How School Choice Affects the Achievement of *Public* School Students

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I. The Effects of School Choice on *Public* School Students are Important

Opponents of school choice often take the view that schools can be "only so good," so that what some students gain, other students must lose. This view of schools becomes most obvious when issues like "cream-skimming" are discussed. The usual argument runs as follow: if the better students leave the regular public schools to attend choice schools, then the students who remain in regular schools will be worse off. In fact, evidence suggests that the choice schools created by recent reforms do *not* cream-skim. Nevertheless, cream-skimming is a theoretical possibility, and we should care about the outcomes of students who remain in regular public schools, especially in the short-term, when regular public schools are likely to contain the bulk of students.

Experts on school choice, particularly those with a background in economics, find the view that schools can be "only so good" to be strange. As a rule, *the* key way in which organizations respond to competition is by becoming more efficient. This tendency is so strong that we often say that an organization has "become more competitive" when we really mean that it has become more efficient or productive in response to competition. Thus, it is not only possible, but likely, that regular public schools will respond to competition from choice schools by raising their pupils' achievement or raising another pupil outcome valued by parents. Better outcomes are the way in which a regular public school would evince increased efficiency. This is because existing choice reforms are designed so that per-pupil spending in the regular pupil schools cannot fall when a student leaves to attend a choice school. In fact, under all but one existing reform, a regular public school's per-pupil spending actually *rises* when a student leaves.

In short, while achievement might fall in regular public schools if choice introduces cream-skimming and only cream-skimming, it might rise if regular public schools raise achievement in order to compete with choice schools. In this chapter, I examine how *public* school students' achievement was

affected by three important, recent choice reforms: vouchers in Milwaukee, charter schools in Michigan, and charter schools in Arizona. I study these three reforms because they are only ones in the choice schools can, legally, garner a large enough share of enrollment to provide a non-negligible amount of competition for the regular public schools. In fact, because even these choice reforms are still modest in size, I attempt to see whether public schools respond competitively when they face the loss of only six percent of their enrollment. Looking at early evidence, as I do, is the worst case for school choice. When a school has lost only a bit of its enrollment for only a few years, it might not respond competitively or respond in any way. Yet, the first few percent of students who leave could easily be the most attractive (extreme cream-skimming). Thus, if I find evidence that public schools raise achievement when faced with early and minor competition from choice schools, the results are likely to understate the improvement in achievement that regular public schools would attain when faced with more sustained, more substantial competition.

Because evidence on recent choice reforms necessary has a short-term character, I also review evidence on how traditional forms of choice in the United States affect the achievement of *public* school students. In particular, I examine the effects of parents' being able to choose among public school districts by choosing their residence. This is the dominant form of choice that exists in the United States currently, but the availability of multiple school districts differs a great deal from metropolitan area to metropolitan area. I also review results based on parents' being able to choose private schools in the metropolitan area easily because their local private schools charge subsidized tuition.

Because choice schools in Michigan and Arizona are charter schools (and therefore supervised by the states' departments of education), complete information on the students they enroll is available. Therefore, I directly examine the race, ethnicity, and poverty of charter school students in the two states, comparing them to the student populations from which the charter schools draw. I look directly, in other words, for evidence that the charter schools are enrolling students who are unusual, given the population

from which they draw.

II. Could Regular Public Schools Raise Achievement?

It is very plausible that competition could stimulate regular public schools to raise achievement enough to swamp any adverse effects that choice might have via cream-skimming. Perhaps it is useful to take a brief step back from the issue of school choice, and think about another formerly public industry that is less controversial but that illustrates the same concerns. In the parcel post industry, the United States Postal Service (USPS) had a monopoly. When lawmakers proposed to allow private firms (like United Parcel Services, Federal Express, and DHL) to complete with the USPS, some commentators issued dire warnings. The private firms, they argued, would cream-skim the most profitable parcel post customers, and the common person's parcel service would deteriorate profoundly. They argued that USPS could not improve so that USPS parcel service would be slower, have fewer options, and so on if private firms were allowed to take some of its best customers. Exactly the opposite reaction has occurred. USPS is now far more efficient in parcel post than it was when it is was a monopoly, and it has introduced new services, like Express Mail and Priority Mail, that make its customers better off. Customers who use the private firms' services are also better off, because they are getting better service than the USPS formerly gave them. With hindsight, the average person now sees that the USPS was able to improve when faced with competition and that the positive reaction to competition swamped other forces that may have led USPS parcel post to deteriorate.

In the school choice debate, there is obsessive interest in the question of "who wins" and "who loses" when choice is introduced. This obsession may turn out to be a mistaken application of energy. Choice need not make some students into losers and others into winners. It is at least possible that all students will be better off. Students who remain in public schools are clearly the group whose "winning" is most in doubt, so I focus exclusively on their achievement in this chapter. A number of other studies

have examined the achievement of students who use vouchers or charter schools, and the evidence suggests that students who enroll in choice schools have better achievement after one or more years. These "choice students," however, will not concern me further.

I examine public school students in three states because only three choice reforms fulfilled some common-sense criteria. If we are interesting in studying cream-skimming (if any) and public schools' competitive reaction (if any), it is necessary that the public schools actually faced non-negligible competition. At a bare minimum, the choice program should be such that (1) there is a realistic possibility that at least five percent of regular public enrollment could go to choice schools, (2) the regular public schools lose at least some money (not necessarily the entire per-pupil cost) when a student goes to a choice school, and (3) the reform has been in place for a few years. The reforms that satisfy these minimal requirements are school vouchers in Milwaukee, charter schools in Michigan, and charter schools in Arizona. I describe each of these reforms below in the course of examining the reaction to it. Apart from these three reforms, most choice reforms fail to meet at least one of these requirements. In particular, choice reforms are typically characterized by constraints on enrollment (for instance, no more than one percent of local students can attend choice schools) or perverse financial incentives (for instance, the local district loses no money when it loses a student to a choice school).[1]

III. The Effect of Vouchers on Milwaukee Public School Students

Vouchers for poor students in Milwaukee were enacted in 1990 and were first used in the 1990-91 school year. Currently, a family is eligible for a voucher if its income is at or below 175 percent of the federal poverty level (at or below 17,463 dollars for a family of four).[2] For the 1999-00 school year, the voucher amount was 5,106 dollars per student or the private school's cost per student, whichever was less. For every student who leaves the Milwaukee public schools with a voucher, the Milwaukee public schools lose state aid equal to half the voucher amount (up to 2553 dollars per voucher student in 1999-

00). Milwaukee's per pupil spending in 1999-00 was 8,752 dollars per pupil, so the district was losing 29 percent of the per pupil revenue associated with a voucher student. Currently, the vouchers may be used at secular and non-secular private schools.[3]

The voucher program had a difficult start. While approximately 67,000 students were initially eligible for vouchers, participation was initially limited to only 1 percent of Milwaukee enrollment. In 1993, the limit was raised to 1.5 percent and, in 1998, to 15 percent of enrollment. The 1998 changes followed a prolonged legal dispute in which most voucher students had to use privately donated, not publicly funded, vouchers. For instance, in 1997-98, only 1,500 students (about 1.4 percent of Milwaukee students) were able to use publicly funded vouchers. Also, until 1998, the future of the program was very much in doubt.[4] Overall, while the voucher program began in 1990 and might have been expected to have had a small impact on the Milwaukee Public Schools beginning with the 1990-91 school year, the program generated very little potential competition until the 1998-99 school year. However, because the program was already somewhat established and familiar to Milwaukee residents by 1998, one would expect a quicker response to the program than one would expect for a completely new program. In short, it is plausible to look for a productivity impact, if any, over the few most recent school years. The 1996-97 school year effectively predates serious competition.

