition that a school experiences (Booker et al. 2005; Buddin and Zimmer 2005; Ni 2007). However, there is no existing research that confirms whether the geographic density of schools (potential competitors), the distance to other schools, or transfer rates are consistently related to the amount of competitive pressure experienced by school leaders.

The inconsistency in the results of existing causal analyses of the effects of competitive pressure, combined with the plausible reasons for this inconsistency, provides motivation for exploring the nature of competitive pressure as it is experienced and responded to within schools. This study uses a survey of principals in Milwaukee Public Schools, combined with administrative data on schools, staff and students, to answer the following questions:

- 1) Which types of schools experience more competitive pressure?
- 2) Which schools do principals identify as their primary sources of competition for students?
- 3) How do schools report responding to competitive pressures?

Our analyses suggest that within this school choice system, principals do perceive competition for students. However, while the distance to other schools predicts which specific schools represent their largest sources of competition, distance to other schools (or the number of other schools within a specified distance) does not predict the magnitude of perceived competition. Instead, a school's performance and the characteristics of their students are much stronger predictors of competitive pressure, with lower performing schools and those serving more disadvantaged students facing higher levels of perceived competition. In addition, while some schools report responding to this competition with program changes, marketing approaches aimed at changing the information families receive are much more prevalent.

Background

Effects of school competition

There have been several recent, high-quality studies that attempt to estimate the effects of increased competition for students. Some researchers have approached the task of estimating the potential effects of increased competition by examining the effects of "traditional," or Tiebout competition on public schools (i.e. the sorting of students into different school districts based on the cost and service preferences of families). Hanushek and Rivkin (2003) examine the effects of traditional competition on schools using data from 27 metropolitan areas in Texas. They find a significant, positive relationship in the five largest metropolitan areas between inter-district competition (measured using a Herfindahl index based on the distribution of students across districts)

and school quality as measured by changes in students' standardized test scores controlling for student and family characteristics. Similarly, Hoxby (2003) explores whether schools' productivity (defined as achievement gains divided by per-pupil spending) is influenced by levels of competition that their districts are exposed to. She first examines the relationship between school productivity and competition generated by the availability of school options that families can access by moving to a nearby school district. Using NELS data, she measures school productivity using 8th grade reading scores, 10th grade math scores, and 12th grade reading scores after controlling for student characteristics. She instruments for inter-district competition using the number of streams in a metropolitan area and finds that competition is significantly and positively related to productivity.

Other researchers have attempted to estimate the effect of increased competition for students generated by the creation of charter schools; there is a large amount of variation in their findings. Using data from Michigan and Arizona, Hoxby (2003) finds that public schools experienced improvements in student achievement in the presence of charter school competition, even after considering schools' prior growth trends. Similarly, Booker et al. (2005) find that the presence of charter schools is associated with increased student achievement in traditional public schools in Texas, and Sass (2006) finds that charter school competition is associated with an increase in math scores for students in Florida public schools. However, using the number of pre-existing, large buildings in a neighborhood as an instrument for the presence of charter schools, Imberman (2008) finds that competition from nearby charter schools causes a *decrease* in cross-sectional and value-added measures of student achievement in math and reading, though also a decrease in disciplinary problems in public schools. Using data from Michigan, both Ni (2007) and Bettinger (2005) also find that charter school competition results in a decrease in student

achievement in public schools. Bifulco and Ladd (2006) use data from North Carolina and find that after controlling for student fixed-effects, there does not appear to be a statistically significant relationship between charter school competition and public school student achievement.

Finally, some researchers have attempted to estimate the effects of competition generated by voucher programs. West and Peterson (2004), Rouse et al. (2007), and Chiang (2009) examine the influence of Florida's A+ program, which utilized a mix of sanctions and incentives that included providing vouchers for students in persistently failing schools to attend other public or private schools. They find that the sanctions that low-performing schools faced induced improvements in student achievement. In particular, Rouse et al. (2007) and Chiang (2009) both find that schools that were threatened with sanctions responded through meaningful educational changes (e.g. changes to curricula or instruction). Figlio and Hart (2010) take advantage of the timing of the implementation of the Florida Tax Credit Scholarship Program (essentially a voucher program) to estimate the effect of perceived competition separately from the effects of school stigmatization and students sorting themselves across school sectors and exerting different peer effects (mechanisms that might be influencing the estimated effects of competition in most of the studies identified above). They find that the competition generated by the presence of a planned voucher initiative resulted in positive, albeit fairly small, gains in student achievement.

Overall, the variation in estimates of competitive effects is likely to stem from two sources. First, there is wide variation in school choice policies, and the design of a policy can have a large influence on its outcome. The estimates obtained in the aforementioned studies may not represent the effects of charter school competition in locations with different sets of policies.

Second, previous studies have not been consistent in the measurement of competition. Different measures of competition include the number of other schools within a specified distance, the presence of another school within a specified distance, the share of students enrolled in other schools within a specified distance (or within a district), the share of students lost to other schools, or some combination of these measures. Differences in measures of competition are likely to create differences in the estimated effects of competition.

Although estimates of the effects of competition suggest that competitive pressure has the potential to effect change within school systems, it is important to recognize that these estimates may not accurately reflect the true influence of competition for students. Because the effects of competition primarily rely upon school personnel recognizing and reacting to competition for students, all of these estimates implicitly assume that the measures of competition that they employ are related to perceptions of and responses to competitive pressure.

Explaining variation in perceptions of and responses to competition

Many estimates of the effects of competition use the geographic locations of schools to create measures of the extent of competitive pressure experienced by schools (Holmes, DeSimone, and Rupp 2003; Bettinger 2005; Buddin and Zimmer 2005; Sass 2006; Carr and Ritter 2007; Imberman 2008). The rationale for this approach is straightforward: because transportation to schools imposes some non-trivial cost (e.g. the amount of time that students must spend on the school bus each day or efforts undertaken by parents to bring their children to schools), families might tend to choose schools that are close to them (Teske, Fitzpatrick, and O'Brien 2009). If families are frequently choosing from within a set of geographically proximate school options, schools that are closer to some number of other schools might be expected to face more competition for students. However, the relationship between geographic distance and

the selection of schools is likely to be mediated by other factors which in turn may attenuate the relationship between school density and principals' perceptions of competition for students (Saporito and Lareau, 1999; Hastings et al., 2005).

