School Choice, Segregation, and Academic Outcomes:

Educational Trajectories under a Controlled Choice Student Assignment Policy

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Abstract

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(Under the direction of Dennis K. Orthner)

During the past twenty years there has been an increase in the number and variety of school choice policy options in education. Influential articles and reports such as *A Nation at Risk* document the failures of our public education system with tales of gaps in achievement by race, gender, social class, and country. School choice is widely discussed as a solution to these, and other, issues. Administered appropriately, proponents argue, school choice could liberate low-income and minority students from their underperforming schools and give them access to the higher performing schools of the upper and middle class. Yet, there is also evidence of unintended consequences resulting from school choice such as increased racial and socioeconomic segregation.

The three papers included in this dissertation discuss and evaluate different aspects of school choice. The first paper, "Evaluating School Choice: Considerations for Research and Policy," discusses the varieties and extent of school choice currently available in the United States, summarizes the multidisciplinary theory that frames school choice research, and develops a conceptual framework based on theory and educational purpose as a guide to future evaluations.

The second paper, "Racial and Socioeconomic Segregation in a District with Controlled School Choice," uses a multilevel comparison model to examine the relationship between a controlled choice student assignment plan and racial and socioeconomic segregation over an eleven-year period. Findings indicate an increase in school-level racial and socioeconomic segregation within the district during the implementation of the student assignment plan.

The third paper, "School Choice, Racial Segregation, and Student Academic Outcomes," uses a multilevel growth model to examine the impact of attending racially segregated schools on academic test scores. The results confirm previous research regarding the racial achievement gap and indicate no discernable effect on student achievement growth over time that can be attributed to the racial makeup of the school.

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Abstract

Over the past twenty years, school choice in the United States has become a widely supported catch phrase for a growing collection of policies and practices designed to increase parental and student involvement in school assignments. A careful evaluation of the impact of school choice on educational practices and outcomes is essential to demonstrate the long-term value of the trend. In this paper, I make three contributions to the collective effort to evaluate the impact of school choice. First, I clarify the type and variety of school choice programs and provide an estimated current summary of the extent of school choice available and used in the United States. Second, using market and social science theory, I review the theoretical and empirical basis both for school choice and for potential unintended consequences. Finally, I develop a conceptual framework to guide future evaluation research in light of the seldom-discussed purpose of public education as well as the theory that underlies school choice policy. Considerations such as the type of school choice, the theoretical foundations of school choice and its potential consequences, and purpose-driven outcome measures are essential in future evaluation of this growing policy trend.

Evaluating School Choice: Considerations for Research and Policy

Education policy in the United States today is intense and confusing. The public press and academic journals debate such issues as high-stakes testing, accountability, financial equity and adequacy, school assignment policies and administrative bureaucracy. Newspaper and magazine articles and reports such as *A Nation at Risk* (National Commission on Excellence in Education 1983) bemoan the failures of our public education system by rehearsing tales of gaps in achievement by race, gender, social class, and country. A recent update of the *Nation at Risk* report finds little improvement in U.S. education since 1970—some progress in narrowing resource gaps, but a continuing, albeit slightly smaller, achievement gap (Peterson 2005).

School choice is widely discussed, in its many institutional forms, as a potential solution to several of the problems mentioned above (e.g., Kahlenberg 2001; Peterson 2005). Administered appropriately, proponents argue, parents would choose the school that best meets the needs of their student(s), and the result would be several benefits to the current system. First, it would liberate low-income and minority students from their underperforming schools and give them access to the higher performing schools of the upper and middle class, thus reducing the racial and socioeconomic achievement gaps. Second, it would force administrators to make schools more efficient and improve education. In our consumerist society, choosing between schools seems to be as reasonable as choosing between different makes and models of cars. However, critics of school choice suggest that school choice is not the panacea some proponents offer, and that there are unknown and unintended consequences of school choice (e.g., Betts and Loveless 2005; Henig 1994).

In this paper I make three important contributions to the debate about school choice. First, I provide examples of current school choice policies as well as make a rough estimate of the number of U.S. students impacted by school choice. Second, I examine the multidisciplinary social science theory that underlies the debates surrounding school choice. Finally, I develop a conceptual model of school outcomes, clarified by this multidisciplinary theoretical foundation, which is based on a neglected discussion of the purpose of public education and its role in the United States.

Background on School Choice

While school choice overall is becoming more prevalent in the United States, there are widely divergent views about what constitutes "school choice," and what is generally understood by that phrase. Historically, student assignment has been almost exclusively a decision made by school boards; however, over time, student assignment has become decentralized due to increasing school choice. School authorities traditionally assigned most children to a "neighborhood school," thus limiting school choice to neighborhood choice and advantaging parents who could afford to live in more exclusive neighborhoods, often with small, exclusive school districts. During the late 1960s, after the *Brown v. Board of Education* decision in 1954, federal courts began to require local school boards to design and implement policies to end racial segregation (Green v. New Kent County School Board 1968). Schools affected by court-ordered desegregation plans assigned students to schools in order to balance the schools' racial compositions, and school boards had fewer options in setting their assignment policies. Many districts, as an alternative to busing, developed such school choice options such as magnet schools—an option that increased choice for parents who selected integration. Because the courts have relaxed requirements to assign students based on race, and in an effort to integrate schools through choice, some additional districts have returned to local control and developed school choice options such as magnet schools. Districts that were never under a court-ordered desegregation plan now also offer more student assignment options because parents request them and because school choice is frequently seen as a solution to perceived problems in the U.S. public education system (Chubb and Moe 1990; Kahlenberg 2001; Peterson 2005). Finally, No Child Left Behind (2002) includes elements of choice in that it permits students attending failing schools to transfer to another public school of their choice, an increase in the trend toward school choice.

Types and Scope of School Choice

All U.S. school districts offer one or more varieties of school choice, or different degrees of parental and student involvement in school assignment. One of the difficulties in evaluating school choice is the institutional variety of school choice plans and the constant change in these plans and their availability, as well as poor take-up data. Estimating the usage of school choice plans is, at best, based on "back of the envelope" calculations. However, the availability of school choice options is more easily estimated.

School choice options can be classified into three groups: advantaged choice, intradistrict choice, and interdistrict choice. By far the most commonly available and used form of school choice is advantaged choice, which an estimated 17.4 million students use—approximately 28% of total school-age children in the United States. The other two categories, intradistrict and interdistrict choice, are used by an estimated 5 million students—approximately 8% of total school-age children in the United States, or 11-14% of public school students (see Appendix A for details and references).

The first school choice category includes residential choice, private schools, and home school (Henig and Sugarman 1999). In residential choice, families purchase homes based on their perception of the quality of neighborhood schools. Students who are home schooled may participate in public or private schools for a portion of the school day, yet receive a significant portion, if not all, of their instruction from their parent(s) in their home environment. I call this category of traditional forms of school choice *advantaged choice*, because it is available primarily to advantaged families—those families with financial resources to pay for private schools, homes in exclusive neighborhoods with high-quality schools or temporal resources to teach their children at home. These forms of school choice are available everywhere in the United States, although fewer private schools are available in rural areas.

The second school choice category is *intradistrict choice*, or options within a district, including magnet schools, controlled choice, and student transfers. At least forty states and the District of Columbia offer *magnet schools*, which may provide special classes and often a schoolwide focus, and are subject to state-imposed requirements and usually state testing. Students who apply to magnet schools are admitted under specific admission policies determined by the school board. *Controlled choice* is available in districts in Massachusetts, North Carolina, and Florida, among others (Fiske 2002; Willie, Edwards, and Alves 2002). Controlled choice requires that all parents and students rank their choice of schools, usually with a theme or emphasis; then school district officials assign students based on those rankings and the district's school assignment policy. Student transfers to another school within a residential district are available in all but ten states (NCES, 2005, see Appendix A). Approximately, two million students use intradistrict school choice.

The third school choice category is *interdistrict school choice*, or options between districts within a single state. This choice includes charter schools, statewide open enrollment, urban-suburban programs, and public voucher plans. *Charter schools*, while often operated within a single district, are licensed by the state and are usually open to any student, regardless of district. As in magnet schools, students apply to charter schools and are admitted under specific admission rules outlined in the charter. Approximately 655,000 students attended 2,368 charter schools in the 2001-2002 school year, but the number of students has increased as 3,623 charter schools were operating in 2005. *Open enrollment school choice* requires that all students apply to their preferred public schools, and it allows them to attend, if accepted, any public school within an area, either within a district or between districts. Currently, while forty-six states allow at least some students to attend schools in any district, no state requires that all students apply to their preferred public school(s) for admission (NCES table, see Appendix A). *Urban-suburban programs* are located in specific metropolitan areas with separate urban and suburban school districts (e.g., Ryan and Heise 2002). These programs, developed with the purpose of integrating schools, primarily bus urban students to suburban schools. Finally, s*chool vouchers* allow parents and students to choose a school, often public or private; and all or a portion of the tuition is paid by the sponsoring institution—a state or local school district, wealthy individuals, or nonprofit foundations—to the school the parents have chosen. Voucher programs are available for low-income or disabled students in many states (Florida, Utah) and cities (Milwaukee, Wisconsin, Washington, DC, New York City, New York, Cleveland, Ohio) (Henig and Sugarman 1999; Howell, Wolf, Campbell, and Peterson 2002). Over 40,000 students use these publicly funded vouchers. Overall, an estimated 720,000 public school students participate in interdistrict school choice programs (see Appendix A for references).

All of these institutionally unique programs increase the ability of parents and students to choose the school the student attends, yet relatively few U.S. students take advantage of these options. Given the poor quality of the data available on school choice usage—many of the numbers in Appendix A are from the 2001-2002 school year; and other numbers such as transfers within and between districts, are unavailable—a rough estimate based on the most current available data indicates that approximately 11% of U.S. students take advantage of intra- and interdistrict public school choice programs (see Appendix A). This number is close to the estimated 14% made by other researchers (Bielick and Chapman 2003). As the availability of school choice increases, the number of students exercising school choice will continue to grow. Evaluating current school choice policies and their impact on educational outcomes is essential to guide future policy decisions with respect to school choice.

As illustrated above, the institutional variety of school choice policies and practices inherently creates difficulties for researchers analyzing the impact of school choice on public education. This is due largely to the individual characteristics of unique district-specific assignment policies and practices that make the results of these studies difficult to generalize among the growing varieties of institutional designs (Witte 2000). In addition to the difficulties from institutional variety, school choice evaluations draw from a variety of theoretical areas.

School Choice Theoretical Models

The theoretical basis for most school choice evaluation is implied, rather than explicit. One of the contributions of this paper is to use market and stratification theory to clarify that theoretical foundation. Research that evaluates school choice examines primarily two issues: *school productivity*, typically measured by student test scores; and the *unintended consequences* of school choice, such as racial and socioeconomic segregation. Although not cleanly divided between the two, research in these areas emphasizes two different theoretical models.

Market Model

The theoretical perspective that motivates school productivity models is based on market theory, with individual consumer decisions at the core. School choosers, parents and/or students, are the "stakeholders and consumers"; and education providers, school administrators and teachers, are the "suppliers." In a perfect market, schools would operate in an optimal situation where parents' and students' preferences would be met, the result being improved efficiencies and academic outcomes.[1] Despite the potential advantages from competition, there are concerns that an unrestrained market is not an appropriate model for public education. Betts (2005), after carefully reviewing the assumptions needed for perfect competition, concluded that the education market violates those assumptions. He concluded that rather than reducing bureaucracy, differentiating products, and liberating low-income students, school choice will require additional regulations and policies in order to mitigate the potential negative consequences of school choice and improve overall educational outcomes.

Proponents of increasing school choice suggest several paths through which competition may improve educational outcomes. The basic argument, as expressed by Paul

Peterson (1990), is that increasing the options for individual choice and possible differential school funding through consumer involvement will encourage schools to maximize consumer services or lose students to other schools. This is the model that underlies Public Law 107-110, known as "No Child Left Behind," whereby students who attend "failing" schools—as indicated by test scores overall and by racial subgroup—have an option to choose a different, non-failing, school to attend. The schools losing students thus have an incentive to either improve their product or differentiate it from the competition, or eventually face the consequences of being shut down. This incentive to differentiate, Goldring and Shapira (1993) argue, may encourage the suppliers to specialize in distinct curricula and pedagogical philosophies, and thus allow parents and students to match style and interest from a wider variety of schools. Greater compatibility among student learning styles, interests, teaching styles and curriculum may then improve the students' academic outcomes. Similarly, Chubb and Moe (1988) suggest that increased choice will decrease bureaucracy, which will in turn make schools more efficient and improve educational outcomes. In response to this argument, Lubienski (2006), reviewing research on school choice programs in Chile, New Zealand, and Great Britain, found that instead of diversifying teaching practices, schools were embracing more traditional curriculum and choosing to innovate through marketing and image management.

Another path by which competition may improve education outcomes is to eliminate the connection between housing prices and neighborhood school quality. Traditionally, when students attended neighborhood schools, because of the close correlation between school quality and the price of homes, parents purchased education along with their housing costs (Tiebout 1956). Hoxby (2003) argues that school choice has the potential to relax housing budget constraints, allowing consumers to choose a school regardless of neighborhood housing costs and thus liberate low-income students from poor quality schools. A national study comparing areas with magnet school to areas without found no difference in socioeconomic distribution, evidence that magnet schools, one variety of school choice, are not liberating low-income students (Archbald 2004). While there are several potential paths by which school choice may improve educational outcomes, significant unintended consequences may also require additional, not less, regulation to facilitate competition in the public education market.