Not all schools in Milwaukee experienced the same increase in competition as the result of the voucher program. The greater was a school's share of poor children, the greater was the potential competition because the greater was the potential loss of students. Some Milwaukee schools had as few as 25 percent of their schools eligible for vouchers, while other Milwaukee schools had as many as 96 percent eligible. Also, because private elementary schools cost significantly less than private high schools, more than 90 percent of vouchers were used by students in grades one through seven in 1999-00. Thus, only elementary schools in Milwaukee faced significant potential competition.

These facts about the voucher program suggest that the following type of evaluation is most

appropriate for examining the effect of vouchers on Milwaukee public school students. First, one should focus on achievement in grades one through seven. Second, achievement should be compared from 1996-97 (before significant competition) to 1999-00 (after significant competition). Third, schools in Milwaukee can be separated into two groups. In schools that "faced more competition," a large share of students were eligible for vouchers, and cream-skimming or competitive response should be more acute. In those that "faced less competition," a smaller share of students were eligible and the cream-skimming or competitive response should be correspondingly smaller. In the language of medical experiments, the schools that faced more competition got the full treatment and the schools that faced less competition got a partial treatment. As in medical experiments, it is desirable to find some schools that were not treated at all: "control schools." I chose a control group of schools from Wisconsin that most closely matched Milwaukee's schools in urbanness, their shares of black and Hispanic students, and their poverty rates. Finding control schools was not easy because Milwaukee's schools are much poorer and have much larger shares of minority students than most other schools in Wisconsin. Because the control schools are slightly less disadvantaged than the Milwaukee schools, they initially had better achievement and higher achievement growth. In other words, if vouchers had no effect at all, the control schools would be expected to improve relative to Milwaukee schools, simply because more advantaged schools tend to improve relative to less advantaged ones.[5] Thus, the evidence I present is likely to slightly *understate* any improvements that took place in Milwaukee's schools.

Table I shows some demographic indicators for the three groups of elementary schools: 32 Milwaukee schools that faced more competition (those in which at least two-thirds of students were eligible for vouchers), 66 Milwaukee schools that faced less competition (those in which less than two-thirds of students were eligible for vouchers, and control schools that faced no competition.

In the schools that faced the most competition, an average of 81.3 percent of students were eligible for free or reduced-price lunches (and thus eligible for vouchers), 65.4 percent of students were

black, and 2.9 percent of students were Hispanic. In the schools that faced less competition, an average of 44.5 percent of students were eligible for vouchers, 49.1 percent of students were black, and 13.7 percent of students were Hispanic.[6]

I included a Wisconsin elementary school in the control group if it (1) was not in Milwaukee, (2) was urban, (3) had at least 25 percent of its students eligible for free or reduced-price lunch, and (4) had black students compose at least 15 percent of its students. There were only 12 schools in Wisconsin that met these criteria. In the control schools, average enrollment in a grade was 51 students, 30.4 percent of students were eligible for free or reduced-price lunch (and, thus, would have been eligible for vouchers had they lived in Milwaukee), 30.3 percent of the students were black, and 3.0 percent of students were Hispanic.

Students in Wisconsin take state-wide examinations in grades 4, 8, and 10. Because I am focusing on the reactions of elementary schools, I use the fourth grade score, expressed in national percentile rank points (NPR), on five tests: mathematics, science, social studies, language, and reading. It is worth noting that, during the period in question, Wisconsin enacted a controversial new reading curriculum that emphasized whole-language methods, as opposed to phonics.

Table II shows the results of comparing the three groups of schools, before and after voucher program created significant competition in 1998. Examine the top panel, which shows achievement on the mathematics exam. In 1996-97, the schools that later faced the most competition attained 34.5 NPR points. In 1999-00, they attained 53.3 NPR points: an *annual* gain of 6.3 points. The schools that ultimately faced less competition attained 33.7 NPR points in 1996-97 and 48.2 NPR points in 1999-00: an annual gain of 4.8 points. Math achievement in the control schools grew from 50 NPR points in 1997-97 to 60.6 NPR points in 1999-00: an annual gain of 3.5 points. Clearly, math achievement grew the most in the schools that faced the most competition from vouchers, less in the schools that faced less competition, and the least in the schools that faced no competition.

Without going through all of the numbers for science, social studies, language, and reading, we can look down the right hand column of Table II and immediately see the same pattern for all subjects. In every subject, achievement grew most in the schools that faced the most voucher competition, a medium amount in the schools that faced less competition, and the least in the schools that faced no competition. The pattern holds even in reading and language, where the controversial curriculum may have been responsible for the lower rates of achievement growth, which are actually negative for schools that were not faced with a lot of competition from vouchers.

Overall, an evaluation of Milwaukee suggests that public schools made a strong push to improve achievement in the face of competition from vouchers. The schools that faced the most potential competition from vouchers raised achievement dramatically. Growth of four or more NPR points *per year* is highly unusual in education, yet Milwaukee schools managed such improvements in math, science, and social studies. Recall, moreover, that the achievement effects of vouchers are likely to be understated because the control schools contain slightly more advantaged students.

IV. The Effect of Charter Schools on Michigan Public School Students

In 1994, Michigan enacted a charter school law as part of a series of changes in its method of financing schools. Michigan charter schools receive a per pupil fee that is essentially the same as the state's foundation level of per pupil spending (the state's minimum level of per pupil spending, given the characteristics of the school's student population). For instance, in 1999-00, the average charter school student in Michigan had 6,600 dollars spent on his education, while the average regular public school student had about 7,440 dollars spent on his education. Detroit public schools spent 8,325 dollars per pupil and the average charter school student in Detroit had about 6,590 dollars spent on his education. A district that loses a student to a charter school loses approximately the foundation level of per pupil revenue. Charter competition tends to be most substantial in the elementary grades because the charter

fees more adequately cover costs for the lower grades. By the 1999-00 school year, approximately 3.5 percent of all non-private elementary students in Michigan were enrolled in charter schools. The corresponding number for secondary students was 0.7 percent. Charter schools can receive their charters from state-wide organizations, such as universities, so they can compete with local public schools, unlike charter schools in many other states that have their charters granted and renewed by their local district.[7]

I evaluate the effect of charter schools on Michigan public school students in much the same way as I evaluated the effect of the Milwaukee voucher program. I separate schools into those that faced charter competition and those that did not, and I compare their performance before and after charter competition. I focus on elementary grades because public elementary schools felt most of the charter competition. Michigan students take exams in the fourth, seventh, and tenth grades, so I show results for the fourth and seventh tests. Michigan tests its students in math and reading, and the tests are scored in scale points (like the familiar SAT-I test). A scale point is worth between 1.25 and 2.5 percentile points, depending on the test and grade.