Other estimations of competitive effects use transfer rates as measures of the extent of competition that a school experiences (Booker et al. 2005; Buddin and Zimmer 2005; Ni 2007). The reasoning for using the flow of students to other schools as a proxy for competitive pressure is also straightforward: when schools lose students unexpectedly, they are faced with an imminent loss of the funding associated with serving those students, which in turn might generate negative consequences. Thus, a school that is losing students at a higher rate is experiencing greater levels of palpable competitive pressure. However, it seems clear that transfer rates will almost never perfectly describe competitive pressure; schools are likely to experience high degrees of competition simply attracting students into entry-level grades. Moreover, transfer rates are, in part, endogenous, as schools that respond effectively to competitive pressures may reduce attrition. The extent to which transfer rates are related to overall competitive pressure felt by schools remains an open question.

The way in which families select schools is inextricably tied to the competitive pressure that schools experience; schools that have highly desirable characteristics are likely to receive larger numbers of students applying to attend them, while schools that are less desirable may face difficulties as a result of their disadvantages in attracting students. Therefore, it seems that schools' characteristics will be strongly related to perceptions of competitive pressure, although this has never been empirically examined.

Not only is there likely to be variation in the perception of competitive pressure that is caused by some combination of geography, mobility, and school attributes, but there is also the possibility that there is substantial variation in school responses to competition. Although there is a wide variety of potential actions that schools might take when faced with competition for students, it might be helpful to consider two broad categories of responses: school service changes (e.g. personnel, curricula, instruction, or resource allocation) and marketing changes (e.g. recruitment efforts). The mix of responses that schools engage in will have a large impact on the actual effect of competition. For example, Lubienski (2007) found that schools often responded to competition by disseminating marketing materials to the families of prospective students that focused more on attractive presentation (e.g. well-designed logos) and emotional appeals than specific information about a school's educational practices and track record. Similarly, Hess (2002) notes that the expansion of school choice opportunities available to Milwaukee families in the late 1990s primarily resulted in tepid and insubstantial advertising efforts at the school level (e.g. creating radio or newspaper ads and distributing t-shirts or flyers). Schools might tend to respond in this manner because marketing efforts are less expensive solutions to competitive pressure, especially if families are currently imperfectly informed about school options. However, the long term effects of marketing responses to competition (especially fairly superficial ones) are not likely to drive the systemic increase in innovation and school efficacy that school choice advocates might expect. Little research has assessed how schools specifically respond to competition and whether their responses are related to levels of competition or specific school conditions.

Finally, the way in which a school experiences and responds to competitive pressure might be a function of the schools with which they are competing for students. Therefore, it is

useful to consider schools' primary sources of competition. Schools that are competing with others that are higher-achieving might tend to make a concerted effort at improving themselves, either undertaking initiatives to improve overall quality or to better attract and serve a particular set of students. In order to do this, they might choose to mimic their competitors' successful practices, make strategic personnel decisions (i.e. hiring, retention, and support) in order to increase the quality of their services, or embrace innovative curricula. However, if schools tend to identify other schools as their sources of competition based on criteria other than academic achievement, it is more difficult to predict how (or if) they will respond.

In this paper, we examine whether the mechanisms that might generate competitive effects are related to measures of competition that commonly appear in the literature or to other observable school characteristics. We explore whether competitive pressure is related to geography, mobility, and school characteristics; which schools principals identify as their primary sources of competition; and how schools tend to respond to competition.

Data

School choice in Milwaukee

During the 2009-2010 school year, Milwaukee Public Schools (MPS) served approximately 82,000 students in 198 schools. These schools include: 130 traditional public schools, 35 charter schools (25 of these are “instrumentality” charter schools, which have much of the same operational flexibility that non-instrumentality charter schools have, but are housed in facilities that are owned or leased by MPS and staffed by MPS personnel), and 29 partnership or alternative schools that serve students who are identified as academically struggling, behaviorally troubled, or at-risk of dropping out; families could select any public and charter

school through an open enrollment process (MPS 2009a; MPS, 2011a; MPS, 2011b). Not only can families can choose from the wide selection that MPS offers, but they can also make use of the Milwaukee Parental Choice Programs (MPCP), which provides vouchers to attend private schools, or take advantage of statewide open enrollment policies and a voluntary racial integration program (Chapter 220) to attend schools in other districts. MPS provides transportation for students attending schools within their “transportation region” (there are eight regions, each of which corresponds to a public high school) or attending schools designated as “citywide” schools, unless they reside within one mile of the school that they attend. Charter schools have their own transportation policies (MPS, 2011b). During the 2009-2010 school year, schools that participated in the MPCP received per-pupil funding of \$6,442, Milwaukee charter schools received \$7,775 in per-pupil funding, and funding for students in MPS-operated schools was allocated according to a formula that resulted in an average per-pupil funding level of approximately \$15,000 (Borsuk, 2011).

Milwaukee is a particularly favorable location to study competition for students. To the extent that the variety of school options has made Milwaukee families into more active school shoppers by generating an overall culture of school choice, we might expect to find higher levels of competition for students than in other urban areas. The longstanding nature of school choice opportunities in Milwaukee might imply that competitive pressure and responses to it have had time to fully develop. In addition, a combination of general population trends as well as the presence of alternatives such as the MPCP and charter schools has generated a steady decline in student enrollment for MPS, and district leaders project that this trend will continue. As a result, schools are operating under capacity (the district notes that average school enrollment was the second lowest in the nation), staff levels have been reduced, and schools have faced closure and

consolidation (MPS, 2009b; MPS, 2011a). As a result, we can expect that principals in Milwaukee are particularly cognizant of and sensitive to competition for students.

Administrative data

This study uses administrative data collected by the Milwaukee Public Schools (MPS) for the school years 2007-08 through 2009-10. In all, 211,652 different students appear as 867,905 observations in the data. The administrative data identify students' grade, gender, ethnicity, English language learner (ELL) status, language spoken at home, eligibility for free or reduced price lunch, and number of disciplinary infractions by year. In addition to basic demographic, administrative, and enrollment information, the dataset contains scores for Wisconsin's state assessment, the Wisconsin Knowledge Concepts Examination (WKCE). Since the 2005-06 school year, the exam has been administered to students in grades 3-8 and 10 (Wisconsin Department of Public Instruction, 2009). Based on these test scores, the MPS data identifies students by proficiency level in math, reading, and English language arts (ELA). There are four proficiency categories: minimal, basic, proficient, and advanced. We aggregate all student-level data to the school level (e.g. obtaining percentage of students in a school who are classified as having an advanced proficiency in math). The first three columns of Table 1 present summary statistics for the school-level characteristics that we observe.