Stratification Model

The theoretical perspective that motivates evaluation models by examining the unintended consequences of school choice is based on social science theory and research on community interactions and networks. Research in this area focuses on the impact of school choice on peer groups and segregation, and their impact on individual educational outcomes. The researchers' primary concern is that school choice will result in schools stratified by race, socioeconomic status, or even parental involvement. Such stratification may have detrimental effects not only on individual students, but on society as a whole.

Peer effects—the impact of an individual's social environment—observed in education may operate either directly through students or indirectly through resource allocation. Sociologists like Blau (1964) and Homans (1974) suggest that direct peer influences occur when group definitions of appropriate behavior are adopted, as if those definitions unconsciously create a personal matrix that includes the costs and benefits of social choices which either conform or fail to conform to peer group norms. Peer effects also measure an indirect peer effect, a correlation with available school resources and organizations that indirectly influences student academic outcomes. For example, in general, middle-class schools have better trained teachers, more challenging curriculum, and more involved parents; thus stratification by class would result in a decrease in quality of low-income, minority schools (Cook and Evans 2000; Kahlenberg 2001). These peer effects have the potential to operate on multiple, overlapping levels—e.g., race, gender, socioeconomic status, parental involvement.

In general, researchers find some evidence of general peer effects at the family and neighborhood (Case and Katz 1991), high school (Zimmer and Toma 2000), and college levels (Sacerdote 2000). It is less clear that school peer composition affects academic outcomes. While one study using the natural variation in gender and race between grades to identify peers found that classroom composition affected academic outcomes (Hoxby 2000), another study using stable cohorts and a value-added model found that the racial composition of schools did not significantly influence student academic outcomes (Jones-Sanpei 2006). The impact of peer effects may also vary by race; one study found that a higher percentage of Black schoolmates had an adverse effect on the achievement of Blacks (Hanushek, Kain, and Rivkin 2002).

Stratification by socioeconomic status also affects educational outcomes, either through direct or indirect peer effects. For example, Rumberger and Palardy's (2005) study of over 14,000 students in 913 U.S. high schools used resources available at the school level to find that the average socioeconomic level of students' schools had as much impact on their achievement growth as their own socioeconomic status, net of other background factors.

A third possible stratification category is parental involvement which indirectly influences student achievement through expectations and school resources. This is reflected in Rumberger and Palardy's (2005) study of the differential school resource allocations or indirect peer effects. For example, parents involved in their children's education voice concerns and participate in the school community; the potential result is school policies that would be good for all the students, not just their own (Brandl 1998). The loss of these parents and the potential for them to congregate in choice schools could be an overall loss for the schools and students left behind. A key factor in school choice policies is access to information. However, even with school choice information available to all consumers, differences in parental access and abilities suggest different opportunities to use the information (Bourdieu 1970). For example, parents with greater time constraints, such as multiple jobs or health problems, may not be able to use the information as effectively as others, the potent result being student sorting by parental involvement. One example is that parent volunteer hours are required at many charter schools, which effectively excludes students whose parents have greater time constraints, thus potentially sorting by parental involvement.

The two theoretical approaches discussed above, the market model and stratification model, emphasize different aspects of school choice. School choice has the potential to improve educational outcomes. Yet it also has the potential to further divide society. The following section incorporates both perspectives into a third approach by developing a goal-driven evaluation model.

Evaluating School Choice in Public Education

Purpose of Public Education

The first step in evaluating any public policy is to consider the policy's mission, goals and objectives. Education policy often skips this step, either assuming agreement or avoiding the discussion due to space or time constraints, with some noted exceptions (Gutmann 2000; Wolf 2005). There is diversity of opinions among educators, parents, and other interested parties regarding the purpose of education, yet two statements of public education goals suggest the potential for broad categories that could be incorporated into a conceptual model.

First, the Goals 2000: Educate America Act (1994) included, among goals on school readiness, school completion, teacher readiness, and parental participation, a goal for student achievement and citizenship: "By the year 2000, all students will leave grades 4, 8, and 12 having demonstrated competency over challenging subject matter including English, mathematics, science, foreign languages, civics and government, economics, arts, history, and geography, and every school in America will ensure that all students learn to use their minds well, so they may be prepared for responsible citizenship, further learning, and productive employment in our Nation's modern economy." In addition to the commonly accepted goal of academic competency, this goal statement includes civics education, preparation for responsible citizenship, and preparation for productive employment.

This relatively recent list of public education goals concurs with a historical list given by Thomas Jefferson to the commissioners of the University of Virginia in 1818. Jefferson's goals for public education were

- To give to every citizen the information he needs for the transaction of his own business;
- To enable him to calculate for himself, and to express and preserve his ideas, his contracts and accounts, in writing;
- To improve, by reading, his morals and faculties;
- To understand his duties to his neighbors and his country, and to discharge with competence the functions confided to him by either;
- To know his rights; to exercise with order and justice those he retains, to choose with discretion the fiduciary of those he

delegates; and to notice their conduct with diligence, with candor, and judgment;
- And in general, to observe with intelligence and faithfulness all the social relations under which he shall be placed. (Jefferson 1944: 400-401)

These statements suggest that public education goals include both private goods—those that benefit a single individual; and public goods—those that provide benefits to a number of individuals simultaneously without diminishing returns to individuals. Private goods include personal income, professional success, personal well-being, and the ability to interact with a diverse group of individuals. Public goods include civic engagement, political activity, tax revenue, qualified worker pools, increased numbers of volunteers, and equality of opportunity. There is some overlap between public and private goods produced by education, such as increased tax revenue from high-wage earners. However, as one researcher suggests, public education is an investment in the individual by society, benefiting both the individual and society (Levin 1987). Because education provides both public and private goods, education policy and research should use models that include both private and public goods as desired outcomes.

The two lists of goals, both modern and historical, can be loosely grouped into three categories: first, the widely accepted individual outcomes of academic achievement and job readiness; second, community outcomes such as parental empowerment and social capital networks; and third, individual social outcomes, such as future political engagement, social skills, and civic skills.

Community Outcomes

The first goal category of public education emphasizes such community outcomes as parental empowerment and community social capital. Previously, the involvement of parents in their children's education has been treated as a means to higher academic outcomes; however, parental empowerment, in addition to increasing parental involvement, is a means in itself in that it contributes to community social capital. By bringing parents together to improve their children's education, an optimal public education system fosters civic skills, such as deliberation and community decision-making, thus increasing the involvement of parents in their children's education, and empowering them by increasing social capital at the community level. On a community level, social capital refers to the relationships and networks existing among individuals and groups that can be called upon for support or reciprocity in times of need (Putnam 2000). Like human and economic capital, social capital facilitates productive activity, increasing production through networks and relationships. Specific forms of social capital include obligations and expectations, information channels, and social norms (Coleman 1988). Social capital enables members of communities to trust one another and establish business and political organizations.

A democratic society requires an educated populace (Pangle and Pangle 2000)—citizens with "the capacity to cope with political disagreements among citizens in a more mutually justifiable way than its alternatives" (Gutmann 2000). A functioning democracy relies on the ability of its members to show mutual respect, tolerance, and deliberation—skills that promote social capital. These civic skills, taught in homes and in schools, have traditionally been practiced by students in schools, and by adults in school board meetings and community groups. As part of the political system, schools provide opportunities for citizens to be involved in the democratic process through school board elections and parent/teacher associations, thus encouraging parental empowerment, as well as demonstrating to succeeding generations the civic virtues that may allow them to build individual social capital and participate in the political society.

Individual Outcomes

The second goal category of public education emphasizes individual outcomes used to evaluate school effectiveness, such as academic achievement and job readiness, as shown in the center path in Figure 1. It is closely aligned with the mission of the U.S. Department of Education in preparing students to be competitive in future job markets, and it is commonly used in education evaluation models (Orthner 2007). These skills are usually measured by changes in standardized exam scores as a result of factors within school control, such as, but not limited to, teacher attributes, pedagogical philosophy (learning styles) and school structure (classroom reforms) (e.g., Coleman, Campbell, Hobson, McPartland, Mood, Weinfeld, and York 1966). Other factors that affect educational outcomes, as shown by the vertical dotted line in Figure 1, include factors outside individual school control—school-external factors; and factors over which schools have limited control—school-mixed factors. Examples of school-external factors include student attributes, student composition, peer effects, and future labor markets. Some school-mixed factors include parental involvement, curriculum, funding, equity issues, and community involvement. The strengths of the individual model outcomes are found in simplicity and familiarity, not to mention readily accessible data in the form of test scores and multilevel administrative data. The weaknesses of the individual model are that it deemphasizes potentially vital community and individual social outcomes.

Individual Social Outcomes

The third goal category of public education emphasizes individual social outcomes, such as future political engagement, and individual civic and social skills. In addition to civics education, these goals are realized and practiced through social interactions among peer groups. At the individual level, as discussed above, research on peer effects shows that group membership influences individuals who belong to that peer group (Merton 1968).

Social interactions can also be understood in terms of social capital. Social capital theory introduces a vital distinction between bridging (or inclusive) and bonding (or exclusive) social capital (Putnam 2000). Public schools foster both of these dimensions of social capital. Bonding social capital looks inward, reinforcing exclusive identities and homogeneous groups, such as ethnic fraternal organizations, fashionable country clubs, church-based book clubs, school clubs and cliques; these lead to advantages such as specific reciprocity and solidarity. On the other hand, bridging social capital looks outward, encompassing people across diverse social divides, such as service groups, environmental groups, and civil rights movements (Putnam 2000). Bridging also includes exposure to, and interaction with, a diverse group of individuals; these lead to advantages such as information diffusion and linkages to external assets. For example, widespread bridging social capital facilitates career networking, while a bonding form of social capital provides solidarity in times of personal or family need. In *Bowling Alone*, Robert Putnam writes that "[b]onding social capital constitutes a kind of sociological superglue, whereas bridging social capital provides a sociological WD-40" (2000: 23). One potential negative externality is that bonding social capital, "by creating strong in-group loyalty, may also create strong out-group antagonism…and for that reason we might expect negative external effects to be more common with this form of social capital" (Putnam 2000: 23).

Schools can structure institutional arrangements and policies to emphasize either bridging capital, bonding capital, or both. Segregated schools may be more likely to build "bonding" social capital, while desegregated schools may be more likely to encourage "bridging" social capital by providing opportunities to practice civic skills of toleration, mutual respect, and deliberation, as students and parents interact with individuals from different races and socioeconomic classes.

One example of bridging social capital is the social skill of interacting and working with interracial groups. For example, an amicus brief filed in the 2003 Supreme Court case of *Grutter v. Bollinger* recounts that the U.S. military in the 1960s and 1970s was on the verge of self-destruction because of "racial polarization, pervasive disciplinary problems, and racially motivated incidents" ("Consolidated brief of Lt. Gen. Julius W. Becton, Jr., et.al." 2003). Integration increased the percentage of African-Americans in the enlisted ranks, yet the percentage of minority officers was extremely low, leading to pervasive perceptions of discrimination. The brief was written to support racially integrated schools and educational settings at the university level, arguing that this educational experience "provides [future officers] with invaluable experience for their future command of our nation's highly diverse enlisted ranks" ("Consolidated brief of Lt. Gen. Julius W. Becton, Jr., et.al." 2003). Amicus briefs from various Fortune 500 companies concurred with the importance of integrated schools as opportunities to practice working with diverse groups of individuals in preparation for working within the increasingly diverse U.S. population ("Brief for Amici Curiae 65 Leading American Businesses" 2003; "Brief of General Motors Corporation" 2004). While both bridging and bonding capital are important, these military and business leaders, concerned about the lack of bridging capital in the current school system, believe that integrated schools will foster bridging social capital.

The dashed lines connecting school inputs to community outcomes and individual social outcomes in Figure 1 indicate that these potential outcomes are seldom included in school choice evaluations. The private choices made by parents under school choice policies have the potential to lead to wide-ranging consequences for students and communities, not just impacts on student academic performance.

Measurement

In order to include community and individual social outcomes, additional measures will be necessary. Researchers are developing measures of social capital and trust and evaluating their school effects. For example, Bryk and Schneider (2002) found that trust among the people within public schools, such as teachers, administrators, and parents, affected student academic outcomes. Other researchers use membership data to measure community social capital (Putnam 2000) and ethnic homogeneity, income inequality, attachment to place, education, age, and female labor force participation (Rupasingha, Goetz, and Freshwater 2005). Still other researchers are elucidating the relationships between political participation and education (Helliwell and Putnam 1999; Nie, Junn, and Stehlik-Barry 1996).

Use of this broader outcome model will be complicated, given the difficulties of education policy research. For example, empirical models are limited to quantifiable inputs and outcomes (Murnane and Nelson 1984) and usually do not include organizational assets or non-monetary inputs (Vandenberghe 1999). Thus the inputs and outcomes of interest are often either indicated by poor proxy measures (Koretz 2002) or they are left out of the models. Ideally, measures of community outcomes and individual social outcomes (Figure 1) would be included in evaluation models. Progress is being made in developing relational measures such as trust (Bryk and Schneider 2002) and organizational learning (Orthner, Cook, Sabah, and Rosenfeld 2006), datasets measuring community social capital (Putnam 2000; Rupasingha, Goetz, and Freshwater 2005), and elucidating the relationships between political participation and education (Helliwell and Putnam 1999; Nie, Junn, and Stehlik-Barry 1996). The major difficulty is bridging the gap between individual education experience and community measures of social capital and political activity.