There are a few issues that arise with Michigan that did not arise with Milwaukee. It was easy to define *ex ante* the treatment and control schools in Wisconsin: schools outside of Milwaukee faced no competition and Milwaukee schools faced competition that depended simply on the share of their students who were poor enough to eligible for vouchers. In Michigan, "treatment" and "control" and "before" and "after" must be defined on a district-by-district basis, where a district is being "treated" and is in the "after" period once it is forced to recognize that it is losing a critical share of students to charter schools." Of course, we do not know what this critical share might be, but it is useful to know that the mean year-to-year change in a Michigan school's enrollment *prior to 1994* was 5.1 percent. Therefore, a small drawing away of enrollment by a local charter school would be hard to differentiate from normal year-to-year variation in enrollment. However, a persistent drawing away of enrollment of more than 5 percent, say, would be likely to be noticed and attributed to charter schools. I initially looked for a

critical level of 6 percent and, because it worked well, I kept it. A critical level of 7 or 8 percent works

very similarly.[8] In short, I say that a Michigan school faces "charter competition" if at least 6 percent of

the students enrolled in its district are enrolled in charter schools.[9]

The left-hand side of Table III list the Michigan districts in which charter schools account for at

least 6 percent of total enrollment inside the district's boundaries. There are 597 districts in Michigan

and only 34 listed in the table, so a non-negligible charter school presence is still the exception and not

the rule. Districts of all sizes, including Michigan's large city districts, are represented among the

districts that face charter school competition.   Detroit, Lansing, and Kalamazoo all have at least six

percent of enrollment in charter schools.

It is probable Michigan districts that had to face competition from charter schools were not a

random group of districts. Charter schools may have formed as a response to local circumstances. In

some cases, charter schools may have formed where parents were unusually concerned about education

and active (good circumstances for achievement). In other cases, charter schools may have formed where

parents and teachers were frustrated because the district was run poorly (bad circumstances for

achievement). Thus, it is important to look at how each school changes, subtracting its initial level of

performance. I do this by allowing each school's achievement to have a fixed effect, which is simply a

method of subtracting each school's initial level of performance.

Moreover, I compare Michigan schools that faced charter competition to those that did not, over

the same period. Recall that Michigan enacted a school finance reform, which affected all schools, at the

same time that charter schools were enacted. Thus, I am looking for changes that occurred in schools

facing competition, *above and beyond* the changes that occurred in other schools in the state, which may

have been responding to the finance reform.

What I show in Table IV is the change in achievement for schools that faced charter competition

above and beyond the change in achievement for schools that faced no such competition over the same

period. This statistic is sometimes called "difference-in-difference" because it contains two differences:

average of (achievement after - achievement before) in schools that faced competition

minus

average of (achievement after - achievement before) in schools that did not face competition.

The statistic should be familiar from medical experiments in which researchers subtract the change in health experienced by the control group (who receive a placebo) from the change in health experienced by the treatment group (who receive the real treatment).

Table IV shows difference-in-difference statistics for Michigan's fourth and seventh grade exams. Fourth grade reading and math scores were, respectively, 1.21 and 1.11 scale points higher in schools that faced charter competition *after* they began to face competition. Seventh grade reading and mathematics scores were, respectively, 1.37 and 0.96 scale points higher. Recall that these improvements in scores are not only relative to the schools' own initial performance (the first difference), but also relative to the gains made over the same period by Michigan schools that did not face charter competition (the difference-in-differences).[10]

In short, Michigan public schools raised achievement in the face of competition from charter schools. They raised achievement not only relative to their own previous performance but also relative to other Michigan schools not subjected to charter competition. The improvements in achievement appears to occur once charter competition reaches a critical level at which a public school should notice that a charter school is consistently drawing away students.

Michigan public schools' gains statistically significant, and we should keep in mind that a scale point is worth between 1.25 and 2.5 percentile points. Nevertheless, the improvement in Michigan's public schools is more modest than the improvement in Milwaukee schools subjected to voucher competition. We cannot know, at this point, why the difference is more modest. It is likely that the threat of competition in Milwaukee was more serious than the threat of competition in Michigan, if for

no other reason than that Milwaukee's voucher program grew much more rapidly (when it was released from enrollment constraints) than Michigan's charter schools grew. This is probably because Milwaukee's program had some history by 1998, while charter schools were truly fledglings for the first few years after Michigan's reform. There may be other reasons why the results for Michigan are more modest: it is simply too early to test other explanations.

V. The Effect of Charter Schools on Arizona Public School Students

Like Michigan, Arizona enacted a charter school law in 1994. Arizona's charter school law is widely regarded as the most favorable to charter schools in the United States, as it allows charter schools to have considerable fiscal and legal autonomy. There are also few constraints on the growth of charter schools in Arizona. As a result, 5.3 percent of Arizona's non-private enrollment was in charter schools in 1999-00. This percentage is the highest of any American state.

In Arizona, state sponsored charter schools get a fee equal to the state's share of revenue (45 percent of total revenue for a regular public school). District sponsored charter schools get a fee equal to local per pupil revenue, but are less able to compete with the regular public schools because they must seek renewal of their charters from the very districts with which they compete.

My evaluation of Arizona follows the same strategy as I employ for Michigan, so I will merely highlight a few differences between the Michigan and Arizona situations here. In Arizona, a municipality may contain multiple districts: for instance, a few elementary districts, a middle school district, and a high school district. A local charter school may therefore be competing with multiple districts. Therefore, I associate regular public schools and charter schools with a municipality, not a district. All Arizona fourth and seventh graders were required to take the Iowa Test of Basic Skills (ITBS) through 1995-96 and have been required to take the Stanford 9 test since then. The shift in the test does not pose problems for the analysis because both tests offer national percentile rank (NPR)

scores (which have a 0.97 correlation at the school level), and all the schools switched tests in the same year. Thus, it is a simple matter to use the two tests and allow for a one-time, state-wide shift in each national percentile rank. [11] I use NPR scores at the school level for the school years from 1992-93 to 1999-00. I again use 6 percent of enrollment as the critical level at which charter schools are held to be a non-negligible competitive threat. I use the same critical level as I use for Michigan in order that the two states' results be as comparable as possible. However, a variety of critical levels between 6 percent and 11 percent produce similar results for Arizona.[12]

The right hand panel of Table III lists the Arizona municipalities that had at least six percent of local enrollment in charter schools. Municipalities of all sizes are represented. The list includes some of Arizona largest cities (Phoenix, Tempe, Scottsdale), some medium-sized cities (Avondale, Flagstaff, Gilbert, Kingman), and 30 smaller municipalities.

As in Michigan, it is important to subtract out each Arizona school's initial achievement. Also, it is important that the difference-in-differences statistics control for what was happening to other Arizona schools over the same period. While Arizona did not experience a school finance reform, it did have an activist state department of education that enacted numerous programs (including a school report card program so that parents would be better informed about performance).

Table V shows that results of the evaluation of Arizona's charter competition. The difference-in-differences statistics suggest that Arizona public schools raised achievement in response to competition from charter schools. Achievement rose by 2.31 NPR points on the fourth grade reading exam, by 2.68 NPR points on the fourth grade mathematics exam, and by 1.59 points on the seventh grade mathematics exam. (The effect on seventh grade reading scores appears to have been positive, but it is not statistically significantly different from zero.) Recall that these gains are not only relative to the schools' own initial performance (the first difference), but also relative to the gains made over the same by Arizona schools that did not face charter competition (the difference-in-differences).[13]

In summary, Arizona public schools raised achievement in the face of competition from charter schools, and their improvements occurred after they faced charter competition above a critical level at which we might expect them to take notice of their students being drawn away by charter schools. The Arizona gains are similar to or just a bit larger than the gains made by Michigan public schools students.