Quantifying transfer rates

One of measures of competition that we use stems from student transfer rates. Students are identified with unique scrambled IDs in the administrative data, and every student has a separate observation for each school year that he or she appears in the data. The data show the school in which the child was enrolled in the fall, winter, and spring of that academic year. This

longitudinal data enables us to distinguish between students who change schools within an academic year and students who change schools between them. This dataset contains complete attendance information about students enrolled in traditional public schools, some charter schools, and partnership schools but only partial information about the rest. As a result, our calculations of transfer targets and sources include only students who move between traditional MPS public schools, the charter schools for which we have attendance data, or partnership schools. Using this data, we attempt to identify student mobility that principals will be most sensitive to and will potentially interpret as the result of families' strategically selecting an alternative school instead of continuing at their school. Student mobility within a school year is unlikely to be interpreted as problematic or the result of competition; instead, movement within a school year is more likely to be the result of some disruptive event (e.g. a residential move, a divorce, or an altercation at school) (Rumberger et al. 1999). Therefore, we restrict our calculations of transfer rates to students who change schools between school years.

We are able to observe students who are enrolled in traditional MPS public schools, MPS instrumentality charter schools, or MPS partnership schools. We define between-year mobility as students who are enrolled in a school during a school year and then leave that school after the spring of one year and before the fall of the following year, omitting "promotional movers" who cannot stay in the same school the following year because they have successfully completed the highest grade level offered by that school. We identify students as transferring after year t :

- if they are observed in different schools in the spring of year t and the fall of year $t + 1$ and they are not promotional movers;

- if they are observed in different schools in the spring of year t and the winter of year $t + 1$ with a missing fall school observation for year $t + 1$, and they are not promotional movers;
- if they are observed in different schools in the winter of year t and the fall of year $t + 1$ with a missing spring school observation for year t , and they are not promotional movers;
- or if they are observed in a school in the spring of year t with missing fall and winter school observations for year $t + 1$, and they are not promotional movers.

After identifying these transfers, we create two types of variables: overall transfers rates out of each school, and transfer rates from each school i into each other school j .

Geographic data

We also measure competition with geographic proximity measures. Using addresses for Milwaukee schools, we obtained geographic coordinates for MPS, charter, private, and Chapter 220 schools. With these, we calculated distances between pairs of schools; the number of schools within a 1 mile, 2 mile, and 5 mile radius of each school; the distance to the closest school; and the average distance to another school. Because it is possible that school selections are made based on the neighborhoods within which schools are located, we used 2000 census data to identify neighborhood characteristics (specified at the census block-group level) for each school. Figure 1 is a map of Milwaukee census block groups classified by median household income (darker shades indicate higher income). Using student administrative data, we obtained geographic coordinates for the home addresses of students who appear in our data. With these, we calculated geographic centroids for the students attending each school which were the centers of standard distance circles (a circle within which approximately 68% of students reside) that

describe the dispersion of students being served by schools in the 2008-2009 and 2009-2010 school years. Figure 1 depicts a representative subsample of the 2009-2010 standard distance circles. We calculated the overlap between the dispersion areas of each pair of schools for each school year. With these, we calculated the percent of schools' dispersion areas that overlap with each other school's dispersion area. If two schools' dispersion areas do not overlap, then this value is zero; if one school's dispersion area is completely encircled by another school's dispersion area, then this value is 100.

Survey data

Finally, our measures of perceived competition and responses to competition come from principals' reports. We worked with Milwaukee Public Schools (MPS) to survey principals in May of 2010. Of the 156 MPS principals, 143 (93 percent) filled out the survey, though response rates for individual items were sometimes lower. The survey asked principals to reflect on myriad aspects of their work ranging from personnel management to budgeting background and future career plans. A section of the survey focused on principals' perceptions of competitive pressure, their biggest source of competition, and their responses to competition for students (Appendix Table 1). We describe responses to these survey questions in more detail below.

Methods

Competitive pressure

Our first question asks which types of schools experience more competitive pressure. In particular we are interested in exploring whether schools located closer to other schools feel greater competition; whether schools who lose more students to other schools feel more competitive pressure; whether schools with lower performing students feel greater competition;

and whether competitive pressure is associated with other geographic or demographic characteristics of schools.

In order to detect whether the extent of competition for students that principals experience is related to geographic characteristics, school characteristics, or transfer rates, we employ logit regression models predicting whether principals indicated that they felt a potentially meaningful level of competition for students:

$$P(Y|X) = \frac{1}{1+e^{-(\alpha_0+X\beta)}} \quad (1)$$

where X is a vector of covariates that might be related to the extent of competition experienced by principals and β is a vector of coefficients. As a specification check we estimate models similar to Equation 1 but using an ordered logit to make full use of the survey question.

In these analyses we run four sets of models testing the relationship between perceived competition and different sets of school characteristics. Our first set of models includes geographic variables that are similar to those employed in studies that use geographic characteristics as proxies for school competition: school density within specified radii, average distance to other schools, and the distance to the closest school.¹ Our second set of models explores transfer rates, which represent an alternative indicator of competition. In the first model of this set, we simply predict competition with transfer rates (between the 2008-2009 and 2009-2010 school years). In the second, we include transfer rates along with school characteristics such as demographics, school level (i.e. whether a school is an elementary, middle or high school), and suspensions that might be related to both principals' perceptions of the competition

¹ These geographic variables include *all* other schools (i.e. public, private, charter, or inter-district public) in calculations of densities and distances. We also calculate these variables using only MPS schools and obtain similar results that are not presented here.

that they face and transfer rates from schools. In the third model, we replace transfer rates with lagged transfer rates (between the 2007-2008 and 2008-2009 school years) in order to detect whether these might be a stronger predictor of principal perceptions, which might be the case if principals tend to consider their most recent transfers to be atypical occurrences. In the final model of this set, we return to using transfer rates and also include principal characteristics that are potentially correlated with perceptions of competitive pressure and whose omission might bias our estimates, as well as school characteristics and transfer rates. Our third set of models explores the relationships between measures of student achievement and principal perceptions of competition. The first model uses standardized WKCE math scores along with school level. The second replaces math scores with proportions of students scoring at specified proficiency levels, which, while less reflective of the full distribution, families, teachers, and district administrators might pay more attention to than test scores. The third model includes controls for student demographics and transfer rates, which might be related to both student achievement and principal perceptions of competition.² Our fourth set of models test some further potential indicators of competition and include neighborhood characteristics, student dispersion areas, lagged student dispersion areas, and net changes in student dispersion areas.³

Sources of competition

An additional aim of this study is to determine whether geographic characteristics, relative school characteristics, or transfer rates are related to the schools that principals identify as their primary sources of competition for students. First, we construct a dataset of school pairs

² We also run similar models that include WKCE reading and ELA test scores and proficiency levels. These models produce similar results and are not presented in our tables.