Incorporating additional outcomes into these studies will require bridging the gap between multiple units of analysis—individual and community—over time. For example, there is a consensus that a relationship between degree attainment and future job preparation and earnings exists (Blaug 1991), but a connection between school factors, as in Figure 1, and future individual social and community outcomes is only beginning to be explored (e.g., Wolf 2005). Nor has the relationship, if any, between school factors and current community outcomes been established. In addition to the temporal connection, it will be necessary to establish a relationship between individual-level preparation for civic and social skills with future community outcomes, such as social capital.

The two primary methods for establishing these relationships are longitudinal studies of individuals that incorporate their surrounding environment, both educational and community, and using community level outcomes that incorporate measures of community migration and individual educational measures. Longitudinal studies of students beyond their primary educational years are expensive and difficult to conduct, and they seldom include measures of diversity at the schools students attended. These in-depth studies that follow individuals over the course of their lives may result in more information regarding bridging and bonding social capital in public schools and the impact of student networks and social capital on their lives after high school. For example, while short-term impacts of segregation are unclear (Schofield 1995), longitudinal studies show that desegregated schooling has a positive long-term effect on the earnings and occupational attainment of African American students (Trent 1997), possibly because of the benefits of bridging social capital.

However, if the amount of community migration is known or estimable, it may be possible to make assumptions regarding the relationship between a specific community's educational policies and future community measures of social capital. These data are accessible. Sociologists conduct longitudinal studies of individuals in life-course and aging research, demographers measure community migration, and other social scientists measure community social capital. While challenging, incorporating measures of community and individual social capital into longitudinal research on students can be accomplished and would contribute significantly to a fully informed educational policy.

School Choice and the School Outcomes Model

As the discussion of the evaluation models above illustrates, school choice policy and research are incomplete without incorporating the multiple inputs and outcomes illustrated in Figure 1, based on the multiple purposes of public education discussed above. The advantage of emphasizing the individual outcomes in the center path in Figure 1 is ease in measurement and focus. The primary outcome measured, test scores, reflects private goods that accrue principally to the individual student. The additional outcomes introduce public goods through community and individual social capital outcomes, such as parental empowerment, political activity, civic skills, and social skills. This school-outcomes model reinforces the value of social capital, both to communities and to individuals (Putnam 2000). For example, bridging social capital, or learning to work with diverse networks, is an important goal of public education in a diverse society. Racially and socially diverse schools offer students the opportunity to interact with peers from different social and racial backgrounds. This interaction fosters the social cohesion and civic skills—bridging social capital—that are needed in a diverse society.

Implications and Recommendations for School Choice

School choice policies, in many different forms, are increasingly being considered by local school districts. The issues discussed in this paper have significant implications for evaluating school choice policies. The variety of institutional programs and the overall low student use of school choice programs suggest that rigorous, quantitative case studies may be more helpful at this stage than large aggregated evaluations. These case studies could focus on details obscured in aggregated evaluations in order to learn the best practices of the different school choice options. They could also focus on the interest of parents and students in school choice programs, to learn whether the low take-up is due to lack of available programs, lack of knowledge of available programs, or lack of interest.

Second, school choice policy, like most public policy research, draws from multiple social science disciplines. While market theory is often used to support school choice, theoretical analysis of market competition indicates that public education, like many public goods, does not meet the requirements for perfect competition and thus requires more regulation, not less (Betts 2005). Increased community and/or organizational change at the school level, such as school specialization and less bureaucracy, may improve academic outcomes. It may also increase political and community activity among adults as they become more involved in their local school communities. But school choice, through incomplete information and unclear or opposing preferences, may also lead to racial and economic segregation in public schools, which may then foster conformity and homogeneous peer groups. Peer effects among homogenous peer groups may exacerbate inequalities in student achievement, reduce bridging social capital, and fail to provide opportunities to practice such civic skills as mutual respect, toleration, and deliberation. The outcome model developed in this paper relies on this multidisciplinary theoretical foundation to illustrate how research from sociology, political science, psychology, and economics has a role in education policy development and evaluation.

Finally, a fully informed educational policy can no longer be supported or explained solely by test scores and single educational outcomes, such as drop-out rates (Koretz 2002). Education is characterized by social interactions, and those interactions must be included in the models and research if the goal is to develop a socially optimal system of education that serves the broad interests of students and society. Both positive and negative outcomes may be simultaneously possible from school choice. Smaller class sizes for schools with higher percentages of at-risk students and the ability to group students according to ability and interest may impact academic achievement positively. On the other hand, grouping students according to ability and interest may result in a decrease in bridging social capital, or less toleration and social cohesion, which may or may not impact the preferred academic outcome of test scores. The model of school outcomes proposed in this paper offers a framework for education policymakers through which the implications of educational policies such as school choice and the unintended consequences of such policies can be considered.

As indicated in Figure 1, schools have little or no control over many of the factors that contribute to student success. For example, school administrators can encourage parental involvement, but if the parents do not want to be involved, or do not have time to participate, there is little they can do about it. They are also limited with respect to student composition, peer effects, and student attributes. For example, the student composition of a school district in the Midwest will look very different from one in the South, Southwest, or Northeast. However, school administrators can do their best to balance schools racially and socioeconomically within districts or within reasonable transportation distances, provide students additional opportunities for individual social capital development, and provide parents opportunities to be involved in the community. Issues of funding and curriculum are often decided at the district, or even state level, although there is a trend to give more "management tools" to local school administrators as part of accountability standards. However, more important than incorporating any of these inputs into specific policies is for school administrators to facilitate and encourage public discourse on the purpose of education. Only when multiple educational outcomes are recognized and debated, if not agreed on, will stakeholders recognize the need for policies regarding such inputs as student composition and peer effects.

Given the methodological difficulties of education policy research, incorporating additional variables at multiple levels—individual, institutional, and societal—seems daunting, but it is necessary to develop socially optimal education policies. For example, a comprehensive evaluation of any education policy will begin with the understanding that public education provides both public and private goods, both community and individual social capital, and civic and social skills, in addition to primarily private goods, such as academic measures. Thus, policy evaluation should measure and include multiple outcomes in evaluating the policy impact. In addition to test scores, school choice evaluations should include individual measures of political activity, social skills, civic skills, peer interactions, and measures of parental empowerment and community networks, as well as institutional and classroom level measures.

During the past twenty years, school choice has become an increasingly popular phrase in education policy. Future school choice evaluations should consider the type of school choice, underlying theories that contribute to school choice, and a goal-driven conceptual outcome model. Only by more carefully evaluating the full complexity of school choice programs will we avoid, or limit, the unintended and potentially negative consequences of social experiments such as school choice.

Endnotes

[1] In economic terms, the schools would operate along the production possibilities frontier where under the circumstances of perfect competition, no one buyer or seller could become better off without making at least one other agent worse off—Pareto efficiency. Under noncompetitive, or monopolistic, conditions, the information-gathering costs to operate on the production possibilities frontier would be very high, because school administrators would need comprehensive information about consumer preferences and needs (Betts 2005).

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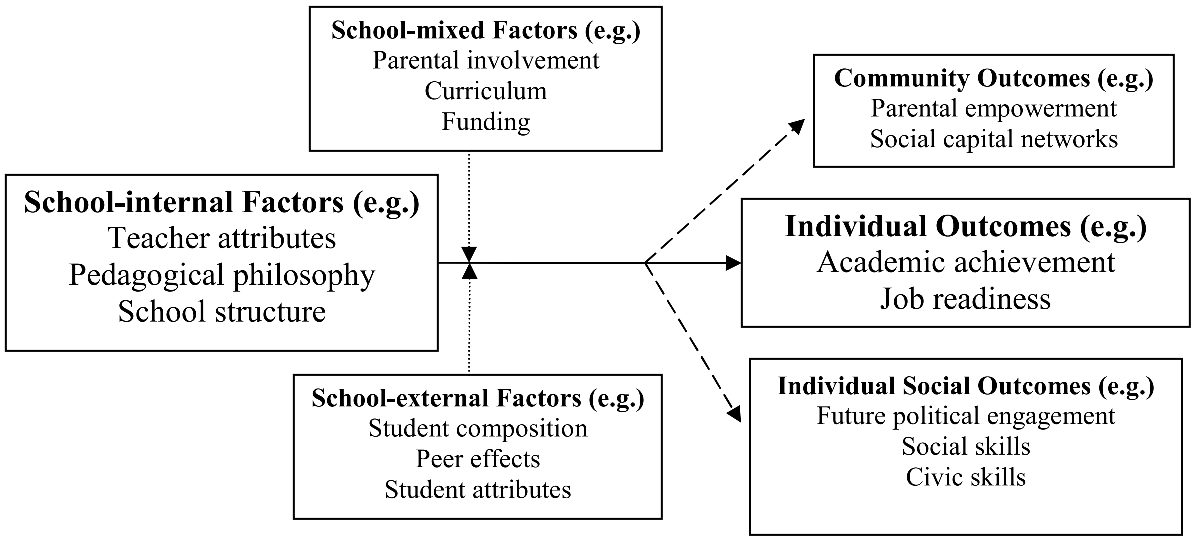
Figure 1: Conceptual Model of School Outcomes



Appendix A: Availability and Estimated Use of School Choice Options

		Students	Year	Source
U.S. school-aged children		61.4 million	2001-2002	U.S. Census National Population Estimates
U.S. public school children		54.6 million	2001-2002	http://nces.ed.gov/fastfacts/display.asp?id=65
	Availability	**Estimated students**	**Year**	**Source**
Advantaged Choice				
Residential choice	Everywhere	13.7 million	2001-2002	(e.g., Henig and Sugarman 1999, p. 14-16)
Private schools	All states, fewer in rural areas	5.3 million	2001-2002	(Broughman and Pugh 2005)
Home school	Everywhere	1.1 million	2002-2003	(Princiotta, Bielick, and Chapman 2004)
Intradistrict choice				
Magnet	1736 schools	3% (1.6 million)	2001-2002	http://nces.ed.gov/pubs2003/overview03/tables/table_09.asp
Controlled choice	Districts in MA, NC, NJ, NY	~200,000 students	2004-2005	(Henig 1994: 111); district websites (available from author)
Transfers	30 states	unknown	2005	http://nces.ed.gov/programs/statereform/sssco_tab1.asp
Interdistrict choice				
Open-enrollment (Transfers)	46 states (29 with multiple policies)	unknown	2005	http://nces.ed.gov/programs/statereform/sssco_tab1.asp
Urban-suburban	~12 districts/ programs	~25,000 students	1995-2000	See (Ryan and Heise 2002) for short summary of programs.
Charter schools	2348 schools 3623 schools	1.2% (655,000 students) unknown	2001-2002 2005	http://nces.ed.gov/pubs2003/overview03/tables/table_09.asp http://nces.ed.gov/programs/statereform/sssco_tab2.asp
Public voucher plans	DC, WI, FL, OH	~40,000 students	2003-2006	District websites and public announcements (available from author).

Racial and Socioeconomic Segregation in a District with Controlled School Choice

Abstract

One of the key policy developments in public education over the past twenty-five years has been the increase in school choice. A major criticism of school choice is the potential for racial and economic segregation. This study uses a two-level hierarchical linear model to examine the relationship between a controlled choice plan and racial and socioeconomic segregation within a North Carolina school district over an eleven-year period. Findings indicate an increase in school-level racial and socioeconomic segregation within the district during the implementation of the controlled choice plan. While similar North Carolina districts, used as comparison groups, also increased in school-level racial and socioeconomic segregation, the results of the HLM model comparing policy schools with non-policy schools indicate that a controlled choice student assignment plan will increase racial and socioeconomic segregation within a district, as measured by deviation from the district average.

Racial and Socioeconomic Segregation in a District with Controlled School Choice

School choice has been a major development in public education for over twenty years. School districts began providing parents and students more choice for a variety of reasons, including parental demands, policy shifts to encourage integration through school choice, and federal legislation (e.g., No Child Left Behind). For example, federal "No Child Left Behind" legislation requires that students at "failing" schools be allowed to transfer to a new school of their choice. Examples of school choice include assigned schools, neighborhood schools, controlled choice, and open enrollment. Other examples of school choice include school vouchers, charter schools, magnet schools, and home school. Because all school districts provide some degree of parental and student involvement in student assignment, the policies and processes impacting school choice greatly influence public education in the United States.

Historically, school assignments provided little opportunity for parents to select the schools their children attended. Neighborhood school assignment policies limited school choice to residential choice, as students' residential neighborhoods determined where they attended school. Supreme Court decisions in *Brown vs. Board of Education* (1954) and *Swann v. CMS* (1971) created a policy environment to integrate public schools by busing in larger districts. However, busing students away from neighborhood schools was politically unpopular because of the amount of time children spent on school buses and the loss of neighborhood schools and the community attachments they helped to create. Since the early 1990s, elementary and secondary school attendance policies in the United States as a whole, but especially in the South, have gradually been changing to increase school choice options, often as a means to encourage integration. This is arguably a result of several key desegregation court cases forbidding the use of race in school assignment, which restricted busing programs to integrate schools (Boger 2000), as well as in response to parental demand for more choices.