VI. What Happened in Milwaukee, Michigan and Arizona Public Schools?

The effects of the Milwaukee voucher, Michigan charter school, and Arizona charter school programs on *public* school students all suggest that the efficiency response to competition swamps cream-skimming effects (if any) that choice introduces. Moreover, not only does one effect swamp the other for the average public school student, it is like to do so for even the public school student who is made worst off by choice. Consider the following highly pessimistic and unlikely scenario. Suppose that, prior to choice, a student was in a Milwaukee school where the average student scored at the 90th percentile for Milwaukee elementary schools. Suppose that, because of choice, all of his good peers left and he remained in a public school with peer who scored, on average, at the 10th percentile for Milwaukee elementary schools. The difference between elementary schools at the 90th and 10th percentiles for Milwaukee is about 32 NPR points on the math exam. Thus, the Milwaukee student's worst case scenario would be to experience a fall of about 32 national percentile points in his peer group. Moreover, let us make the extreme assumption that the student is *very* influenced by his peers so that his scores fall by 32 points. This scenario is not strictly impossible, but it is so pessimistic that is barely plausible. Nevertheless, if the student enjoys the achievement growth rates that Milwaukee students are enjoying now in schools that face significant competition from vouchers, he will "grow out of" the bad peer effects within 4.5 years. That is, he will be better off for having experienced vouchers within 5 years of the voucher program affecting his school and peer group.

While I do not have information on individual students who took up vouchers in Milwaukee in

recent years, other researchers who have studied them have demonstrated that their achievement is at least as high (better, after a few years) as that of regular public school students in Milwaukee. Thus, we need not worry that Milwaukee's public schools have improved because of "reverse cream-skimming"–that is, the voucher schools' drawing off all of the worst-performing students. It seems odd to even mention reverse cream-skimming, because–at the outset of this chapter–I pointed out that school choice commentators are obsessed with the possibility that choice schools will "cream skim" from the public schools, not do the reverse. However, I can check for indications of reverse cream-skimming, and the check can be direct in Michigan and Arizona, for which I have similar data on the demographics of charter school students and regular public school students.

Tables VI and VII present these checks. The tables show each district (Michigan) and municipality (Arizona) that has some charter school students and that has total enrollment (public plus charter) of at least 1000 students. Within each district or municipality, charter schools and public schools are compared on: the share of their students who are black, the share of their students who are Hispanic, the share of their students who receive free or reduced-price lunch, and the share of their students who are Native American (Arizona only; there are very few Native Americans in Michigan). All of the statistics are for the 1999-00 school year.

The statistics on black and Hispanic students are accurate, but we must interpret the statistics on free and reduced-price lunch *very* cautiously because subsidized lunch is not a good measure of poverty for charter schools. A student may be poor and yet not enrolled in the federal subsidized lunch program. In particular, small charter schools are unlikely to offer a formal lunch program because the costs of filing the paperwork exceed the federal funds they would receive. They are more likely to offer an informal meal program. Other charter schools offer free lunch to all of their students, poor or non-poor, and they are thereby disbarred from receiving federal funds. Data on students in the federal lunch program are not available for Arizona, and the Michigan lunch data are missing for a good number of

charter schools.

Table VI shows that Michigan charter schools do not cream-skim or reverse cream-skim in any consistent way.   In the 10 largest districts, for instance, some charter schools enroll a higher share of black students, some charter schools enroll a smaller share of black students, and some charter schools enroll a virtually identical share of black students as the regular public schools do. In the next 10 largest districts, there is a similar lack of pattern. The black student shares are the most informative for Michigan because the state does not have many Hispanic students and the lunch statistics are clearly noisy.

The Hispanic student shares are the most informative for Arizona because the state does not have many black or Native American students. If we study the Hispanic share columns in Table VII, we see that charter schools appear to be very similar to the public schools with which they compete. In most cases, the charter schools' and regular public schools' shares of Hispanic students differ by only few percent. Moreover, there is no consistent pattern to the differences that do exist.

In short, direct examination of student data suggests that cream-skimming and reverse cream-skimming are not important phenomena in Michigan and Arizona and are too weak and inconsistent enough to account for the achievement results described above.

VII. The Effect of Traditional Forms of School Choice on Public School Students

Parents' ability to choose among public school districts (through residential decisions) and to choose private schools are such established features of American education that they are taken for granted. Yet, through these mechanisms, American parents have traditionally exercised some choice over their children's schooling. These traditional forms of choice are useful for establishing the effects of choice on achievement, especially because the availability of traditional choice mechanisms varies greatly across metropolitan areas in the United States. Some metropolitan areas contain many

independent school districts and a large number of affordable private schools. Other metropolitan areas are completely monopolized by one school district or have almost no private schooling.

In previous work, I have drawn upon traditional forms of choice to generate evidence about how choice affects achievement. I review this evidence here. (For detail on the empirical work described here, see Hoxby [2000a] and Hoxby [2000b].) Traditional forms of choice generate evidence that is useful because it is *long-run* and *general*. That is, traditional choice can affect all schools, not just selected schools; and can affect schools for decades.

In the short term, an administrator who is attempting to raise achievement has only certain options. He can induce his staff to work harder; he can get rid of unproductive staff and programs; he can allocate resources away from non-achievement oriented activities (building self esteem) and toward achievement oriented ones (math, reading, and so on). In the slightly longer term, he can renegotiate the teacher contract to make the school more efficient. If an administrator actually pursues all of these options, he may be able to raise achievement substantially.

Nevertheless, choice can affect achievement through a variety of long-term, general mechanisms that are not immediately available to an administrator. The financial pressures of choice may bid up the wages of teachers whose teaching raises achievement and attracts parents. It may thus draw people into teaching (or keep people in teaching) who would otherwise pursue other careers. Indeed, it may change the entire structure of rewards in teaching and thereby transform the profession.[14] The need to attract parents may force schools to issue more information about their achievement and may thus gradually make parents into better "consumers." Because parents' decisions are more meaningful when schools are financed by fees they control, choice may make schools more receptive to parent participation. The need to produce results that are competitive with those of other schools may force schools to recognize and abandon pedagogical techniques and curricula that are unsuccessful in practice though philosophically appealing. Finally, in the long-term, choice can affect the size and very existence of schools. Choice

makes districts' enrollment expand and contract; it makes private schools enter and exit. In the short term, we mainly observe how the existing stock of schools changes its behavior.

Both traditional forms of choice can inform us about the long-run, general effects of choice on achievement.

Traditional Inter-District Choice

The first traditional form of choice occurs when parents choose among independent public school districts by choosing a residence. The degree to which parents can exercise this form of choice depends on the number, size, and housing patterns of districts in the area of the parents' jobs. There are some metropolitan areas in the United States that have many small school districts with reasonably comparable characteristics. Boston, for instance, has 70 school districts within a 30-minute commute of the downtown area and many more in the metropolitan area. Miami, on the other hand, has only one school district (Dade County) that covers the entire metropolitan area. Most metropolitan areas are, of course, somewhere between these two extremes. A typical metropolitan area has an amount of choice that corresponds to having four equal-sized school districts (or a greater number of less equally sized districts).

People with jobs in rural areas typically have only one or two school districts among which to choose. To avoid a much-choice/little-choice comparison that mainly reflects urban/rural differences in school productivity, it useful to focus on metropolitan areas when analyzing traditional inter-district choice.