³ We explore the robustness of the findings from our second, third, and fourth sets of models by employing similar models that predict “a lot” of perceived competition as well as ordered logit models predicting the extent of competition. The results were qualitatively similar to those of our initial models and are not presented here

where school i might potentially identify school j as its primary source of competition. All traditional MPS schools, which were administered the principal survey, are included as respondent schools i and all traditional MPS schools and partnership schools that serve one or more of the same grade levels as school i are included as competition sources j . We employ conditional logit models that predict the selection of school j as the primary source of school competition for school i :

$$\Pr (Y_i = j | J_i) = \frac{e^{X_{ij}\beta + Z_{ij}\gamma}}{\sum_{j=1}^{j=J} e^{X_{ij}\beta + Z_{ij}\gamma}} \quad (2)$$

where J_i is a vector of potential sources of competition for school i , X is a vector of relative school characteristics for schools i and j , Z is a vector of absolute values for differences in school characteristics for schools i and j , and β and γ are corresponding vectors of coefficients. By including both absolute and relative differences in characteristics, we can detect how both the similarity and directionality of specific school attributes are related to the likelihood of one school identifying another as its primary source of competition.

In our first set of models, we include school characteristics that could plausibly be associated with the identification of a school as a source of competition for students: the distance between schools, the absolute and relative differences between schools' demographics and test scores, the transfer rate between schools, and the lagged transfer rate between schools. In our second set of models, we explore other factors that might be related to identification of competition sources. Principals might be aware of which schools tend to pull students from wider or small areas, which schools tend to serve students from the same places that their schools do, and the characteristics of the neighborhoods within which schools are located. Therefore, in this set of model we include relative and absolute differences in student dispersion areas and

neighborhood characteristics, overlaps between the schools' student dispersion areas, and control for the absolute and relative differences between schools' demographics and test scores.⁴

Principal responses to competition

Our final set of questions addresses how schools tend to respond to competitive pressures. In particular, we are interested in the extent to which schools make changes to their curricula or practices; the extent to which schools engage in marketing or recruiting efforts; and whether schools responses to competitive pressures differ systematically between more and less effective schools and schools serving different student populations.

In order to examine whether principal responses are related to school characteristics or transfer rates, we employ two sets of logit models (one for each response type):

$$P(Y|X) = \frac{1}{1+e^{-(\alpha_0+X\beta)}} \quad (3)$$

where Y represents principals responding that they engage in a substantial amount of either recruiting or school changes, X is a vector of school characteristics, and β is a vector of coefficients. Our sets of models include principals' perceptions of competition for students along with variables that are potentially related to both principals' perceptions of competition and their responses: school demographics, school level, student proficiency levels, transfer rates, student dispersion areas, and principal characteristics.⁵

⁴ In order to explore the robustness of our findings, we run rare-event logit models which correct for the expected proportion of successes in the population (King and Zeng 2001). We use expected success proportions of .01, .015, and .02. The results are qualitatively similar to those of our initial models and are not reported.

⁵ We also employed models that predicted "a lot" of curricular or marketing responses as well as ordered logit models predicting the extent of these responses; the results were largely similar to those from those of our initial models and are not reported.

Results

Competitive pressure

Figure 2 shows how MPS principals responded to a question regarding the extent to which their schools compete for students with other schools. Perceived competitive pressure varies across schools with a large proportion of principals indicating that they experienced a potentially meaningful amount of competition for students: forty-five percent of principals who responded to this question reported “a lot” of competition, 30 percent reported “some” competition, 14 percent reported “a little” competition, and 11 percent reported no competition at all.

Schools that perceive substantial competition differ systematically from those that do not. The last four columns of Table 1 show school characteristics by extent of competitive pressure (with schools where principals who responded that they felt “some” or “a lot” of competition for students representing high competition schools). We see that schools perceiving some or a lot of competition have a greater proportion of students in poverty (as measured by eligibility for subsidized lunch) and a greater proportion of special education students, than those who do not (82.4 percent vs. 73.7 percent and 21.8 percent vs. 18.3 percent respectively). We also see that schools that score higher on the Wisconsin standardized test (WKCE) in English Language Arts and in Mathematics tend to feel less competitive pressures.

We first explore whether geographic proximity predicts principals' perceptions of competition. Table 2 presents the results of models that predict whether a substantial amount of competition is experienced by principals with geographic variables including the number of schools within one mile, the number of schools within two miles, the number of schools within

five miles, the average distance to another school, and the distance to the closest school. None of these variables is predictive of competitive pressure in Milwaukee, nor do the estimated relationships consistently predict a negative relationship between distance and perceived competition. We test the robustness of these null findings three ways. First, we employ a slightly different measure of competition, whether principals indicated that they experienced “a lot” of competition for students instead of “some” or “a lot”. Second, we use an ordered logit model predicting the amount of competition experienced (a lot, some, little, or no), and third, we run models that also included school achievement and student demographics. The results of these models appear in Appendix tables 2 through 4. None of them indicate any statistically significant relationships between geographic proximity and perceptions of competition.

Given that we do not find a relationship between geographic proximity and reported competitive pressures, we assess the extent to which transfer rates of students predict perceived competition. Table 3 presents these results. Principals in schools with higher transfer rates are more likely to report experiencing a substantial amount of competition for students. This relationship remains even after controlling for school and principal characteristics that are potentially related to both transfer rates and principals’ perceptions. In Model 3 we replace transfer rates with lagged transfer rates. Although there is still a positive relationship between this variable and competition likelihood, it is weaker and is not statistically significant at the $p = .05$ level. This result suggests that principals base their perceptions of competition for students more on recent transfers from their school than on prior transfers.

In addition to transfer rates, school performance, both true and perceived, might also predict competitive pressures. Table 4 includes mean student WKCE math scores and proportions of students at different proficiency levels in mathematics. Interestingly, schools with

many high performing students and schools with many low performing students perceive greater pressure than those in the middle. This pattern holds true after controlling for transfer rates, school level, and school demographics. Although the linear math score is not associated with competition, the coefficients on corresponding categorical variables suggest an interesting non-linear relationship between student achievement levels and perceived competition.

Finally, we test the hypotheses that competitive pressure is related to either neighborhood characteristics or to student dispersion areas (Table 5). We find that attributes of the neighborhoods that schools are located in do not appear to be related to the extent of competition that principals experienced. Similarly, we do not find any indication that competitive pressure is related to the dispersion area of students being served by a school, to the dispersion area being served by a school in the previous year, or to changes in dispersion areas between years.