The impact of school choice on educational goals and outcomes is uncertain. On the one hand, proponents of school choice argue that it liberates poor children by lifting the restrictions that limit them to poor quality schools with poor educational outcomes and by encouraging administrators to improve overall school quality (Hoxby 2003a; Peterson 2005). On the other hand, critics of school choice argue that it aggravates the growing racial and socioeconomic segregation found in public schools, potentially negatively impacting equity goals such as integrated schools and equal access to quality education for all students (Henig 1994). Empirical studies of the impact of school choice on racial and socioeconomic segregation are limited both in number and in scope, in part due to the variety of school choice policies. Controlled choice is one type of school choice proposed to voluntarily integrate school districts. The study presented here examines whether the incremental implementation of a district-wide controlled choice student assignment plan impacted the racial and socioeconomic segregation in the school district.

Controlled choice attendance plans were initially implemented in San Lucie County, FL, and Boston, MA, in 1989 (Willie, Edwards, and Alves 2002) and are supported by a coalition of conservative and liberal policymakers—conservatives because the plans introduce more elements of the free market into the public schools, and liberals because the plans allow school boards who feel that diversity is an important educational purpose, to make student assignments that support diversity. The key components of a controlled choice plan are student diversity, school choice, and school improvement for the least attractive schools (Willie, Edwards, and Alves 2002). Under controlled choice, the school district is first divided into one or more attendance zones, depending on the size of the student population and the district's geographic area. Students and parents then rank their choices of the elementary or middle schools within their attendance zone and district officials match students with a school based on their rankings, the composition of students within the schools, and other district priorities. The district is then responsible for providing transportation.

The literature on school choice policies suggests that the details of implementation determine the success of the program (Fiske and Ladd 2000; Willie, Edwards, and Alves 2002; Witte 2000). In order to include those details, which often vary dramatically between districts, most studies of controlled choice are case studies, including this one. Any generalization to a larger population depends on the similarity with the local policies and situation. With that caveat, this case study will contribute to the school choice literature and guide future efforts to improve education policy by clarifying the relationship between a student assignment policy and resulting racial and socioeconomic segregation. The question asked in this paper is whether a controlled choice assignment policy increased the racial and economic homogeneity in the school district. Because the policy was planned and phased in over a five-year period in the county under examination, the impact of the attendance policy may be more easily identified than in districts where the policy was implemented in the entire district at the same time.

This study is a significant advance over past research both because of access to more comprehensive longitudinal data and a more robust research design: it is a multi-level longitudinal study that measures racial and socioeconomic segregation before, during, and after the implementation of the controlled choice policy in a single district; the implementation was phased in over a five-year period; and several other comparable districts with alternative school assignment policies are included in the model as comparison groups.

The goal of the study is to estimate the effect of implementing the controlled choice student assignment plan on the school-level racial and socioeconomic segregation in the district. First, I review the literature on school choice theory and critiques. Second, I describe the district and the circumstances leading to the implementation of the controlled choice policy. Third, I outline the research design and the process of selecting comparison groups. Next, I introduce the model and discuss the empirical results. The concluding section summarizes the findings and discusses directions for future policy decisions and research.

School Choice Theory and Critiques

School choice is widely viewed as a means for introducing student options and competition into the public educational system, potentially ameliorating problems such as bureaucratic complexity (Chubb and Moe 1990), monopolistic structure (Peterson 1990), lack of innovation, weak community ties, lack of diversity (Coleman 1990), and poor educational outcomes (National Commission on Excellence in Education 1983), as well as a lack of equity between races and classes. Equity arguments in favor of school choice are often based on what one scholar calls a "liberation model" whereby poor and minority children are given a means to escape the trap of inferior, poverty-stricken public schools (Archbald 2004). This liberation model is echoed in other research. For example, Hoxby (2003b) suggests that school choice will eliminate the link between neighborhood segregation and housing values on the one hand and school quality on the other. Godwin, Kemerer, Martinez and Ruderman (1998) wrote that liberating low-income students from poor quality schools would increase their potential for higher educational outcomes.

School choice researchers also rely on a market competition model and Hirschman's (1970) organizational theory of exit and voice. For example, Chubb and Moe (1988) argue that by allowing the parents/consumers to choose a school (or increase their exit options), the administrators will be more receptive to their requests (voice) and thus reduce bureaucracy and improve efficiency and innovation. In other words, the incentive to maintain or increase market share by exchanging resources without diminishing educational quality may reveal savings in non-teaching areas such as overhead and bureaucracy. Despite Weiss's (1998) argument that parents do not speak with a single, clear voice regarding what is important in education, this model is appealing to consumers who are accustomed to choosing among multiple goods and services.

One of the primary critiques of school choice is that choice, either through insufficient information or a preference for segregated neighborhood schools by parents, has the potential to exacerbate existing racial and socioeconomic segregation in public schools as it fundamentally alters how students are distributed among schools within a district (Archbald 2000). Several studies suggest that choice may lead to segregation (Archbald 2004; Godwin and Kemerer 2002), but others suggest that the segregation may be the result of factors other than choice policies (Clotfelter, Ladd, and Vigdor 2005). We know little about the effects of school choice on racial and socioeconomic segregation.

However, racial segregation in public schools, especially in the South, has arguably been increasing by several measures (Clotfelter, Ladd, and Vigdor 2005; Orfield and Yun 1999). The causes of this "resegregation" are unclear. Orfield and Lee (2005) suggest that it may be a result of changing demographics, urban sprawl, and declining inner cities, or the dismantling of desegregation policies and increasing public school choice. The appeal of the controlled choice student assignment policy is that it combines potentially positive outcomes projected by the market competition and liberation models with a means to limit the unintended consequences of school choice as district priorities are expressed through centralized student assignment.

Demographic Changes

Due to the correlation between race and poverty, demographic changes in poverty concentrations may be correlated with changes in racial demographics in schools. For example, a national study using 1990-2000 census data found that concentrated poverty in the U.S. decreased dramatically during the 1990s (Jargowsky 2003). In the study, the number of people living in high-poverty neighborhoods—defined as having a poverty rate at 40% or higher—decreased by 24%, or 2.5 million people. This occurred most dramatically in the South and Midwest. Jargowsky also found that concentrated poverty declined among all racial and ethnic groups, especially African Americans where the percentage of poor black individuals living in high-poverty neighborhoods declined from 30% to 19%. Jargowsky's (2003) study suggests that general changes in neighborhood demographics between 1990 and 2000 in the South may have led to decreases in school homogeneity. Similarly, a recent study by Clotfelter, Ladd, and Vigdor (2005) found that while the average level of segregation in large Southern school districts has not changed since 1995, public schools have become more nonwhite due to the general increase in the nonwhite percentage in the student population.

While there is a substantial amount of research examining school choice and segregation, there is little research looking for the policy impact of a controlled school choice plan on subsequent racial and socioeconomic segregation. Fiske's (2002) descriptive analysis of the impact of controlled choice in Cambridge, MA found during a period of racial balancing that only two schools fell outside the district guideline that schools be within ten percent of the district-wide average of 40 percent white students. However, case studies of magnet school choice in two locations found racial implications in school choice decisions. Saporito (2003) found that in Philadelphia, Pennsylvania white families avoided schools with higher percentages of non-white students after controlling for test scores, safety, and poverty rates. Similarly, Henig (1995) found in Montgomery County, Maryland that white families tended to request transfers into schools with lower percentages of minority students, and minority families were more likely to opt for schools in low-income neighborhoods. In a national study, Archbald (2004) used NCES data and demographically controlled comparison groups to examine the relationship between magnet school choice and socioeconomic stratification. The author found no difference in socioeconomic segregation between school districts with magnet-based choice and those without choice. The current study extends this school choice research by using a longitudinal growth model and carefully selected comparison school districts to examine the relationship between implementing the Choice Plan and the racial and socioeconomic segregation within a school district in North Carolina.

School Choice in the Target District

The Winston-Salem/Forsyth County Public Schools (WSF) is the 107th largest school district in the United States, the 5th largest in North Carolina. The student population was approximately 44,600—52% Caucasian and 48% minority students—during the 2000-2001 school year. The 408 square-mile county is in the northern Piedmont area of North Carolina. The total population was 306,067 in 2000, the fourth most populous county in the state. In 2000, a little over half of the population lived in Winston-Salem (185,776), while the remainder lived in outlying municipalities (69,882) or rural areas (50,409) (NC Center for Statistics, 24 April 2006). Census data show that the increase in minority population between 1990 and 2000 was over 44%, with approximately 20,000 minority students in 2000. Much of this increase has been due to growth in Hispanic residents and students.

In 1981 the Winston-Salem/Forsyth County School District was declared unitary, or no longer under a court-ordered desegregation plan (1981). At that time WSF used a 1971 court-ordered pupil assignment plan that included five grade levels and required that students change schools every two years, more or less alternating between urban and suburban schools, some traditionally white, others traditionally black. The district used school pairings, clusters, satellite zones, and bus transportation to achieve racially integrated schools. Criticisms of the frequent school changes in this plan led to a similar plan with three school levels—elementary, middle, and high school—implemented in 1984-85 after the school district had been declared unitary. At that point, five elementary schools in WSF were significantly outside the district goal of each school's minority representation being within ±5% of the minority representation in the district, and they were considered "neighborhood schools" and supported by their respective communities (Punger 1994).

During the early 1990s the Winston-Salem/Forsyth County Board of Education (Board) began developing a new pupil assignment plan in order to address several issues: a projected increase in the number of students and other demographic changes in the communities, increasing racial imbalances in the schools, parental interest in reducing busing and providing elementary schools in black residential neighborhoods, and improving student achievement. Following the example of controlled choice plans in Florida and Massachusetts (Willie, Edwards, and Alves 2002), the Board developed a controlled choice plan where elementary and middle schools within a geographic zone would have a theme or magnet program to attract students—for example, science and mathematics, year-round traditional academics, languages, etc. The aim of the plan's architects was to integrate all students in the district on a voluntary basis by using parental choice and involvement as a means to make systemic changes and improvements in the overall quality of education provided by WSF. The racial composition of each projected zone in 1993 was within 4-5% of the district-wide minority composition (39%) with the exception of two elementary school zones with 25% and 33% minority students, and one middle school zone with just over 50% minority students.

The implementation of the controlled choice plan in WSF began with one elementary school zone during the 1995-1996 school year. One additional elementary school zone was implemented each of the next two years. In the 1998-99 school year, one additional elementary school zone and three middle school zones were implemented. Finally, in 2000, the remainder of the zones were implemented—four additional elementary school zones and three additional middle school zones. Although initially the district officials considered race in making school assignments in order to maintain desegregated schools, the Board was counseled by the U.S. Office of Civil Rights to stop using race in pupil assignment decisions following the 4th Circuit Court of Appeals decisions in *Eisenberg v. Montgomery County Maryland Public Schools* (1999) and *Tuttle v. Arlington County School Board* (1999). As of the 2001-02 school year, racial balance between schools was no longer considered in making student assignments.

The two primary periods of choice for students are when they are entering kindergarten and 6th grade and must choose an elementary or middle school. While students may choose to attend any high school in the district, transportation is not provided for high school students outside their residential area. Elementary school parents rank their three top choices of the five schools in their zone, and students are then assigned to a school based on the preference rules: residential area, siblings, and children of school employees. A failure to make choices results in an assignment based on a random assignment. There also are grandfathering and hardship transfer rules. School capacity limits the number of students that may be assigned to each school (“Assignment of Pupils” 2002). Approximately 30% of the students in each elementary school choose to attend a school outside their residential area. Sixty-five percent of kindergarten parents choose a school during the choice period, 35% register for school late and are assigned to a school based on choice and school capacity. Ten percent of 6th grade returning students fail to return documentation choosing a middle school and are assigned a middle school by the school district. Students who apply to an oversubscribed school are entered into a lottery for the remaining openings after the preference rules have been applied (Holleman 2005).

Ten years after the initial implementation, the impact of the Choice Plan is unclear. Results from a telephone survey conducted in August 2000 indicate both African American and Caucasian parents are almost equally satisfied with the public school system (Martin 2005). Furthermore, one school board member said that she had “never heard a parent say I hate the redistricting." She also said that "it works and parents are happy, whether they're black, white, or purple" (Tackaberry 2002).

While the specific circumstances surrounding the implementation of the WSF controlled choice plan will never be duplicated exactly, this study will be a valuable addition to the school choice policy literature, as it provides important information on the impact of a controlled school choice plan implemented systematically district-wide, on racial and socioeconomic segregation within the district.

Research Design

Data

The data used for this analysis are from the North Carolina Education Research Data Center (NCERDC). The NCERDC is a repository for all public education data in North Carolina. The data used in this analysis were limited to regular public elementary and middle schools. The WSF Choice Plan allowed more choice in elementary and middle schools than in high schools, where the students could attend any high school in the district but transportation was not provided. Furthermore, elementary and middle schools, as they are smaller, tend to be more racially segregated than high schools due to residential segregation.

While there are several possible measures of racial isolation and segregation (Archbald 2000; Clotfelter 1999; James and Taeuber 1985), this analysis uses a racial imbalance measure at the school level similar to the dissimilarity index used at the district level. This measure captures the relative percentage of minorities in each school compared to the district percentage, or how the students are distributed throughout the district. The segregation measure used in this analysis is the absolute value of the difference between the percentage of minority students at the school and the district, indicating the deviation of the schools from the district measure:

$$(1)\ MR_{ij}=|MS_{ij} - MD_i|$$

where MS_{ij} is the percentage of minority students in school j at time i and MD_i is the percentage of minority students in school j's district at time i. The WSF goal in 1981 when it was declared unitary was to have each school within ± 5% of the district measure of minority students. Other cutoffs that have been used are ± 10% (Fiske 2002) and ±20%, the WSF guideline under the Choice Plan.