It is essential that parents choose among districts that are fiscally and legally independent if this traditional form of choice is to be useful guide to the productivity effects of choice. This is because the mechanism by which parents' housing choices translate into budgetary incentives for a school to be productive, does not operate if, say, a district relies entirely on state revenue or is otherwise held harmless from repercussions associated with an inability to attract parents.

How does one measure the degree of traditional inter-district choice in a metropolitan area? A particularly good index of inter-district choice is the probability that, in a random encounter, two students in the metropolitan area would be enrolled in different school districts. If there were only one district, as in Miami, this probability would be equal to zero. If there were many districts, as in Boston, this probability would be very close to one (greater than 0.95).[15]

Table VIII lists the names and choice indices of metropolitan areas in the United States that have very high or low degrees of inter-district choice. It is interesting to note that metropolitan areas as disparate as Saint Louis and Seattle have comparably high degrees of inter-district choice. Metropolitan areas as disparate as Las Vegas and Wilmington equal have zero inter-district choice.

Despite the range of metropolitan areas with less choice and range of metropolitan areas with more choice, it is a good idea to control for background variables that might affect achievement. I control for household income, parents' educational attainment, family size, single-parent households, race, region, metropolitan area size, and the local population's income, racial composition, poverty, educational attainment, and urbanness. Because I have good measures of racial, ethnic, and income segregation by school and school district, I also control for segregation that may be affected by inter-district choice. I also instrument for the measure of inter-district choice with factors that likely to affect only the supply of districts, not the demand for them.[16] (This is an issue likely to be of interest to only a minority of readers.)

The evidence on traditional choice among districts is shown in Table VIII, which displays only the effects that are of primary interest, not the effects of control variables. The estimates show that inter-district choice has a positive, statistically significant effect on achievement. In particular, a metropolitan area with maximum inter-district choice (index approximately equal to one) has eighth grade reading scores that are 3.8 national percentile points higher, tenth grade math scores that 3.1 national percentile points higher, and twelfth grade reading scores that are 5.8 national percentile points higher.

Traditional Choice of Private Schools

The second way in which parents have traditionally been able to exercise choice in the United States is by enrolling their children in private schools. Traditionally, private school tuition in America is not subsidized by public funds (as it is in Canada and many European countries), so parents can only afford private school if they can pay tuition and also pay taxes to support local public schools. Partly as a result, private schools enroll only 12 percent of American students.

In the United States, 85 percent of private school students attend a school with religious affiliation, but such schools include a variety of Christian and non-Christian schools and have tuition that ranges from a token amount to over 10,000 dollars. The remaining 15 percent of private school students attend schools with no religious affiliation; these include most of the independent, college-preparatory schools that charge tuition of 5,000 dollars or more. The modal private school student in the United States attends a Catholic school that charges between 1,200 and 2,700 dollars.

A key feature of American private schools is that they typically subsidize tuition with revenues from donations or an endowment (or implicit revenues from an in-kind endowment such as buildings and land). The share of schooling cost that is covered by subsidies is larger in schools that serve low-income students, but even relatively expensive private schools charge subsidized tuition. For instance, Catholic elementary schools, on average, cover 50 percent of their costs with non-tuition revenues.

The number of private school places (of a given quality) that are available at a given tuition varies greatly among metropolitan area in the United States.[17] For instance, in some metropolitan areas, 15 percent of the elementary student population is enrolled in private schools where tuition is about two-thirds of the schools' per-pupil expenditure. (Typical amounts would be tuition of 1,800 dollars and expenditure of about 2,700 dollars). In other metropolitan areas, fewer than 1 percent of the elementary school population is enrolled in such schools, although places might be available in schools where tuition is higher because there are no tuition subsidies. In short, the supply of private schooling varies among

metropolitan areas, and–thus–the degree to which parents have choice between public and private schools varies among metropolitan areas.

It is reasonable to use the actual share of students who attend private school in a metropolitan area as a measure of private school availability *if* the measure is instrumented by factors that affect the supply of private schooling, not by factors that affect the demand for private schooling (such as the local public schools being bad). The best instruments come from historical differences in metropolitan areas' religious composition. Briefly, religious groups left endowments that today generate differences in the amount of non-tuition revenue enjoyed by private schools. A private school presented by history with a generous endowment can provide a given quality of schooling at a lower tuition (and can thus be more competitive with public schools) than a private school with little or no endowment.[18]

In Table IX, I shown the results of greater availability of private schools. The estimates control for the same background variables that I used for inter-district choice (see above). The table shows that private school choice has a positive, statistically significant effect on *public* school students' achievement. For instance, compare two metropolitan areas, one with a moderately high degree of private school supply (about 17 percent of students in private schools) and the other with a moderately low degree of private school supply (about 7 percent of students in private schools). The difference between moderately high and low private school choice is, thus, a 10 percentage point difference in the share of students in private schools. This means that we can interpret the coefficient shown in the top panel of Table IX as follows. A *public* school in the metropolitan area with moderately high private school choice (as opposed to moderately low private school choice) has eighth grade reading scores that are 2.7 national percentile points higher, eighth math scores that are 2.5 national percentile points higher, twelfth grade reading scores that are 3.4 national percentile points higher, and twelfth grade math scores that are 3.7 national percentile points higher.

Discussion of the Effects of Traditional Forms of School Choice

One should keep in mind that both traditional forms of choice provide rather weak incentives compared to choice reforms like vouchers and charter schools. Moreover, many poor families cannot exercise either traditional forms of choice: a family can only choose among districts if it can afford to live in a variety of areas and a family can only exercise traditional private school choice if it can pay tuition. Thus, even if every metropolitan area in the United States had the maximum degree of the traditional forms of choice, poor families would probably be left with schools that did not aggressively pursue achievement.

VIII. Conclusions

In this paper, I have presented evidence that suggests that the school choice debate should focus much more on how *public* schools respond to competition. It appears that public schools are induced to raise achievement when they are faced with competition and that this effect swamps any effect associated with cream-skimming, reverse cream-skimming, or the like. The choice reforms that are currently in place do not appear to generate winners and losers, but only winners. *Public* school students, who are often predicted to be losers, are winners because their schools apparently respond positively to competitive threats. This is not only good news for students; it should be welcome news to those who think that public schools have much good potential that is brought out only when need arises.