Sources of competition

Our next set of analyses explores which schools principals identify as their primary sources of competition for students. Seventy eight principals who responded to our survey identified a specific school as their biggest source of competition. Of these, 60 identified a school for which we have administrative data (i.e. MPS public schools or partnership schools). Table 6 presents analyses predicting the competition source identified by the principal. We find that principals are more likely to identify schools that are located close to them; that have similar, but higher, average student math scores; that are serving similar, but greater, proportions of white or Hispanic students; and that receive greater numbers of transfer students from the respondent school. The results are similar whether or not we include a respondent school fixed effect. The increase of a mile between schools is associated with an approximate 50 percent

decrease in the likelihood of one school identifying the other ($p < .001$). After controlling for geographic distance as well as demographic and achievement differences, every between-year transfer from one school to another is associated with an approximate 25 percent increase in the likelihood of the source school identifying the destination school ($p < .01$).

Table 7 reports the results of models that incorporate student dispersion areas and neighborhood characteristics. Even after controlling for distances between schools and relative school characteristics (both demographics and achievement), our results suggest that a one percent increase in the proportion of a school's dispersion area that overlaps with that of another school is associated with an approximate two percent increase in the likelihood of that school being identified as a primary source of competition ($p < .05$).

Principal responses to competition

Our final set of analyses explores principals' reported responses to competitive pressures. Figure 2 shows the frequency of principal responses to questions about their actions taken as a result of competitive pressure: 25 percent report “a lot” of outreach and advertising, compared with 13 percent reporting “a lot” of instructional or curricular change. Fifteen percent report no outreach or advertising to compete for students while 30 percent report no instructional or curricular change.

In our models that predict the likelihood of a principal indicating that he or she has made a substantial amount of changes to the curriculum or practices in his or her school as a result of competitive pressure (Table 8), we find that the extent of competitive pressure that a principal experiences does appear strongly related to the likelihood of this response. In addition, after controlling for student demographics, schools that are serving greater proportions of students

who are rated as minimal, basic or advanced ability in mathematics (relative to the proportion of students rated as proficient in math) are more likely to indicate that they have made changes to curriculum or practice. Table 9 presents the results of models that predict the likelihood of a principal indicating that he or she has undertaken substantial amounts of recruitment or marketing as a result of competitive pressure. The extent of competition that a principal experiences is consistently, positively associated with the likelihood of substantial marketing or recruiting efforts.

Discussion

This study describes competition between schools with the aim of understanding the extent of competition, the variation in competition across schools, and the responses of schools to the competition they experience. Our results suggest that there is a substantial amount of variation in how principals experience competitive pressure. Somewhat surprisingly, the extent to which principals perceive competition for students does not relate to geographic factors such as the number of nearby schools serving overlapping grades, the average distance to another school, or the distance to a school's closest competitor. It is possible that these results are partially a reflection of the longstanding and robust choice system in Milwaukee, where families not only have many options but also quite a bit of support (e.g. transportation to the schools that their children attend) when choosing schools. However, estimates of the effects of competition that use these sorts of geographic characteristics as a proxy for the extent of competition that a school experiences might need to be re-examined. Similarly, policies that attempt to create increased competitive pressure on a set of schools simply by increasing school density in a particular geographic area are unlikely to have the intended effects.

The lack of evident relationship between geography and reported competition could result if the reported competition measure were simply noise. However, we do find that the extent of competition perceived by school leaders is related to other school characteristics, for example student transfer rates out of a school. This makes sense: not only are transfers something that principals are likely to be both aware of and associate with pressure to attract and retain students, but they also appear in the mobility rate that is reported on a school's "report card," which is available to families who are evaluating schools (MPS 2011). In addition to transfer rates, student performance also is related to principals' perceptions of competitive pressures. Both low and high achieving schools feel more pressure than schools in the middle.

Principals display predictable patterns when identifying their primary sources of competition. When principals do experience competitive pressure, they tend to associate that pressure with schools that are geographically close, serve populations of students that overlap with their own, serve demographically similar students, and have similar but somewhat higher levels of student achievement. They are also more likely to indicate that a school represents a source of competition for students if they experience a greater number of transfers to that school. Overall, it seems that principals are aware of schools that families might select instead of their own.

Finally, this study provides evidence that while some schools respond to competition by trying to improve curricula or instruction, a more common approach is to use outreach or advertisement. Although principals might react in ways other than the ones that we inquired about, examining these two broad categories of responses provides some useful insight into how school leaders handle competition for students. It is possible that some principals conduct outreach efforts that are purely intended to increase family or community involvement in ways

that improve students' educational experiences. However, to the extent that our findings reflect school leaders' beliefs that increased marketing efforts are an effective way to compete for students, they point to the importance of information barriers in the smooth functioning of school choice systems. If families already had access to accurate information or could not be swayed by marketing, then advertising would not influence their choices and would not be an attractive strategy for school leaders.

Our study provides evidence of both potential benefits of competition and potential drawbacks. We see some suggestive evidence that competitive pressure is not only being perceived by principals in lower-performing schools but also inspiring efforts that have the potential to improve student outcomes (i.e. curricular or instructional changes). However, the positive effects of competition are likely to be limited for three reasons: competitive pressure is not experienced in all schools, does not appear to uniformly inspire changes within schools themselves, and induces competition largely between schools that are geographically close and similar to one another.