Available school data provide incomplete information to determine the socioeconomic status of the students; therefore, the percentage of students who used free lunch (28-41%) is used as a proxy to measure socioeconomic status and create a measure of socioeconomic segregation:

$$(2)\ PR_{ij}=|PS_{ij}-PD_i|$$

where PS_{ij} is the percentage of students using free lunch in school j at time i and PD_i is the percentage of students using free lunch in school j's district at time i.

Comparison Groups

The goal of this study is to estimate whether the racial and socioeconomic segregation in the WSF schools was higher than it would have been if they had not implemented the Choice Plan. The research design problem is that we cannot observe the district both implementing the Choice Plan and not implementing the Choice Plan. Ideally, schools would be randomly assigned to different treatment and control groups in order to minimize potential bias from unmeasured as well as measured characteristics. However, in this research it would be impractical to have student assignment policies vary randomly by school. While the ideal research design is experimental, an empirical test of this hypothesis must be conducted with a quasi-experimental research design (Black 1999; Cook and Campbell 1979).

The potential difficulty in a non-random research design is selection bias. With a random design we can be reasonably sure that the difference between treatment and controls is not due to an unknown characteristic, but due to the treatment itself. We can confidently say that with the exception of the intervention, members of the control group are subject to the same forces as members of the treatment group. With a quasi-experimental research design only one outcome can be observed for any particular school, thus raising issues of potential bias. Schools in other districts are not subject to the same forces as schools in WSF. However, by carefully selecting comparison groups, this bias is minimized as much as is feasible.

In evaluations where random assignment is not possible, it is important to establish a counterfactual, or what amount of segregation would have happened in WSF in the absence of the Choice Plan. That counterfactual, or segregation level, would depend on WSF's student assignment policy. The decision made by WSF's school board was not between school choice and an ideal nonsegregated state, but between multiple policy options (Archbald 2000). In this particular instance, there were several possibilities. One option could have been to continue busing students for integration, which may have increased segregation only slightly, but was not politically feasible. A second option would be to adopt a neighborhood school assignment policy where students would be assigned to the school closest to their homes, which would have increased segregation dramatically due to residential segregation. A third option would be to adopt a policy to integrate schools using school choice and magnet schools, which would have resulted in a level of segregation between the first two options. In summary, the counterfactual, or what would have happened in the absence of the Choice Plan, was most likely an increase in segregation.

Each of the student assignment policies mentioned above was used in other urban districts in North Carolina at the time of this study. Using these districts as a comparison group does not resolve the selection bias. There may be unknown characteristics in each district leading to the implementation of these different school assignment policies that may also impact the outcome of interest, or segregation with the districts' schools.

While using comparison groups in lieu of random assignment and control groups is a second-best situation, and relying on only one identification strategy to address selection bias has been shown to provide unreliable estimates (Hollister and Hill 1995), using multiple identification strategies to select the comparison groups will result in the most reliable estimates available. The first identification strategy is to statistically match other North Carolina school districts to the intervention district by similar base populations and demographic changes between 1990 and 2000 using U.S. Census Data. The second identification strategy is to consult with practitioners in the school districts to learn which districts they used in comparisons. The third identification strategy is to use multiple comparison groups as a sensitivity analysis. Finally, multilevel longitudinal methods have been shown to have distinct advantages over standard econometric methods in nonexperimental program evaluations (Gordon and Heinrich 2004) where experimental evaluations are not feasible.

One of the contributions of this research project is the longitudinal analysis of a controlled choice policy using multiple comparison groups, thus minimizing the potential bias in a quasi-experimental research design. As mentioned above, two possible comparison groups are used in the analysis in order to provide a sensitivity analysis. The first is based on the assumption that in the absence of the Choice Plan, WSF would have adopted school assignment policies similar to Guilford County School District, a neighboring urban school district that would have been subject to similar economic and demographic changes during the time period. The Guilford County school district merged with two adjoining city school districts in 1992. The school assignment policies for the cities, but not the county, included busing of students to maintain racial diversity, and this practice continued with slight changes throughout the study period. The advantage of this comparison group is simplicity—one treatment district, one comparison district. The disadvantage is that Guilford County School District was not static. The school assignment policies were officially consistent during the study period; however, they may have been influenced in practice by the 1992 merger of the city and county school districts.

The second comparison group utilizes a combination, or average, of five other urban school districts in North Carolina. This comparison group is based on the assumption that if WSF had not adopted the Choice Plan, it would have adopted school assignment policies or practices that would have had an effect similar to the average impact of these other school districts. These urban school districts (Charlotte-Mecklenburg, Cumberland, Durham, Guilford, and Wake) were chosen based on similar base populations and demographic changes between 1990 and 2000 to WSF, using U.S. Census Data and a logit regression model;[1] as well as on the advice of practitioners in the school districts.

The school assignment policies in these districts changed during the time period of the study (see Appendix A for a timeline). In three of the districts, their school assignment policies were based on neighborhood schools, with some busing to maintain school diversity. Two of these districts, Guilford and Durham, merged their county and city school districts in the early 1990s. Guilford officially maintained the previous student assignment policies until the late 1990s. Durham, however, instituted a student assignment policy based on neighborhood schools, with the option to transfer. Two larger districts, Wake County and Charlotte-Mecklenburg Schools (CMS), had student assignment policies that relied heavily on busing to maintain racial diversity during the early 1990s. In the mid 1990s, an assignment policy based on maintaining socioeconomic balance within the district was implemented in Wake County, and in 2001 a controlled school choice policy similar to WSF's was implemented in CMS. The final school district, Cumberland, is arguably very different from WSF in that it contains a military base and thus a more transient population. However, census data showed similar demographic composition and changes compared to WSF between 1990 and 2000.

One potential limitation with this study is that while the comparison districts were matched at the district level, the analysis is conducted at the school level. The option of using propensity score matching was not feasible in this case, due to the difficulty of matching schools within districts, within zones. However, an examination of the random effects at the school level indicated that the effect of matching comparison groups at one level and conducting the analysis at another level did not significantly impact the analysis.[2]

Hypothesis

Initial data exploration indicates that schools in the subject county have become more racially homogenous between 1990 and 2000. As previously discussed, one factor potentially influencing this is the change in county demographics, as illustrated in Table 1.

The number of Caucasians in Forsyth County increased by 6% between 1990 and 2000, and the number of African Americans increased by 19%. However, there was a large influx of Hispanics during the same time period, an increase of over 900%, from 0.7% in 1990 to 6% in 2000. The percentage of minorities in all the school districts, as shown by Table 2, steadily increased during the study period. It is not clear if increasing segregation within the districts is a result of changing demographics or school choice student assignment policies.

Given the conflicting research and polemic literature regarding school choice and racial and socioeconomic segregation, a non-directional hypothesis—that schools have not become racially and socioeconomically segregated as a result of the change in attendance policies—is suggested.

Models

As the Choice Plan was implemented over time, this study uses hierarchical linear models (HLM) as an analytical technique to test the hypothesis. Multilevel approaches can produce a more precise understanding of the complex, multi-level relationships (Heinrich and Lynn 2000) that exist in education policy situations. They also provide flexibility with time-varying covariates and missing data, and correct for serial autocorrelation by including random effects in the models (Raudenbush and Bryk 2002; Singer and Willett 2003). The intraclass correlation coefficient calculated from the unconditional means model provides the relative magnitude of within-school, or over time, and between-school variation and summarizes the size of the residual autocorrelation. Analysis showed that as much as 59 percent of the total variance in segregation outcomes was between schools rather than over time within schools, thus showing that a multilevel model was a more appropriate method than a conventional regression model. SAS was used to estimate all the models presented in this study.

In this study, the changes over time in segregation at the school level were investigated using an "intercepts- and slopes-as-outcomes" model specification. In the HLM model, the changes in school level segregation over time are modeled as a function of time while controlling for districts. At level one, the segregation of school j at time i is represented as depending linearly on time:

$$(3)\ Y_{ij} = \beta_{0j} + \beta_{1j} time_{ij} + \varepsilon_{ij}$$

where Y_{ij} is a measure of racial or socioeconomic segregation in each school; the subscript (i) indicates time (1992-2003; or 0-10); the subscript (j) denotes the schools and allows each school to have a unique intercept and slope for each of the level one predictors, and the residual ε_{ij} is assumed to be normally distributed with a zero mean and a constant variance. The errors within schools are expected to be heteroscedastic and correlated over time, and identically distributed across schools (Singer and Willett 2003).[3]

At level two, the intercept and slopes of level-1 coefficients are expressed as a linear function of each school within a specific district:

$$(4)\ \beta_{0j} = \gamma_{00} + \gamma_{01} Cumb + \gamma_{02} Dur + \gamma_{03} Guil + \gamma_{04} CMS + \gamma_{05} Wake + \gamma_{06} ST_j + \mu_{0j}$$

$$(5)\ \beta_{1j} = \gamma_{10} + \gamma_{11} Cumb + \gamma_{12} Dur + \gamma_{13} Guil + \gamma_{14} CMS + \gamma_{15} Wake + \gamma_{16} ST_j + \mu_{1j}$$

where each district is an indicator variable for school j with WSF as the reference category; ST is the average student-teacher ratio for each school j; and μ_{0j} and μ_{1j} are random effects associated with each school within a district that are assumed to be normally distributed with a zero mean and a constant variance. Model testing indicated that the average student-teacher ratio at the school level, a proxy for school-level finances, did not contribute significantly to the model so it was not included in the final model.

The second model is similar to the first, but instead of controlling for districts, schools implementing the policy within WSF are compared to schools both in WSF and in the other districts not implementing the policy. The level one equation for the second model is:

(6) $Y_{ij} = \beta_{0j} + \beta_{1j} time_{ij} + \beta_{2j} policy_{ij} + \varepsilon_{ij}$

where Y_{ij} is a measure of racial or socioeconomic segregation in each school; the subscript (i) indicates time (1992-2003; or 0-10); the subscript (j) denotes the schools and allows each school to have a unique intercept and slope; policy is a dichotomous variable equal to 1 if the Choice Plan was used in school j at time i, otherwise 0, as the zones were phased in between 1995 and 2000; and the residual ε_{ij} is assumed to be normally distributed with a zero mean and a constant variance across schools. The effect of the policy is expected to be time-varying as increasing numbers of parents become accustomed to the policy and change schools. The second level equations include only intercepts and random effects associated with each school:

(7) $\beta_{0j}=\gamma_{00}+\mu_{0j}$; $\beta_{1j}=\gamma_{10}+\mu_{1j}$; $\beta_{2j}=\gamma_{20}+\mu_{2j}$

Again, the random effects are assumed to be normally distributed with a zero mean and a constant variance.[4]

The dependent variables MR and PR are the natural logarithms of percentages. The key difference between a dependent variable that is a percentage and one that is the natural log of that percentage is in the predicted values. Predicted values of a log transformation approach 0, but never exceed it. Therefore, they can never be out of boundaries, unlike one that is a percentage (White, Biddlecom, and Guo 1993). However, predicted values must be interpreted as in a logistic regression.

As discussed above, similar studies looking at the impact of school choice on segregation primarily use descriptive methods (e.g., Archbald 2004; Fiske 2002; Henig 1995). This study extends those because it measures the segregation within the district before, during, and after the implementation, includes multiple comparison groups, and methods that separate the initial implementation effect from the slope, or change over time.

Results

Descriptive Results

Measures of racial and socioeconomic segregation at the district level indicate that with the exception of Durham, racial and socioeconomic segregation increased in all of the districts during the study period. Figure 1 shows that the dissimilarity index—the percentage of minority students that would need to be transferred in order for the racial balance at each school to match that of the district—increased in all of the districts except Durham, but most dramatically in WSF. Of all the districts, Wake County was the most consistently integrated. Wake County began busing students for socioeconomic, rather than racial, integration in the mid-1990s, and shows the smallest increase in racial segregation during the study period. However, another way of measuring segregation may show one reason Wake County is consistently lower. As shown in Figure 2, the exposure index—the percentage of white students in the average minority student's school—decreased in all the districts during the study period. This measure reflects both the overall composition and the distribution of students by race within the districts. Wake County, with the lowest percentage of minority students, had the highest exposure index, illustrating that exposure to white students is easier to maintain in districts with fewer minority students.

As discussed above, the percentage of students receiving free lunch is frequently used as a proxy to measure poverty. The percentage of students using free lunch in the districts ranged from 16% to 35% (Table 2). Using the percentage of students receiving free lunch is a stricter definition of poverty than the percentage of students receiving free and reduced lunch. Figure 3 shows that over the study period the dissimilarity index—the percentage of students using free lunch that would need to be transferred in order for the percentage of students using free lunch at each school to match that of the district—increased in WSF compared to the other districts, which remained relatively static with the exception of Durham and Mecklenburg. Finally, Figure 4 shows that the exposure index—the percentage of students not using free lunch in the school attended by the average student using free lunch—decreased in WSF during the study period compared to the other districts.

Multi-level Analysis

Racial Segregation

Table 3 shows the gamma coefficients from the HLM analysis of the minority result (MR) for selected models of both comparison groups. The Unconditional Means Model (not reported) fitted to the outcome variables produced estimates for the variation within-school and between-schools and for the variance components of the parameters that differ among schools. The one fixed effect, for both comparison groups, estimated the grand mean of MR across all years. Interpreting the gamma coefficients directly is very difficult since the outcome variable is the natural log of a percent. The predicted values of the models will be discussed below. However, the intercepts for all models were significant at the $p<0.001$

level. These intercepts indicated that on average the percentage of minority students in individual schools was not the same as the district percentage of minority students.