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Table I[19]
Pupil Characteristics in Schools that were Faced with More Competition,
Less Competition, and No Competition from Vouchers in Wisconsin

	Percentage of Students Eligible for Free/ Reduced-Price Lunch	Percentage of Students who are Black	Percentage of Students who are Hispanic
schools faced with more competition	81.3	65.4	2.9
schools faced with less competition	44.5	49.1	13.7
schools faced with no competition (control schools)	30.4	30.3	3.0

Table II[20]
Fourth Grade Test Scores in Schools Faced with More Competition,
Less Competition, and No Competition from Vouchers in Wisconsin

		1996-97	1999-00	annual change
Math NPR Score	schools faced with more competition	34.5	53.3	6.3
	schools faced with less competition	33.7	48.2	4.8
	schools faced with no competition (control schools)	50.0	60.6	3.5
Science NPR Score	schools faced with more competition	31.9	52.8	7.0
	schools faced with less competition	32.3	49.7	5.8
	schools faced with no competition (control schools)	56.0	62.9	2.3
Social Studies NPR Score	schools faced with more competition	41.6	54.2	4.2
	schools faced with less competition	43.4	50.7	2.4
	schools faced with no competition (control schools)	61.0	65.6	1.5
Language NPR Score	schools faced with more competition	41.8	49.4	2.5
	schools faced with less competition	41.8	46.2	1.5
	schools faced with no competition (control schools)	53.4	53.2	-0.1
Reading NPR Score	schools faced with more competition	44.2	46.5	0.8
	schools faced with less competition	45.1	43.6	-0.5
	schools faced with no competition (control schools)	59.0	55.0	-1.3

Table III[21]
Michigan School Districts and Arizona Municipalities
where at least 6% of Pupils Entered Charter Schools

Michigan School Districts		Arizona Municipalities	
Alba	Huron	Avondale*	Keams Canyon
Bark River-Harris	Inkster-Edison	Benson	Kingman*
Big Rapids	Jackson*	Bisbee	Mayer
Boyne Falls	Kalamazoo**	Camp Verde	Page
Buena Vista	Kenowa Hills	Cave Creek	Phoenix**
Caledonia	Kentwood*	Chinle	Pima
Charlevoix	Lansing**	Chino Valley	Prescott
Coldwater	Mount Pleasant	Clarkdale	Queen Creek
Detroit**	Oak Park	Concho	Safford
Elk Rapids	Onekama	Coolidge	Saint Johns
Flat Rock	Pentwater	Cottonwood	Scottsdale**
Forest Hills*	Petoskey	Enrenberg	Sedona
Godwin Heights	Sault Sainte Marie	Flagstaff*	Show Low
Grand Blanc*	Southfield*	Fountain Hills	Sierra Vista
Hartland	Wayne-Westland**	Gilbert*	Tempe**
Hillsdale	Westwood	Globe	Tuba City
Holland*	Wyoming*	Golden Valley	Vail
		Green Valley	Winslow
		Higley	

Table IV[22]
Effects of Charter School Competition on Michigan Public School Students' Achievement

Difference-in-Differences Results	Dependent Var: Achievement Based on:			
	Fourth Grade Reading Exam	Fourth Grade Math Exam	Seventh Grade Reading Exam	Seventh Grade Math Exam
Change in Achievement (NPR score) After District is Faced with Charter School Competition (charter schools represent at least 6% of enrollment in district)	1.21** (0.65)	1.11* (0.62)	1.37** (0.60)	0.96* (0.48)

Table V[23]
Effects of Charter School Competition on Arizona Public School Students' Achievement

Difference-in-Differences Results	Dependent Var: Achievement Based on:			
	Fourth Grade Reading Exam	Fourth Grade Math Exam	Seventh Grade Reading Exam	Seventh Grade Math Exam
Change in Achievement (NPR score) After District is Faced with Charter School Competition (charter schools represent at least 6% of enrollment in district)	2.31** (0.69)	2.68** (0.79)	1.11 (0.95)	1.59* (0.89)

Table VI
The Demographics of Michigan's Regular Public and Charter School Students

District	Pupils in District	%Black in Charter Schs	%Black in Public Schs	%Hispanic in Charter Schs	%Hispanic in Public Schs	%Lunch* in Charter Schs	%Lunch* in Public Schs
Detroit	168,118	90	91	4	4	34	78
Utica	27,038	8	1	3	1	n/a	6
Grand Rapids	25,648	49	44	4	18	34	62
Flint	24,411	75	74	1	2	26	64
Lansing	19,461	60	35	8	14	64	52
Ann Arbor	17,113	14	17	3	3	31	15
Dearborn	16,990	30	2	3	2	64	33
Wayne-Westland	15,128	81	15	2	2	n/a	28
Warren	14,513	26	2	0	1	n/a	15
Saginaw City	13,418	38	59	14	13	5	65
Pontiac	13,138	65	62	7	12	10	64
Kalamazoo	12,191	49	44	3	6	44	61
Port Huron	12,096	6	8	3	3	8	34
Chippewa Valley	11,931	3	1	0	1	n/a	6
Farmington	11,671	7	7	0	1	n/a	5
Southfield	10,856	81	80	0	1	n/a	26
Midland	9,786	3	2	3	2	19	13
Kentwood	8,899	18	18	4	5	12	26
Portage	8,701	10	5	2	2	8	12
Forest Hills	8,401	4	2	3	1	10	3
Jackson	8,055	21	34	2	3	15	66
Battle Creek	8,012	12	36	3	5	9	51
Lapeer	7,724	0	0	4	2	n/a	18
West Ottawa	7,552	3	3	10	12	17	18
Howell	7,220	0	0	0	0	n/a	9
Muskegon	6,905	76	50	9	8	75	69
Grand Blanc	6,656	12	8	2	1	n/a	8
Roseville	6,382	23	4	1	1	n/a	30
Van Buren	6,316	81	23	0	1	64	24
Grand Haven	6,158	0	1	0	3	n/a	17
Wyoming	6,124	6	8	4	10	12	32
Holland	6,085	4	5	23	32	22	35
Benton Harbor	6,044	27	92	6	1	57	86
Bedford	5,611	1	0	1	2	17	8
Carman-Ainsworth	5,428	36	20	6	2	n/a	32
Saginaw	4,935	63	7	10	6	51	15
Ferndale	4,893	83	33	0	1	38	42

District	Pupils in District	%Black in Charter Schs	%Black in Public Schs	%Hispanic in Charter Schs	%Hispanic in Public Schs	%Lunch[*] in Charter Schs	%Lunch[*] in Public Schs
Holly	4,622	0	2	1	2	n/a	18
Hartland	4,606	1	1	0	1	6	3
Romulus	4,510	4	45	1	1	22	49
Mount Pleasant	4,407	2	2	2	3	22	25
Southgate	4,354	8	2	12	4	n/a	12
Kenowa Hills	4,147	6	2	5	3	24	21
Oak Park	4,107	100	84	0	0	n/a	44
Greenville	4,008	0	0	4	2	76	29
Highland Park	3,915	100	100	0	0	48	80
Coldwater	3,686	1	1	6	2	48	26
Inkster	3,607	90	98	0	0	18	86
Eaton Rapids	3,448	0	1	2	2	n/a	17
Lakeview(Calhoun)	3,381	14	4	6	2	41	9
Waverly	3,373	25	17	5	7	22	15
Sault Sainte Marie	3,315	0	0	0	0	82	38
Cedar Springs	3,273	0	0	3	2	n/a	26
Petoskey	3,253	1	1	1	1	n/a	17
Byron Center	2,905	2	1	1	2	5	14
Huron	2,677	4	1	2	2	19	17
Big Rapids	2,622	5	6	2	1	51	35
Godwin Heights	2,560	52	10	13	15	40	53
Belding	2,503	0	0	0	1	n/a	33
Comstock Park	2,379	2	5	3	3	22	11
Hillsdale	2,234	1	0	2	1	n/a	32
Spring Lake	2,230	0	0	0	1	n/a	18
Buena Vista	2,046	88	90	6	6	81	72
Essexville-Hampton	2,007	5	1	14	2	n/a	18
Beaverton	1,842	2	1	0	1	n/a	44
Tawas	1,813	7	0	0	0	n/a	27
Manistee	1,802	3	1	7	3	50	34
Elk Rapids	1,737	1	0	3	5	n/a	22
Fennville	1,730	0	2	7	33	n/a	32
Leslie	1,495	0	0	0	2	n/a	30
Westwood Heights	1,463	64	57	2	3	30	53
Charlevoix	1,460	1	1	0	2	n/a	18
Atherton	1,270	10	4	4	2	n/a	36
Ishpeming	1,168	0	0	0	0	n/a	32