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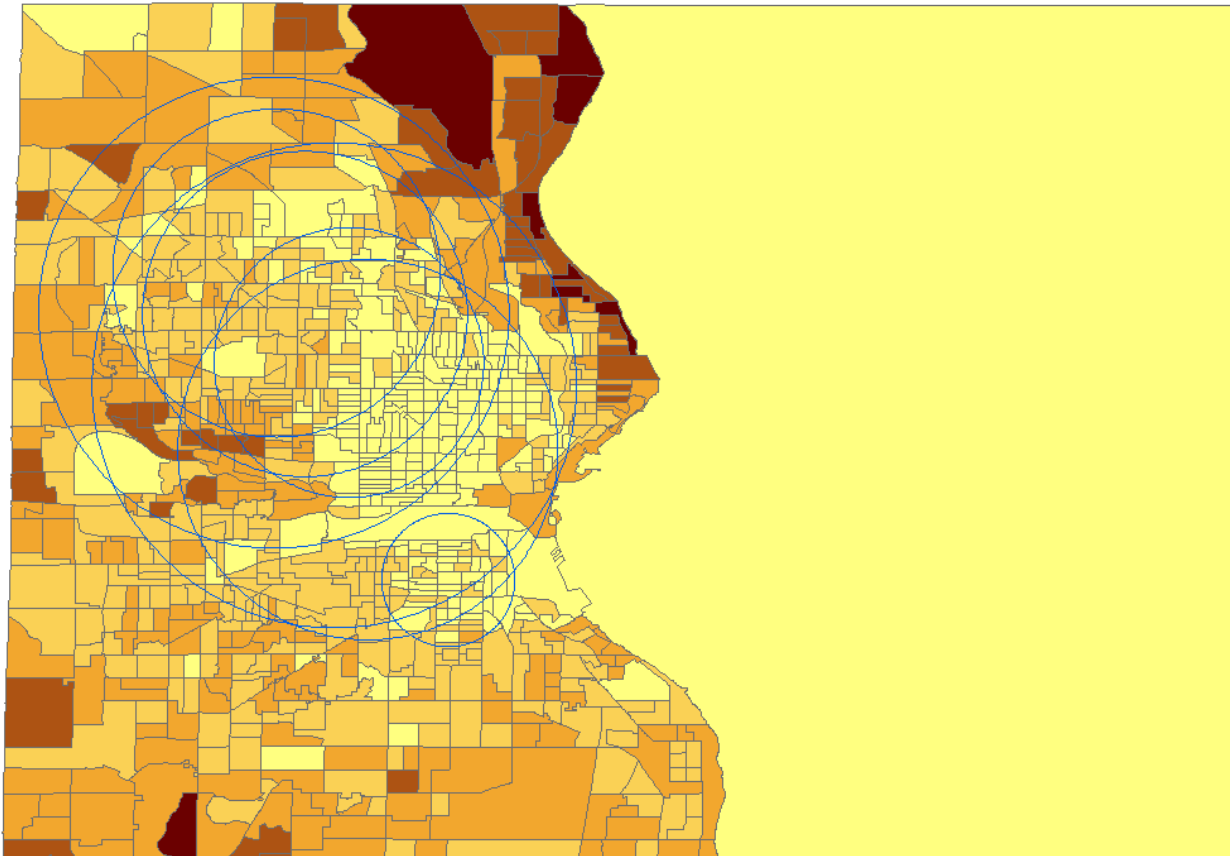
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Figures and Tables

Figure 1: Map of census blocks in Milwaukee by median income (including representative subsample of student dispersion areas)



Darker shades represent higher median income areas Figure 2: Summary of principal survey responses

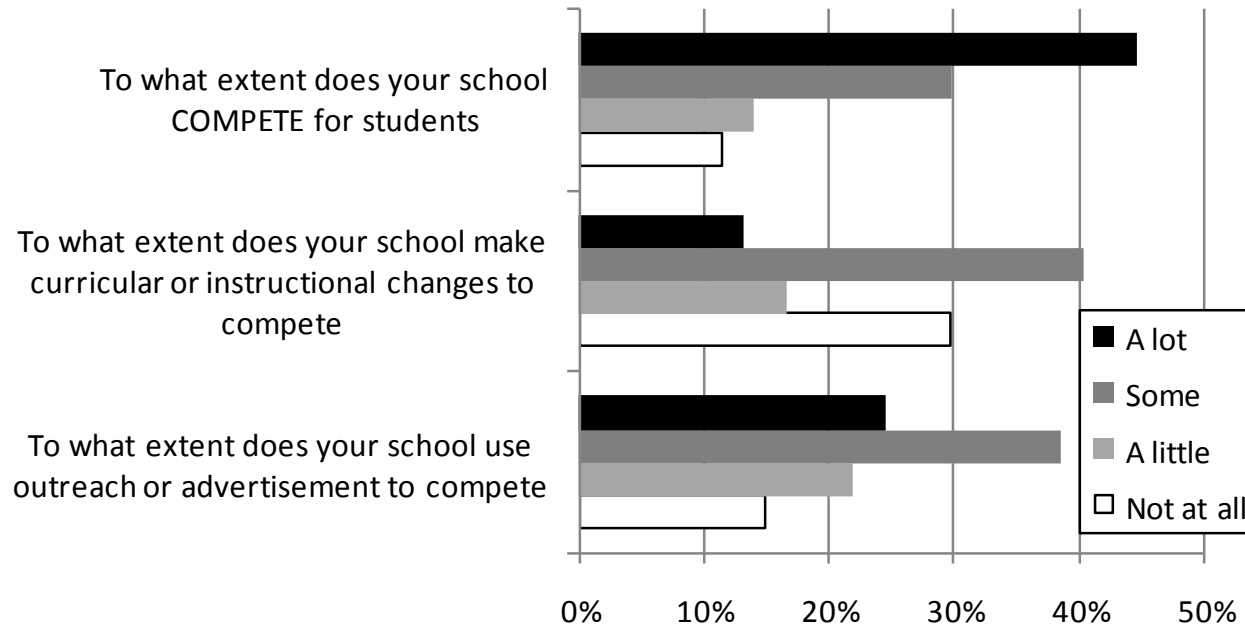


Table 1: Summary statistics for respondent MPS schools

	overall			“Some” or “a lot” of competition responses indicate schools facing more competition			
	Mean	SD	N	Less competition Mean	More competition Mean	Less competition N	More competition comp N
% female	48.959	10.656	108	51.42	48.098	28	80
% ell	7.484	14.099	105	5.015	8.381	28	77
% free/reduced lunch	80.118	16.517	105	73.741*	82.437	28	77
% special ed	20.86	6.206	105	18.310*	21.788	28	77
% Black	50.17	38.426	124	44.53	52.757	39	85
% White	10.735	16.017	124	10.577	10.807	39	85
% Hispanic	16.461	25.152	124	10.543+	19.176	39	85
WKCE scale score (ELA)	327.527	47.221	122	342.740*	320.645	38	84
WKCE scale score (Math)	463.391	29.827	122	472.650*	459.203	38	84
WKCE scale score (Read)	455.335	23.359	122	461.139+	452.709	38	84
Avg. number of suspensions	2.073	0.897	102	1.89	2.136	26	76
Principal tenure	16.666	10.157	108	18.255	16.11	28	80

Table 2: Logit models predicting likelihood of “some” or “a lot” of competition with geographic distances

VARIABLES	(1)	(2)	(3)	(4)	(5)
# Schools w/in 1 mile	1.040 (0.876)				
# Schools w/in 2 miles		1.005 (0.307)			
# Schools w/in 5 miles			0.999 (-0.253)		
Average Distance to Another School				1.060 (0.373)	
Distance to Closest School					1.669 (0.850)
Constant	2.186* (1.996)	2.597* (2.148)	3.365* (2.026)	2.366** (2.707)	1.346 (0.388)
Observations	106	106	106	106	106

z-statistics in parentheses; coefficients are odds-ratios

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 3: Logit models predicting likelihood of “some” or “a lot” of competition with school characteristics