The Unconditional Means Model allows us to evaluate numerically the relative magnitude of the within-school and between-school variance components (Singer and Willett 2003). The intraclass correlation coefficient (ICC) describes the proportion of the total outcome variation that lies between schools. The ICC for the first comparison group is 59% and the second is 58%, indicating that most of the total variation in school minority representation is attributable to differences between the schools rather than within the schools over time. Another role of the ICC is to summarize the size of the residual autocorrelation in the composite Unconditional Means Model. Thus for each school, the average correlation between any pair of composite residuals is the ICC (0.59 or 0.58).

The Unconditional Growth Model (not reported) included time as the only predictor of between-school differences for MR. The fixed effects, γ_{00} and γ_{01}, estimated the starting point and slope of the population average change trajectory; however, the gamma coefficients are not easily interpreted. The level 1 residual variance, σ_{ε}^{2}, was 0.199 (0.315), summarizing the scatter of each school's data around its own linear change trajectory. As the level 1 residual variance for the Unconditional Growth Model was 0.16-0.20 less than for the Unconditional Means Model, 16-20% of the within-school variation in school minority representation was systematically associated with linear time. Also, because the null hypothesis for the variance component can be rejected, we know that some important within-school variation still remains, suggesting that the model fit could be improved by introducing substantive predictors into the level-1 submodel. The population covariance between true initial status and true change is quantified by σ_{01}, -0.092 (-0.079). Reexpressing the covariance as a correlation coefficient (-0.73 and -0.65) suggests that the relationship between the true rate of change in MR and its initial status was negative and not small. In other words, schools that were more segregated—further from the district measures—at the beginning of the study increased in segregation less rapidly over time, than schools that were initially closer to the district average.

In Model C, indicator variables are included for the districts, with WSF as the reference district. While Wake and CMS, in the multiple district comparison, did not have significantly different intercepts from WSF, the other districts' intercepts were significantly different. This is consistent with the initial policies in those three districts of busing for racial integration. The rate of change, or the slope, for all districts was significantly different from the rate of change for WSF. The predicted values for each district (Table 4) suggested that with the exception of Durham, segregation in each district was slowly increasing during the study period. A graph of these predicted values (not shown) closely replicates the changes in the minority dissimilarity index shown in Figure 1. In WSF, the model suggested that the average school was within ± 6% of the district-wide measure of minority students in 1992. By 2002, the model predicted the average WSF school to be within ± 24% of the district-wide measure.

In Model D, the time-varying predictor of policy was included with time in both the single district and multiple district comparisons. This policy main effects model assumed that school j's value of MR at time i depended on: the number of years since the policy was enacted; the school's contemporaneous value of policy; and three school-specific residuals. The intercept (γ_{00}) refers to a school at the beginning of the time period where the policy was not implemented. Adding the policy variable to the unconditional growth model reduced the magnitude of the within-school variance component by 1-3%. In other words, the time-varying policy explained just over 1-3% of the variation in MR. Predicted values based on this model (Table 7) suggest that implementing the school choice policy led to an immediate increase in school racial segregation, as measured by the deviation from the district average, by ± 6-8%. For example, if the district average was 50% minority students and the average school deviated from that district measure by ± 10%, implementing the school choice policy would increase the range to approximately 33% to 67%. Over a ten year period, the deviation from the district average will increase to ± 25%, resulting in schools with 25% minority students and schools with 75% minority students for the example above. Ultimately, a district that began a school choice policy with the average school within ± 10% of the district-wide percentage of minority students could potentially have the average school within ± 25% of the district-wide percent of minority students within 10 years.

Socioeconomic Segregation

While poverty and race are highly correlated, the same models discussed above with the poverty measure as the dependent variable suggest the school choice policy did not have the same impact on socioeconomic segregation. Table 5 shows the gamma coefficients from the HLM analysis of the poverty result (PR) for both comparison groups. The baseline model (unreported) indicated the results of fitting the Unconditional Means Model to the outcome variables. The intercepts for both comparison groups were similar in size, although difficult to interpret, and significant at the $p<0.001$ level. These intercepts indicated that on average the percentage of students using free lunch at the school level was not the same as the district percentage. The intraclass correlation coefficient for both comparison groups was

52%, indicating that just over half of the total variation in school poverty representation was attributable to differences between the schools rather than within the schools.

In the Unconditional Growth Model, time was included as a predictor of between-school differences for PR. This model presents the results of fitting the unconditional growth model to the outcomes, where time was the only predictor. The fixed effects, γ_{00} and γ_{01}, estimated the starting point and slope of the population average change trajectory.

In Model C, indicator variables were included for all districts, with WSF as the reference category. Durham and Guilford were the only districts in the multiple district comparison that were significantly different at the $p<0.001$ level from WSF. However, the rate of change, or the slope, for all districts was significantly different from WSF, although only significant at the 0.10 level for Wake. The predicted values for each district (Table 6) suggest that with the exception of Durham and Cumberland, socioeconomic segregation in each district was gradually increasing during the study period. In WSF, the model suggests that the average school was within ± 6% of the district-wide measure of socioeconomic segregation in 1992. By 2002, the model predicted the average WSF school to be within ± 22% of the district-wide measure. Again, as with the MR model, at the beginning of the study period, the distribution of WSF schools was closest to their district-wide percent of students using free lunch and at the end of the study period the distribution was the furthest of all the districts from their district-wide measure.

In Model D, the time varying predictor of policy was included with time, thus controlling for schools using the controlled choice policy but not controlling for district. This policy main effects model assumed that school j's value of PR at time i depended on: the number of years since the policy was enacted; the school's contemporaneous value of policy; and three school-specific residuals. The intercept (γ_{00}) refers to a school at the beginning of the time period where the policy is not implemented. Adding the policy variable to the unconditional growth model reduced the magnitude of the within-school variance component by 3-16%. In other words, the time-varying policy explained just over 3% of the variation in PR compared to the average district, and 16% compared to just the Guilford district. Predicted values based on this model (Table 7) suggest that implementing the school choice policy led to an initial increase in socioeconomic segregation, as measured by the deviation from the district average, of ± 4-6%. In other words, if the district average was 50% of students using free lunch, and prior to implementing the choice plan, ± 8%, or between 42% and 58% of the students in the average school used free lunch, then implementing the school choice plan would increase the deviation from the district measure to approximately 37% to 63%. Over ten years the deviation of schools from the district average would increase an additional ± 5%, leaving the schools in the above example with between 32% and 68% of the students using free lunch. Thus the schools are becoming more segregated by socioeconomic status within the district as students using free lunch congregate in some schools, while other schools have fewer of these low-income students.

Summary and Conclusions

School choice is a potentially divisive educational policy issue and this study provides an important contribution to that literature. Policymakers and administrators are split over the benefits and costs of school choice. This study of controlled choice supports previous research showing that school segregation is increasing in public schools (Orfield and Yun 1999). However, in addition to the overall increases in segregation occurring in all the districts, the controlled choice school assignment policy in WSF contributed significantly to further resegregating the public schools. Results from the HLM models suggest that implementing a controlled school choice policy in a racially balanced school district (all of the schools within ± 5% of the district-wide measure) will likely result in the average elementary/middle school within a district initially deviating from the district average by an additional ± 6-8%. Changes over time will increase this range of divergence from the district average to ± 25%. This increase due to controlled choice will most likely be smaller in districts with greater initial segregation such as Guilford or Cumberland.

This study also shows that a controlled choice student assignment policy may have a smaller impact on the distribution of students using free lunch than on the distribution of minority students (initial deviation of ± 4-6% rather than ± 6-8% from the district-wide measure). These results are consistent with the hypothesis that race may be used as a proxy for school quality when other measures of quality are unavailable (Fiske and Ladd 2000), so it is possible that parents could be intentionally avoiding schools that are perceived as "minority." Racial and socioeconomic segregation, while correlated, may be influenced differently by school choice policies as the minority status of students attending a school is potentially more visible than their socioeconomic status.

All of the school districts included in this study have become more racially segregated since the late 1990s, making it clear that the policy choice is not between racially segregated and racially integrated schools, but between policies resulting in greater or lesser degrees of segregation. Given this trend, other policy goals and values should be considered as part of this policy decision. Controlled choice has been promoted as the student assignment policy best able to balance competing policy goals and values such as parental choice, potential community involvement in terms of setting district-wide balancing policy, and equity issues (Kahlenberg 2001). However, as this study shows, a controlled choice school assignment policy without an integration policy will result in segregrated schools.

One alternative, a fundamental part of the original controlled choice plan, would be to balance student assignment either racially or by socioeconomic status. Currently the ability to assign students based on race is not an option in this district due to the 4^{th} Circuit Court of Appeals decisions. Alternatively, WSF could balance student assignment by socioeconomic status. While this is a viable alternative that Wake County and others are using, there are two major concerns. First, Wake County's policy is to have no more than 40% of students in any school eligible for free or reduced price lunch. Given that fewer than 20% of the students in Wake County are eligible, the goal is feasible. As over 40% of the students in WSF are eligible for free or reduced price lunch, the proportionate goal in WSF would be to have no more than 62% of the students in any school eligible for free or reduced price lunch—well over the suggested tipping point (Kahlenberg 2001). The second major concern is that given the slightly greater impact of the school choice assignment policy on racial segregation, balancing by socioeconomic status is not going to achieve the same integration results as balancing by race. However, at this time it is the most feasible policy alternative.

There are several limitations to this study. Although five districts were used as comparison groups, it is primarily a case study of one district, and only grades K-8 were included. Another limitation is that this study evaluated policy changes that occurred in school districts between five and ten years ago. Changes in policy documents, when available, do not necessarily indicate what actually occurred or was enforced. Finally, the data cannot show whether the resulting racial and socioeconomic segregation was a consequence of consumer choices to attend segregated schools or a consequence of competition failure due to incomplete information on the part of the decisionmakers.

When WSF first implemented the Choice Plan there was concern that it would resegregate the public schools after years of operating under a court-ordered desegregation plan. The results from this study provide legitimacy for that concern. The schools in WSF have become resegregated, in part due to demographic changes such as increasing percentages of minority students and in part due to the school choice plan. Despite extensive research, the effect of attending segregated schools is complex and unclear (Schofield 1995); however, segregation is widely viewed as a barrier to equal education opportunities (Orfield and Lee 2005). The advantage of the controlled choice student assignment plan is that policymakers trying to expand opportunities for choice and community involvement can include a mechanism for balancing students within their district by race or socioeconomic status in order to limit unintended consequences that may result from segregated schools.

Endnotes

[1] In order to match comparison districts with the subject district, I used Census Data from 1990 and 2000 to calculate a propensity score. The propensity score is the predictive probability (between 0 and 1) that a school district would participate in the controlled choice program. The logit model used is $Y=\alpha+\beta x+r$, where Y is a binary variable indicating whether the district used the controlled choice student assignment program and x is a vector of covariates including the 1990 population and the percent change between 1990 and 2000 in: children under 18; racial groups such as black, Hispanic, and white; and median income. Given the predicted probability of participating in the program based on demographics from the model, I calculated the logit of the propensity score using the formula: logit=log[predicted value/(1-predicted value)]. After sorting on the logit, the "nearest neighbor" districts were designated part of the comparison group. As there was only one subject district, it was not necessary to use additional caliper matching. With few exceptions, the districts selected through the logit regression were the same as those used regularly as comparison districts by district officials. The exceptions were districts with military bases, arguably subject to different demographic trends and changes than the district of interest.

[2] No strong indications of substantial departures from normality are indicated by plots of the random effects. Some nonnormal distributions indicate that there may be a slight violation of the normality assumption. However, the estimation of fixed effects will not be biased by a failure of the normality assumption at level 2 (Raudenbush and Bryk 1998). A formal test for normality of the random effects, based on the correlation between the ordered residuals and their expected values under normality (Shapiro-Wilk test) indicates that they are all over 0.94, over a general rule of thumb for normality at 0.90. The Kolmogorov-Smirnov test resulted in measures under 0.10 for the random effects.

[3] However, as the level two residual slope variability and residual initial status/slope covariance are near zero, the composite residual variance will be homoscedastic, thereby satisfying the homogeneity assumption that the entire block diagonal error structure is repeated identically across schools (Singer and Willett 2003).

[4] District indicator variables were not included because of the correlation with the policy variable of interest.