Table VII
The Demographics of Arizona's Regular Public and Charter School Students

	Pupils in City	%Black in Charter Schs	%Black in Public Schs	%Hispanic in Charter Schs	%Hispanic in Public Schs	%Native Am in Charter Schs	%Native Am in Public Schs
Phoenix	206,773	16	7	40	46	2	3
Tucson	122,375	8	5	35	41	3	3
Mesa	74,134	4	3	19	21	2	4
Glendale	50,427	12	5	22	24	3	1
Scottsdale	33,926	4	2	9	7	12	1
Chandler	30,159	5	5	12	25	2	1
Gilbert	25,336	3	3	7	11	1	1
Yuma	23,253	3	3	69	64	2	1
Tempe	22,740	17	8	32	29	2	6
Peoria	20,769	6	4	26	20	4	1
Flagstaff	12,214	3	2	11	16	8	22
Casa Grande	8,085	2	5	42	46	2	10
Kingman	7,745	0	1	6	10	2	2
Avondale	7,220	12	7	35	45	2	1
Sierra Vista	7,015	12	11	24	22	3	1
Nogales	6,536	0	0	99	98	0	0
Apache Junction	6,013	1	1	10	12	2	1
Lake Havasu City	5,987	1	1	18	13	0	1
Prescott	5,643	0	1	8	9	2	3
Bullhead City	5,523	1	2	2	28	1	1
Douglas	4,722	0	2	100	89	0	1
Show Low	4,465	4	1	6	8	0	5
Cave Creek	4,230	2	1	4	5	1	0
Cottonwood	3,463	4	1	12	19	7	2
Page	3,446	1	0	5	2	63	69
Safford	3,272	2	3	32	41	1	1
Chino Valley	2,781	0	0	4	10	1	1
Globe	2,723	2	0	49	27	14	19
San Luis	2,220	0	0	100	100	0	0
Fountain Hills	2,214	1	1	7	4	0	7
Queen Creek	2,205	0	0	8	40	1	1
Somerton	1,993	0	0	100	94	0	4
Marana	1,914	0	2	9	27	0	3
Camp Verde	1,654	1	0	3	14	18	12
Willcox	1,639	0	0	27	42	0	1
Sedona	1,595	3	0	8	14	2	1
Higley	1,435	3	2	3	13	0	1
Benson	1,223	2	1	17	24	2	1
Bisbee	1,103	0	0	42	53	0	0

Table VIII[24]
Effect of Traditional Inter-District Choice on Public School Students' Achievement

Effect on Achievement	8th grade reading score	10th grade math score	12th grade reading score
An Increase of 1 in the Index of Inter-District Choice (no choice to maximum choice) Changes Achievement by this many National Percentile Points in a Metropolitan Area	3.818** (1.591)	3.061** (1.494)	5.770** (2.208)

Table IX[25]
Effect of Traditional Private School Choice on *Public* School Students' Achievement

Effect on Achievement	8th grade reading score	8th grade math score	12th grade reading score	12th grade math score
An Increase of 1% in the Share of Students who Attend Private School Changes Achievement by this many National Percentile Points in a Metropolitan Area	0.271** (0.090)	0.249** (0.090)	0.342** (0.172)	0.371** (0.171)

1. See Rees [2000] for a thorough review of current school choice reforms. In most cases where I have not used materials directly obtained from the relevant state's department of education, I have relied upon Rees for a description of reforms.

2. As a rule, any child who is eligible for free or reduced-price lunch is also eligible for a voucher. The actual cut-off for reduced-price lunch is 185 percent of the federal poverty level, but the difference between 175 percent (the cut-off for the vouchers) and 185 percent is not rigorously enforced (and would be difficult to enforce).

3. The information on the Milwaukee program and Wisconsin schools is obtained from several publications of the Wisconsin Department of Instruction [all 2000].

4. The future of the program is still somewhat in doubt for two reasons. First, state Supreme Courts' opinions conflict on the question of whether it is constitutional to have vouchers that can be used at schools with religious affiliation. Therefore, it is likely that the United States Supreme Court will eventually rule on such vouchers. Second, the Wisconsin legislature has threatened to fund the vouchers at such a low level that they are unusable.

5. It is fairly obvious that more advantaged schools will have better achievement if we do not control for demographic differences among students. It is less obvious that more advantaged schools will have better achievement *growth*, but they do in fact. For instance, prior to 1996, Wisconsin elementary students took statewide tests in reading (only). In the pre-voucher period, achievement growth was negative in Milwaukee schools, based on these tests. In contrast, achievement growth was positive in the schools that form the control group.

6. Note that all of these demographic numbers reflect what the schools looked like in 1990, *before* the voucher program was enacted. This is the correct method for choosing treated and control schools. One does not want to measure the extent of treatment using measures of student composition that potentially reflect how students reacted to the voucher program.

7. The information on Michigan charter schools and all the data on Michigan schools are taken from publications of the Michigan Department of Educaton [all 2000].

8. Results for a critical level of 7 or 8 percent are available from the author. If one chooses a critical level much higher than 8 percent, the results depend unduly on just a few districts–simply because only a few districts ever face more than an 8 percent drawing away of their students. Descriptive statistics for the Michigan data set are also available from the author.

9. Note that the charter schools' share of local enrollment is based, in Table X, on the assumption that students attend charter schools in the district in which they reside. Because students who are in particularly unappealing districts are disproportionately likely to attend a charter school outside their district if they do attend a charter school, the statistics on which the table is based slightly understate the enrollment losses of bad districts. It is possible to construct estimates of the share of a district's students who attend charter schools, but such estimates are somewhat noisy and (in any case) generate results that are qualitatively similar to the results shown in Tables XI and XII. The alternative set of results may be found in the working paper version of this paper, available from the author.

10. Some readers may be interested in detrended difference-in-differences results–that is, estimates that allow each school to have a different initial trend. To compute such results, I look for *changes* in a school's trend when it begins to face charter competition. I present such results in Hoxby [2001] for Michigan. They simply confirm the results shown in Table IV: schools that faced charter competition improved their achievement *growth rates* more than schools that did not face charter competition. Detrended difference-in-difference results are a valid test of the effects of charter competition, even if schools faced with charter competition had different initial achievement growth rates than schools that

were not faced with charter competition.

11. To be precise, I allow for a one-time, statewide shift in each percentile rank. The shifts are very small, however. The information on Arizona charter schools and all the data on Arizona schools are taken from publications of the Arizona Department of Education [1988 through 1995, various 2000].

12. These results and descriptive statistics for the Arizona data set are available from the author. Choosing a level much higher than 11 percent makes the results depend unduly on just a few districts–simply because only a few districts ever face more than an 11 percent drawing away of their students.

13. Some readers may be interested in detrended difference-in-differences results–that is, estimates that allow each school to have a different initial trend. To compute such results, I look for *changes* in a school's trend when it begins to face charter competition. I present such results in Hoxby [2001] for Michigan. They simply confirm the results shown in Table IV: schools that faced charter competition improved their achievement *growth rates* more than schools that did not face charter competition. Detrended difference-in-difference results are a valid test of the effects of charter competition, even if schools faced with charter competition had different initial achievement growth rates than schools that were not faced with charter competition.