VARIABLES	(1)	(2)	(3)	(4)
Transfer Rate	1.128*	1.243*		1.238*
	(2.143)	(2.434)		(2.285)
Lagged Transfer Rate			1.171+	
			(1.927)	
% Free/reduced lunch		0.999	1.003	1.010
		(-0.0484)	(0.108)	(0.353)
% Black		0.986	0.987	0.983
		(-0.725)	(-0.680)	(-0.899)
% Hispanic		1.007	1.008	1.007
		(0.273)	(0.330)	(0.274)
% ELL		1.003	1.001	0.992
		(0.105)	(0.0280)	(-0.236)
# Suspension Days		1.653	1.648	1.526
		(1.181)	(1.158)	(0.999)
Middle School		0.949	0.706	1.397
		(-0.0352)	(-0.236)	(0.222)
High School		0.398	0.427	0.351
		(-1.026)	(-0.967)	(-1.092)
Principal is Female				0.332
				(-1.608)
Principal Tenure				0.984
				(-0.608)
Constant	1.220	0.551	0.530	1.118
	(0.450)	(-0.457)	(-0.493)	(0.0780)
Observations	102	99	99	99

z-statistics in parentheses; coefficients are odds-ratios

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 4: Logit models predicting likelihood of “some” or “a lot” of competition with school characteristics (including student achievement)

VARIABLES	(1)	(2)	(3)
WKCE Standardized Math Scores	0.430 (-1.606)		
% Free/reduced lunch			1.027 (0.912)
% Black			0.980 (-0.922)
% Hispanic			1.014 (0.499)
% ELL			0.979 (-0.649)
Middle School	0.623 (-0.378)	1.193 (0.130)	2.671 (0.681)
High School	0.408 (-1.365)	0.274 (-1.549)	0.358 (-0.884)
% WKCE Minimal Math Rating		1.080** (2.694)	1.102** (2.616)
% WKCE Basic Math Rating		1.107 (1.494)	1.170+ (1.870)
% WKCE Advanced Math Rating		1.123* (2.043)	1.182* (2.434)
Transfer Rate			1.175 (1.522)
Constant	3.185*** (4.570)	0.00928+ (-1.888)	0.000101* (-2.494)
Observations	103	103	100

z-statistics in parentheses; coefficients are odds-ratios

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 5: Logit models predicting likelihood of “some” or “a lot” of competition with geographic characteristics

VARIABLES	(1)	(2)	(3)	(4)
Student Dispersion Area (1 SD)	0.840 (-0.281)			
Lagged Student Dispersion Area (1 SD)		0.946 (-0.0915)		
Change in Student Dispersion Area			0.470 (-0.457)	
School Neighborhood Median Income				1.000 (-0.862)
School Neighborhood Population Density				1.000 (-0.186)
Constant	3.410 (1.532)	2.942 (1.401)	2.777*** (4.589)	5.251+ (1.885)
Observations	105	105	105	102

z-statistics in parentheses; coefficients are odds-ratios

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 6: Conditional logit models predicting likelihood of competition source identification with relative characteristics (target school – respondent school characteristics)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Distance Between Schools	0.443*** (-7.703)	0.445*** (-7.697)	0.459*** (-6.789)	0.467*** (-6.676)	0.475*** (-5.886)	0.485*** (-5.749)
School Mean Math Scores, Standardized (Abs.)		0.100** (-3.263)	0.291+ (-1.726)	0.410 (-1.249)	0.640 (-0.619)	0.622 (-0.620)
School Mean Math Scores, Standardized		10.91*** (4.152)	3.161+ (1.899)	1.723 (0.902)	0.618 (-0.721)	0.737 (-0.432)
% White			1.120*** (3.709)	1.081* (2.364)	1.107* (2.466)	1.114* (2.508)
% Hispanic			1.039* (2.354)	1.042* (2.551)	1.050* (2.569)	1.049* (2.436)
% Black (Abs.)			0.982 (-0.935)	0.984 (-0.888)	0.980 (-0.957)	0.977 (-1.086)
% White (Abs.)			0.901** (-3.008)	0.917* (-2.423)	0.917* (-2.042)	0.912* (-2.073)
% Hispanic (Abs.)			0.966* (-2.035)	0.966* (-1.973)	0.964+ (-1.955)	0.965+ (-1.870)
% Free/reduced lunch				0.930** (-2.901)	0.934* (-2.328)	0.942* (-2.031)
% Free/reduced lunch (Abs.)				0.941* (-2.294)	0.953 (-1.619)	0.957 (-1.443)
Enrollment					1.002** (2.703)	1.002** (2.662)
Enrollment (Abs.)					0.998 (-1.593)	0.998 (-1.595)
# Transfers to Target School					1.275** (2.895)	
# Transfers to Target School (Lagged)						1.291** (3.257)
Constant	5.92e-07 (-0.0171)	3.46e-07 (-0.00997)	8.12e-07 (-0.0140)	4.51e-07 (-0.0108)	5.48e-07 (-0.0191)	2.87e-07 (-0.0152)
Observations	4983	4861	4861	4861	4095	4095

z-statistics in parentheses; coefficients are odds-ratios
 *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 7: Conditional logit models predicting likelihood of competition source identification with relative characteristics (target school characteristics – respondent school characteristics), including geographic characteristics

VARIABLES	(1)	(2)	(3)	(4)
Distance Between Schools	0.468*** (-7.455)	0.511*** (-6.405)	0.517*** (-5.719)	0.525*** (-5.594)
Student Dispersion Area (Abs.)	0.0348*** (-3.859)	0.0549** (-3.217)	0.173+ (-1.926)	0.186+ (-1.855)
Student Dispersion Area	7.251** (3.206)	4.652* (2.355)	1.122 (0.153)	1.282 (0.330)
% Dispersion Area Overlap		1.012* (2.308)	1.011* (2.068)	1.010+ (1.907)
WKCE Standardized Math Scores (Abs.)			0.437 (-1.217)	0.575 (-0.792)
WKCE Standardized Math			2.826+ (1.770)	2.529 (1.540)
% White			1.104*** (3.348)	1.100** (3.221)
% Hispanic			1.042* (2.386)	1.041* (2.302)
% Black (Abs.)			0.981 (-1.032)	0.976 (-1.256)
% White (Abs.)			0.923* (-2.384)	0.923* (-2.409)
% Hispanic (Abs.)			0.969+ (-1.825)	0.973 (-1.607)
Neighborhood Median Income (Abs.)				0.971+ (-1.774)
Neighborhood Median Income				1.024+ (1.712)
Observations	4952	4952	4832	4593

z-statistics in parentheses; coefficients are odds-ratios

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 8: Logit models predicting likelihood of “some” or “a lot” of curriculum/practice responses with school characteristics