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Figure 1: Minority Dissimilarity Index

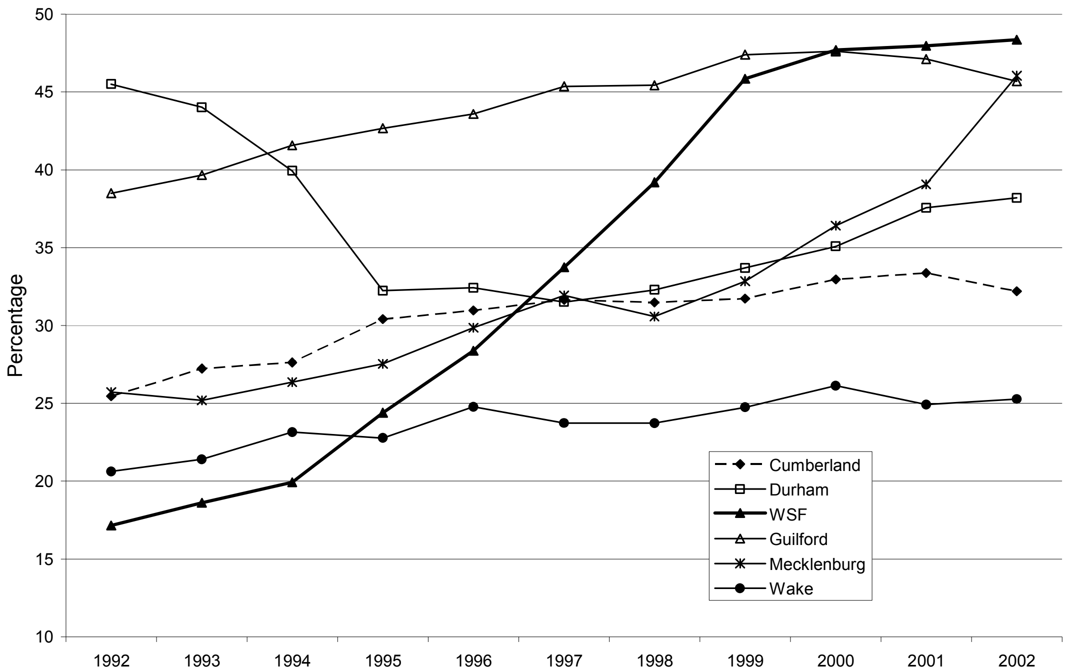

Figure 2: Minority Exposure Index

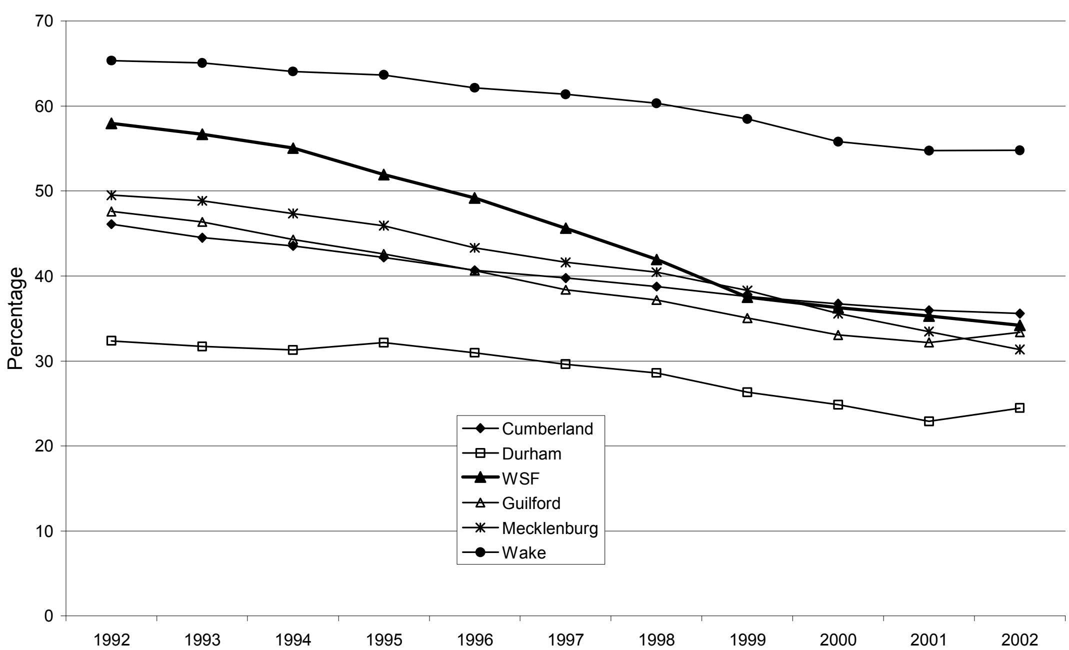

Figure 3: Poverty Dissimilarity Index

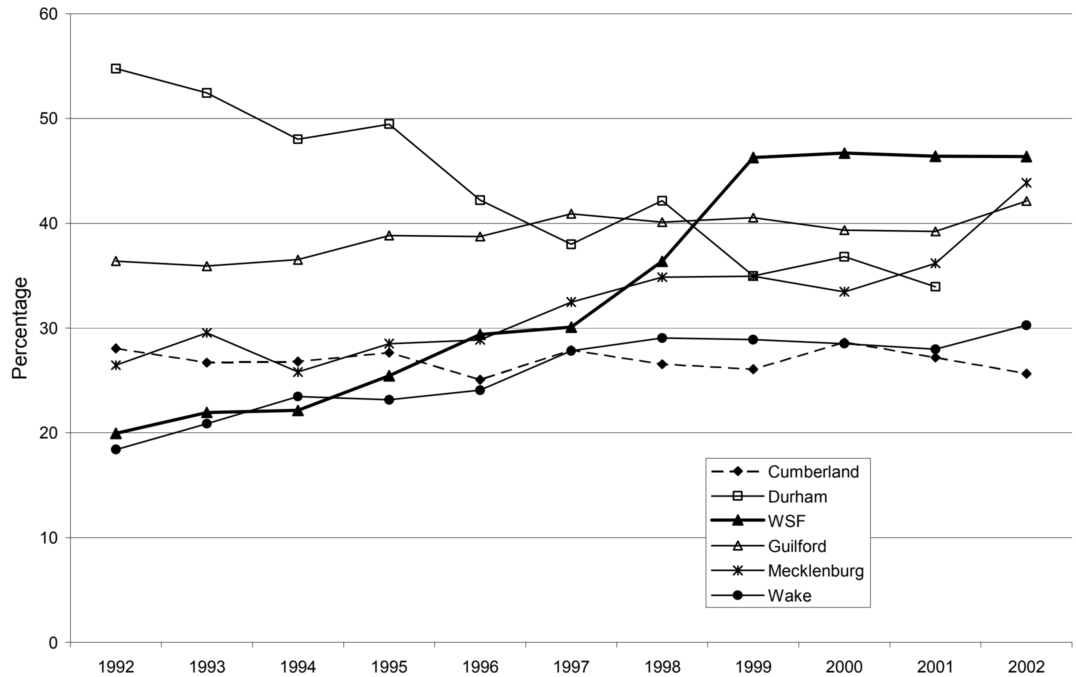

Figure 4: Poverty Exposure Index

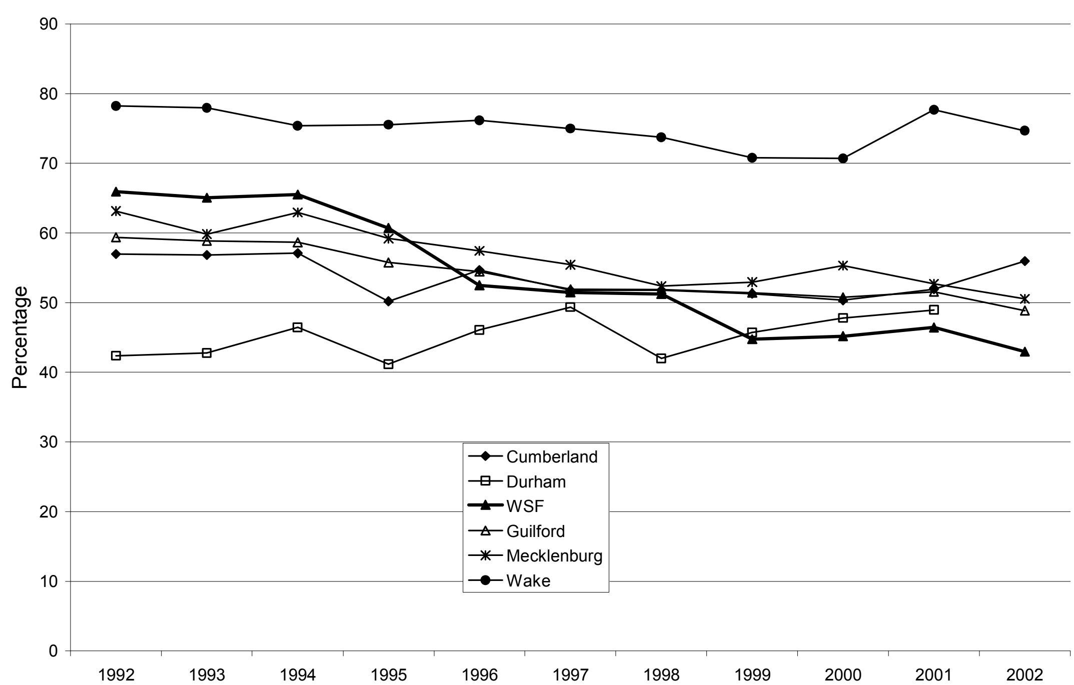

Table 1: Demographic changes in North Carolina counties between 1990 and 2000 (U.S. Census Data)									
	Population		Percent Change between 1990 and 2000						Increase in Number of Children under 18
County	1990	2000	Pop. (%)	Median HsHold Income (%)	% White	% Black	% Hisp.	Children under 18 (%)	
Forsy./WSF	265,878	306,067	15.12	38.25	6.29	18.73	903.93	19.09	12,338
Cumber.	274,566	302,963	10.34	47.14	-2.25	20.90	66.40	20.02	14,811
Durham	181,835	223,314	22.81	41.97	3.96	29.33	706.17	22.03	9,807
Guilford	347,420	421,048	21.19	41.36	8.78	33.95	540.91	26.84	22,551
Mecklen.	511,433	695,454	35.98	49.51	22.19	43.12	642.92	38.93	51,090
Wake	423,380	627,846	48.29	51.81	39.87	40.08	597.49	59.86	62,011

Table 2: Percentage of Minority and Poverty Students by District in Regular Elementary and Middle Schools											
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Forsyth/WSF											
Minority	39	40	41	42	44	45	46	47	48	50	51
Poverty	28	28	29	32	39	40	38	39	37	36	41
Cumber.											
Minority	48	50	51	52	53	54	55	56	57	58	59
Poverty	36	37	37	43	39	41	41	42	42	41	37
Durham											
Minority	55	57	59	62	63	66	67	69	71	72	71
Poverty	33	35	34	40	40	38	45	44	41	41	0*
Guilford											
Minority	40	41	42	44	45	47	49	51	53	54	53
Poverty	28	29	30	31	33	34	35	35	37	36	37
Mecklen.											
Minority	45	45	46	47	49	50	52	53	55	57	57
Poverty	30	32	31	33	34	35	37	36	34	35	33
Wake											
Minority	31	31	31	32	33	34	35	37	38	40	40
Poverty	19	18	19	19	19	19	20	21	22	17	19
*Durham County reported 0 students using free lunch for the 2002-2003 school year. The outcome variable in 2002 for schools in Durham was coded as missing in the analysis.											

Table 3. Coefficients from HLM Analyses of Difference Between the Percentage of Minority Students at Elementary/Middle Schools and the Percentage of Minority Students in the District, 1993 through 2002					
		Single District Comparison (N=160 schools)		Multiple District Comparison (N=560 schools)	
		Model C (Eq. 3)	Model D (Eq. 7)	Model C (Eq. 3)	Model D (Eq. 7)
Fixed effects, initial status, π_{0i}	Intercept, γ_{00}	-2.766*** (0.141)	-2.234*** (0.094)	-2.787*** (0.148)	-2.409*** (.052)
	Cumberland			0.474* (0.197)	
	Durham			1.061*** (0.225)	
	Guilford	0.875*** (0.180)		0.893*** (0.189)	
	Mecklenburg			0.146 (0.177)	
	Wake			0.085 (0.184)	
Rate of change, π_{1i}	Time, γ_{01}	0.134* (0.016)	0.046** (0.010)	0.137*** (0.017)	0.040*** (0.006)
	Cumb.*Time			-0.102*** (0.022)	
	Durham*Time			-0.176*** (0.026)	
	Guil.*Time	-0.113*** (0.021)		-0.115*** (0.021)	
	Meck.*Time			-0.064** (0.020)	
	Wake*Time			-0.102*** (0.021)	
Policy, π_{2i}	Policy, γ_{02}		0.407*** (0.112)		0.603*** (0.097)
Variance and Covariance Components					
Level 1	Within school	.199*** (.008)	.165*** (.007)	.315*** (.007)	.307*** (.007)
Level 2	Initial status	.931*** (.127)	1.071*** (.142)	.985*** (.075)	1.108*** (.082)
	Rate of change	.011*** (.002)	.012*** (.002)	.011*** (.001)	.012*** (.001)
	Policy variance		.929*** (.190)		.910*** (.205)
	Covariance intercept, time	-.067*** (.012)	-.071*** (.014)	-.066*** (.007)	-.072*** (.008)
	Cov: intercept, policy		-.250* (.126)		-.263** (.118)
	Cov: time, policy		-.043** (.014)		-.042*** (.014)
Deviance		2447.1	2305.1	10132.8	10124.9
*p<=.1 **p<=.01 ***p<=.001; Numbers in parentheses are standard errors.					

Table 4. HLM Predicted Values of the Difference Between the Percentage of Minority Students at Elementary/Middle Schools and the Percentage of Minority Students in the District (Fall 1992 through Fall 2002)											
	1992	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*
Forsyth/WSF (ref.)	0.062	0.071	0.081	0.093	0.107	0.122	0.140	0.161	0.184	0.211	0.242
Cumberland (*/***)	0.099	0.102	0.106	0.110	0.114	0.118	0.122	0.126	0.131	0.136	0.140
Durham (***/***)	0.178	0.171	0.165	0.158	0.152	0.146	0.141	0.135	0.130	0.125	0.121
Guilford (***/***)	0.150	0.154	0.157	0.161	0.164	0.168	0.172	0.176	0.179	0.183	0.187
Mecklen. (/**)	0.071	0.077	0.082	0.089	0.095	0.103	0.110	0.119	0.128	0.138	0.148
Wake (/**)	0.067	0.069	0.072	0.074	0.077	0.080	0.083	0.086	0.089	0.092	0.095
Significance compared to reference district for (intercept/slope); *p<=.1 **p<=.01 ***p<=.001.											