14. See Hoxby [2000c] for more on this point.

15. We can calculate this choice index, C_m, using the following equation:

$$C_m = 1 - \sum_{j=1}^{J} s_{jm}^2 \ ,$$

where s_{jm}^2 is the square of district j's share of enrollment in metropolitan area m.

16. We might be concerned that the conduct of local public schools affects the availability of inter-district choice. In particular, districts might consolidate with good districts but secede from bad districts. To obtain unbiased estimates, we need geographic factors that increase a metropolitan area's tendency to contain many independent districts but that have no direct effect on contemporary public school conduct. As explained in Hoxby [2000a], streams and rivers are such factors because, early in American history, they were natural barriers that influenced the drawing of district boundaries. They increased students' travel time to school, causing school districts to be drawn smaller initially. Small streams and rivers probably have no direct effect on how schools conduct themselves now.

17. The quality of a private school can be measured in various ways, the simplest of which is simply the amount of money the private school spends on educating a student. Because private schools face strong incentives to be productive, their costs are a good guide to their quality. Private school expenditure sometimes understates the true cost of educating a private school student because, especially in schools with religious affiliation, labor is donated by volunteers and church buildings are used for educational purposes.

18. Formally, the set of instruments for the share of enrollment in private schools is a vector of variables that measure the population densities of nine major religious denominations in 1950. So long as I control for *current* religious composition of metropolitan areas (which might affect the demand for private schooling), these historical religious population densities should mainly affect the supply of schooling and should have little or no direct effect on the achievement of public school students.

19. Schools faced with more competition are Milwaukee elementary schools where at least two-thirds of students are eligible for free or reduced price lunches (and thus eligible for vouchers). There are 32 such elementary schools, each of which has an average fourth grade enrollment of 72 students.
Schools faced with less competition are Milwaukee elementary schools where fewer than two-

thirds of students are eligible for free or reduced price lunch (and thus eligible for vouchers). In all of these schools, at least 30 percent of students are eligible for free lunch. There are 66 such elementary schools, each of which has an average fourth grade enrollment of 71 students.

       The control schools are all the Wisconsin elementary schools that (1) are urban; (2) have at least 25 percent of their students eligible for free lunch; (3) have at least 15 percent of their students being black. There are 12 control elementary schools, each of which has an average fourth grade enrollment of 51 students.

       The sources for this table are Wisconsin Department of Public Instruction [various 2000] and United States Department of Education, *School District Data Book.*

20. Test scores are measured in national percentile points. Statistics are based on weighted averages over schools in the relevant group, where each school is weighted by its enrollment.

       The sources for this table are Wisconsin Department of Public Instruction [various 2000] and United States Department of Education, *School District Data Book.*

21. ** indicates a very large city district (enrollment in one grade typically exceeds 1,000). * indicates a large city district (enrollment in one grade is typically between 500 and 1,000).

       The share of students who live in a district and attend charter schools is difficult to calculate because students can attend charter schools located outside of their districts (Michigan) or municipality (Arizona). The above statistics are calculated under the assumption that students attend a charter school located in their district (Michigan) or municipality (Arizona).

       The sources for this table are the Michigan Department of Education [2000 various] and Arizona Department of Education [2000 various].

22. The table is based on regressions of school level data from 1992-93 to 1999-2000. The dependent variable is a school's achievement–specifically, a school's scale scores on the Michigan Assessment of Educational Progress (MEAP) tests, which are administered to fourth and seventh graders. The regression includes school indicator variables to pick up characteristics of schools that are constant over the period (location, neighborhood, organization) and year indicator variables that allow for state-wide changes from year to year in the test itself or in the pressure to perform on the test. From 1992 to 2000, the means and standard deviation of schools' average scores (weighted by the number of test takers) were: mean of 611, standard deviation of 19 on fourth grade reading; mean of 528, standard deviation of 16 on fourth grade math; mean of 600, standard deviation of 17 on fourth grade reading; mean of 521, standard deviation of 14 on fourth grade math.

       ** indicates that the change in achievement is statistically significantly different from zero with 95 percent confidence, * indicates the same thing, but at the 90 percent level.

       The sources for this table are Michigan Department of Education [2000 various].

23. The table is based on regressions of school level data from 1992-93 to 1999-2000. The dependent variable is a school's achievement–specifically, a school's national percentile rank (NPR) score on a nationally normed standardized test (the Iowa Test of Basic Skills or the Stanford 9). See the text for details on the tests. The regression includes school indicator variables to pick up characteristics of schools that are constant over the period (location, neighborhood, organization) and year indicator variables that allow for state-wide changes from year to year in the test itself or in the pressure to perform on the test.

       ** indicates that the change in achievement is statistically significantly different from zero with 95 percent confidence, * indicates the same thing, but at the 90 percent level.

       The sources for this table are Arizona Department of Education [1996, 1997, 1998, 1999, 2000 various].

24. Test scores are measured in national percentile points. The coefficients shown come from instrumental variables estimation of regressions in which the dependent variable is one of the achievement measures shown or per pupil spending. The independent variables in the regression include the index of choice (instrumented by a vector of streams variables, see text), several family background

variables (household income, gender, race, parents' education), several neighborhood variables (mean household income in district, income inequality in district, racial composition of district, racial and ethnic homogeneity of district, educational attainment of adults in district), and several characteristics of the metropolitan area (population, land area, mean household income, income inequality, racial composition, racial homogeneity, ethnic homogeneity, educational attainment of adults, homogeneity of educational attainment, region of the country). The regressions are weighted by school enrollment. Standard errors are in parentheses and use formulas (Moulton 1986) for data grouped by districts and metropolitan areas.

 The main source for this table is Hoxby [2000a]. Observations are metropolitan area students from the National Education Longitudinal Study. The number of observations in each column are: 10,790 (from 211 metropolitan areas), 7,776 (from 211 metropolitan areas), and 6,119 (from 209 metropolitan areas). The number of observations varies due to the availability of the dependent variable. Other data sources are the School District Data Book, Common Core of Data, City and County Data Book, Geographic Names Information System, and United States Geographic Survey.

 [**] indicates that the effect is statistically significantly different from zero at the 95 percent level of confidence.

25. Test scores are measured in national percentile points. The coefficients shown come from instrumental variables estimation of regressions in which the dependent variable is one of the achievement measures shown. The independent variables in the regression include the percentage of metropolitan area student enrolled in private schools (instrumented by a vector of religious composition variables from 1950, see text), several family background variables (household income, gender, race, parents' education), several neighborhood variables (mean household income in district, income inequality in district, racial composition of district, racial and ethnic homogeneity of district, educational attainment of adults in district), and several characteristics of the metropolitan area (population, land area, mean household income, income inequality, racial composition, racial homogeneity, ethnic homogeneity, educational attainment of adults, homogeneity of educational attainment, region of the country). The regressions are weighted by school enrollment. Standard errors are in parentheses and use formulas (Moulton 1986) for data grouped by districts and metropolitan areas.

 The main source for this table is Hoxby [2000b]. Observations are metropolitan area students from the National Education Longitudinal Study. Other data sources are the School District Data Book, Common Core of Data, and City and County Data Book.

 [**] indicates that the effect is statistically significantly different from zero at the 95 percent level of confidence.