VARIABLES	(1)	(2)	(3)	(4)	(5)
Perceived Extent of Competition	1.955** (2.908)	1.688* (2.189)	1.834* (2.351)	1.864* (2.389)	1.810* (2.217)
% Free/reduced Lunch	0.995 (-0.231)	1.006 (0.223)	1.010 (0.361)	1.003 (0.117)	1.008 (0.252)
% Black	0.992 (-0.452)	0.985 (-0.799)	0.988 (-0.608)	0.990 (-0.495)	0.990 (-0.519)
% Hispanic	1.001 (0.0291)	1.006 (0.234)	1.007 (0.277)	1.007 (0.283)	1.007 (0.306)
% ELL	0.988 (-0.465)	0.972 (-1.062)	0.974 (-0.980)	0.972 (-1.014)	0.969 (-1.119)
# Suspension Days	1.231 (0.753)	1.081 (0.262)	1.172 (0.529)	1.190 (0.575)	1.200 (0.581)
Middle School	1.948 (0.495)	3.116 (0.812)	2.527 (0.649)	2.955 (0.751)	3.366 (0.829)
High School	1.611 (0.600)	1.399 (0.334)	1.733 (0.551)	1.887 (0.632)	1.917 (0.636)
% WKCE Minimal Math Rating		1.073* (2.273)	1.065+ (1.953)	1.065* (1.977)	1.064+ (1.895)
% WKCE Basic Math Rating		1.153* (1.960)	1.142+ (1.759)	1.145+ (1.813)	1.139+ (1.712)
% WKCE Advanced Math Rating		1.130* (2.057)	1.132* (2.041)	1.140* (2.152)	1.141* (2.108)
Transfer Rate			0.970 (-0.364)	0.969 (-0.383)	0.966 (-0.417)
Student Dispersion Area				0.537 (-0.607)	0.538 (-0.590)
Principal is Female					0.694 (-0.664)
Principal Tenure					0.990 (-0.449)
Constant	0.210 (-1.246)	0.000465* (-2.355)	0.000303* (-2.416)	0.000772* (-1.991)	0.00110+ (-1.837)
Observations	102	102	99	99	99

z-statistics in parentheses; coefficients are in odds-ratios

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 9: Logit models predicting likelihood of “some” or “a lot” of marketing/recruiting responses with school characteristics

VARIABLES	(1)	(2)	(3)	(4)	(5)
Perceived Extent of Competition	1.911** (2.683)	1.842* (2.387)	1.924* (2.409)	1.848* (2.231)	1.901* (2.281)
% Free/reduced Lunch	1.016 (0.689)	1.026 (1.026)	1.035 (1.199)	1.048 (1.494)	1.045 (1.341)
% Black	0.972 (-1.516)	0.979 (-1.027)	0.977 (-1.065)	0.973 (-1.265)	0.973 (-1.221)
% Hispanic	0.967 (-1.371)	0.975 (-0.964)	0.970 (-1.142)	0.969 (-1.163)	0.969 (-1.176)
% ELL	0.983 (-0.605)	0.977 (-0.770)	0.975 (-0.806)	0.979 (-0.685)	0.982 (-0.584)
# Suspension Days	2.306+ (1.896)	2.380+ (1.857)	2.214+ (1.722)	2.247+ (1.677)	2.275+ (1.689)
Middle School	0.598 (-0.362)	0.579 (-0.377)	0.442 (-0.551)	0.295 (-0.791)	0.267 (-0.846)
High School	2.601 (0.951)	3.924 (1.272)	3.586 (1.174)	2.888 (0.943)	2.896 (0.935)
% WKCE Minimal Math Rating		1.009 (0.298)	1.008 (0.235)	1.008 (0.244)	1.009 (0.257)
% WKCE Basic Math Rating		1.048 (0.622)	1.033 (0.418)	1.028 (0.343)	1.033 (0.395)
% WKCE Advanced Math Rating		1.061 (0.983)	1.053 (0.853)	1.038 (0.569)	1.039 (0.591)
Transfer Rate			0.943 (-0.656)	0.947 (-0.585)	0.951 (-0.540)
Student Dispersion Area				3.816 (1.123)	3.663 (1.081)
Principal is Female					1.378 (0.522)
Principal Tenure					1.007 (0.271)
Constant	0.155 (-1.377)	0.00636 (-1.515)	0.00993 (-1.341)	0.00134 (-1.619)	0.000957+ (-1.657)
Observations	102	102	99	99	99

z-statistics in parentheses; coefficients are odds-ratios

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Appendix Table 1: List of survey questions (from survey of MPS principals conducted in May, 2010)

Questions				
To what extent does your school do the following?				
	Not at All (1)	A Little (2)	Some (3)	A Lot (4)
a. Competes for students with other schools in the area	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Makes curricular or instructional changes in order to compete for students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Uses outreach or advertisements to compete for students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Which school does your school COMPETE with MOST intensely for students? Name of School:				

Appendix Table 2: Logit models predicting likelihood of “a lot” of competition with geographic distances

VARIABLES	(1)	(2)	(3)	(4)	(5)
# Schools w/in 1 mile	0.989 (-0.285)				
# Schools w/in 2 miles		0.984 (-1.177)			
# Schools w/in 5 miles			0.993 (-1.529)		
Average Distance to Another School				0.946 (-0.401)	
Distance to Closest School					1.758 (1.337)
Constant	0.833 (-0.522)	1.151 (0.357)	1.609 (0.912)	0.936 (-0.125)	0.595+ (-1.959)
Observations	106	106	106	106	106

z-statistics in parentheses; coefficients are odds-ratios

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Appendix Table 3: Ordered logit models predicting competition perception with geographic distances

VARIABLES	(1)	(2)	(3)	(4)	(5)
# Schools w/in 1 mile	1.015 (0.416)				
# Schools w/in 2 miles		0.994 (-0.514)			
# Schools w/in 5 miles			0.995 (-1.131)		
Average Distance to Another School				0.983 (-0.136)	
Distance to Closest School					1.677 (1.318)
Observations	106	106	106	106	106

z-statistics in parentheses; coefficients are odds-ratios

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Appendix Table 4: Logit models predicting likelihood of “some” or “a lot” of competition with geographic distances, after controlling for school achievement and demographics

VARIABLES	(1)	(2)	(3)	(4)	(5)
# Schools w/in 1 mile	0.984 (-0.268)				
# Schools w/in 2 miles		0.985 (-0.698)			
# Schools w/in 5 miles			0.994 (-0.803)		
Average Distance to Another School				1.211 (0.782)	
Distance to Closest School					2.210 (0.769)
Constant	6.35e-05** (-2.747)	4.67e-05** (-2.821)	6.03e-05** (-2.801)	2.77e-05** (-2.747)	4.36e-05** (-2.847)
Observations	101	101	101	101	101

z-statistics in parentheses; coefficients are odds-ratios

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1