Table 5. Coefficients from HLM Analyses of Difference Between the Percentage of Students using Free Lunch at Individual Elementary/Middle Schools and in the District, 1992 through 2002					
		Single District Comparison (N=160)		Multiple District Comparison (N=560)	
		Model C (Eq. 3)	Model D (Eq. 7)	Model C (Eq. 3)	Model D (Eq. 7)
Fixed effects, initial status, π_{0i}	Intercept, γ_{00}	-2.811*** (0.170)	-2.501*** (0.106)	-2.845*** (0.156)	-2.576*** (.056)
	Cumberland			0.504* (0.207)	
	Durham			1.332*** (0.236)	
	Guilford	0.490* (0.216)		0.520** (0.198)	
	Mecklenburg			0.245 (0.187)	
	Wake			-0.394* (0.194)	
Rate of change, π_{1i}	Time, γ_{01}	0.130*** (0.020)	0.060*** (0.012)	0.134*** (0.019)	0.039*** (0.007)
	Cumb.*Time			-0.139*** (0.025)	
	Durham*Time			-0.179*** (0.030)	
	Guilford*Time	-0.085*** (0.025)		-0.089*** (0.024)	
	Meck.*Time			-0.070*** (0.023)	
	Wake*Time			-0.080* (0.023)	
Policy, π_{2i}	Policy, γ_{02}		0.344** (0.109)		0.564*** (0.096)
Variance and Covariance Components					
Level 1	Within schools	.430*** (.018)	.413*** (.018)	.578*** (.013)	.574*** (.013)
Level 2	Initial status	1.261*** (.177)	1.288*** (.179)	.973*** (.081)	1.176*** (.095)
	Rate of change	.014*** (.002)	.013*** (.002)	.012*** (.001)	.012*** (.001)
	Policy variance		.575** (.206)		.575** (.241)
	Covariance Intercept,time	-.101*** (.018)	-.090*** (.018)	-.071*** (.009)	-.079*** (.010)
	Cov: intercept, policy		-.358** (.136)		-.351** (.116)
	Cov: time, policy		.009 (.016)		-.016 (.017)
Deviance		3348.4	3319.2	12304.4	12398.0
*p<=.1 **p<=.01 ***p<=.001; Numbers in parentheses are standard errors					

Table 6. HLM Predicted Values of the Difference Between the Percentage of Students using Free Lunch at Elementary/Middle Schools and the Percentage of Students using Free Lunch in the District (Fall 1992 through Fall 2002)											
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Forsyth/WSF (ref.)	0.058	0.066	0.076	0.087	0.099	0.114	0.130	0.149	0.170	0.194	0.222
Cumberland (*/***)	0.096	0.096	0.095	0.095	0.094	0.094	0.093	0.093	0.092	0.092	0.092
Durham (***/***)	0.220	0.211	0.201	0.192	0.184	0.176	0.168	0.161	0.154	0.147	0.140
Guilford (**/***)	0.098	0.102	0.107	0.112	0.117	0.122	0.128	0.134	0.140	0.147	0.153
Mecklenburg (/***)	0.074	0.079	0.084	0.090	0.096	0.102	0.109	0.116	0.124	0.132	0.141
Wake (*/*)	0.039	0.041	0.044	0.046	0.049	0.051	0.054	0.057	0.060	0.064	0.067
Significance compared to reference district for (intercept/slope); *p<=.1 **p<=.01 ***p<=.001.											

Table 7: HLM Predicted Values of the Impact of Introducing Controlled Choice on the Distribution of Minority Students and Students in Poverty in the Average School within a District												
		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Minority												
Single County	Non-policy	0.107	0.112	0.117	0.123	0.129	0.135	0.141	0.148	0.155	0.162	0.170
	Policy				0.185	0.193	0.203	0.212	0.222	0.232	0.243	0.255
All Counties	Non-policy	0.090	0.094	0.097	0.101	0.106	0.110	0.114	0.119	0.124	0.129	0.134
	Policy				0.185	0.193	0.201	0.209	0.217	0.226	0.236	0.245
Poverty												
Single County	Non-policy	0.082	0.087	0.092	0.098	0.104	0.111	0.118	0.125	0.133	0.141	0.149
	Policy				0.138	0.147	0.156	0.166	0.176	0.187	0.198	0.211
All Counties	Non-policy	0.076	0.079	0.082	0.086	0.089	0.092	0.096	0.100	0.104	0.108	0.112
	Policy				0.150	0.156	0.163	0.169	0.176	0.183	0.190	0.198

Appendix A: Timeline of Policy Changes in School Districts

	Cumberland	Durham	Guilford	WSF	Mecklenburg	Wake
1992	Neighbor/ busing	Neighbor/ busing	Neighbor/ busing	Race busing	Race busing	Race busing
1993			Merged city bus			
1994		Merged neighbor				
1995				Controlled choice		SES busing
1996						
1997						
1998						
1999						
2000						
2001					Controlled choice	

School Choice, Racial Segregation, and Student Academic Outcomes

Abstract

One of the major questions in the school choice literature today is the impact of segregated schools on the academic achievement of students attending them. This paper analyzes data for a sample of 3,819 students attending public, noncharter schools in a school district implementing a controlled choice student assignment plan between 1995 and 2003. During this time the schools in the district became more segregated—from +/- 10% to +/- 45% of the district's percentage of minority students. The study uses North Carolina end-of grade test data to estimate multilevel models of achievement growth in Grades 3 through 8 in mathematics and reading, which are then used to test the hypothesis that the percentage of minority students at the school level impacts the academic test scores of students attending the school. The findings confirm previous research regarding the racial achievement gap and indicate that the district is making some progress in closing that gap. Findings also indicate that as the percentage of minority students in a school changes there is no discernable effect on student achievement growth over time that can be attributed to the racial makeup of the school. This effect does not vary by race.

School Choice, Racial Segregation, and Student Academic Outcomes

Introduction

In 1966 the United States Department of Education (USDE) published the Coleman report reviewing the equality of education in the U.S. (Coleman, Campbell, Hobson, McPartland, Mood, Weinfeld, and York 1966). The authors found that schools had little influence on academic achievement independent of a student's background and general social context. The report also confirmed the finding in *Brown v. Board of Education* (1954) that widespread school segregation in the U.S. created inequality of educational opportunity. Since then, the methods and conclusions of the Coleman Report have been questioned and although researchers agree that there is a relationship between family background, peer effects, and student outcomes, they do not agree on the extent to which school policies could equalize opportunities between students of different socioeconomic and racial groups (Jencks and Mayer 1990). Currently, integrated schools and equal opportunity seem to be less of a national priority than providing an adequate education for all students (National Research Council 1999).

This study contributes to the desegregation debate by examining, in a rapidly resegregating district, whether attending segregated schools affects the annual growth in students' academic performance. Do minority students need to be exposed to a high proportion of white students in order to do well in school, or can schools with high percentages of minority students provide quality education? The answer to this question has significant implications with respect to public school integration policies.

This study uses a multi-level growth model to follow the trajectories of seven student cohorts from 3rd through 6th, 7th, or 8th grade to examine the impact of attending segregated schools on changes in student test scores. The district implemented a controlled choice student assignment plan in stages between 1995 and 2000. District administrators split the district into eight zones, required parents to rank their preferred schools within their zone, and then assigned students to schools based on parental preference and school assignment policies. A study examining segregation within the district between 1993 and 2003 found that the schools became resegregated during that period (Jones-Sanpei 2006b).

Segregation Theory in Public Schools

Over 50 years ago, the U.S. Supreme Court held in *Brown v. Board of Education* (1954) that legally enforced separate schools deprived minority children of equal educational opportunities. This decision was in part based on psychological and other social science research regarding intangible considerations—for example, separation denotes inferiority which then affects a student's motivation to learn. Since that time, social science research regarding segregation has progressed significantly. Much of this research has been in the area of peer effects using test score outcomes.

Research on peer effects–the impact of an individual's social environment—shows that membership in a group influences individuals who belong to that group (Merton 1968). The peer culture, by providing a sense of community and belonging, influences its members' responses to the social and academic learning environment (Knapp and Wooverton 1995). According to Blau (1964), peer interactions influence students as they adopt group definitions of costly behavior, or group norms. Homans (1974) suggested that individual students may unconsciously create a personal cost-benefit matrix of social choices conforming to group expectations or norms (Homans 1974). Conforming decisions then reinforce their self-identity as a member of a peer group (Akerlof and Kranton 2000).

Peer effects may operate in schools either directly through students or indirectly through resource allocation. Peer effects operating directly through students may create a "culture of success" through high achievement and motivation (Jencks and Mayer 1990). This peer culture may be created through student learning interactions, motivational and aspirational influences, and the influence of peers on social behavior (Kahlenberg 2001). Peer effects may also be correlated with the available resources and organization of a school, thus indirectly influencing student academic outcomes. Middle-class schools have better trained teachers, more challenging curriculum, and more involved parents, thus contributing to a potential decrease in the quality of low-income, minority schools (Cook and Evans 2000).

While peer effects operate at multiple levels and cannot be fully isolated, students' peers have been shown to influence educational outcomes. In general, researchers find some evidence of peer effects at the family and neighborhood level (Case and Katz 1991), high school level (Evans, Oates, and Schwab 1992; Zimmer and Toma 2000), and college level (Sacerdote 2000). Furthermore, some studies show that a student may be more influenced by peers of the same race (Hanushek, Kain, and Rivkin 2002; Hoxby 2000), while others found few or mixed effects from school segregation (Cook and Evans 2000; Schofield 1995). One recent study of school segregation estimated multilevel models for 14,217 students attending 913 high schools and found that socioeconomic segregation, not racial segregation, impacted the academic growth of all students, primarily through specific school practices and policies (Rumberger and Palardy 2005). Other studies use OLS and econometric models to study racial and peer effects. For example, Hanushek, Kain, Markman, and Rivkin (2000) removed student and school-by-grade fixed effects as well as observable family and school characteristics in a matched panel dataset to find that peer achievement had a positive effect on student achievement growth. A second study uses SAT scores and controls for family background and other factors to demonstrate that shifting from a fully segregated to a fully integrated city decreases the racial achievement gap by one-quarter (Card and Rothstein 2006), although there was no significant school segregation effect. The advantage of the current study over these investigations is that it uses a multilevel model which produces a more precise understanding of complex, hierarchical relationships (Heinrich and Lynn 2000) by partitioning the variance in the outcome measure between levels, avoiding aggregation or disaggregation bias, and providing separate errors.

The primary difficulty with estimating peer effects in education is that the majority of variation in students' peers is generated by selection. Families select schools and other peer groups for a variety of reasons, including residential neighborhood (with socioeconomic implications), perceived quality, pedagogical, and possibly racial reasons (Hamilton and Guin 2005; Henig 1995; Saporito 2003), which creates an endogeneity problem in a study controlling for peer effects. For at least some of the students and their families, the peer group is considered in the school choice decision. In the present value-added study, these student characteristics, such as family and neighborhood effects, are assumed to be constant as school social compositions change. As, the purpose of the study is to determine the effect on students' academic achievement while attending schools with different racial compositions, the specific student characteristics are less important than holding those characteristics constant across all school settings.

Over the past fifteen years a substantial literature on individual growth and school effect models in education has developed as multilevel models have been found to resolve some of the problems with single-level models.[1] Attempts to analyze multilevel data with single-level methods, such as OLS regression, results in aggregation bias and misestimated standard errors. Multilevel models resolve these problems by analyzing data at different levels, not requiring an assumption of independence for individual cases, and allowing school effects, for example, to function at different levels (Lee 2000). School effects tested in these models include school type (public, private) and size (Bryk and Driscoll 1988; Lee and Burkam 2003). These studies have shown that school size and composition impact student academic outcomes and the learning environment.

This study contributes to the literature on school effects of racial segregation by examining the educational trajectories of students as they attended increasingly segregated schools between 1995 and 2002. The research is unique in that it examines time-varying school effects in a multilevel model. The peer effects research discussed above suggests a potential negative impact on educational outcomes of attending segregated schools. The hypothesis tested in this study is that students' learning growth rates will vary as a function of the percentage of minority students in a school and that there will be an interaction effect between a student's race and the percent of minority students in a school, in that the impact of attending segregated schools will vary by race. A case study of a single county in North Carolina will be used to test this hypothesis over a period of time when the schools were becoming more segregated.

Case Description

The Winston-Salem/Forsyth County Public Schools district is the 107th largest school district in the United States, the 5th largest in North Carolina. The student population was approximately 44,600—52% Caucasian and 48% minority students—during the 2000-2001 school year. The 408 square-mile county is in the northern Piedmont area of North Carolina. The county population was 306,067 in 2000, the fourth most populous county in the state. In 2000, almost two-thirds of the population lived in Winston-Salem (185,776), while the remainder lived in outlying municipalities (69,882) or rural areas (50,409) (NC Center for Statistics, 24 April 2006). Census data show that the increase in minority population between 1990 and 2000 was over 44%, with approximately 20,000 minority students in 2000. Much of this increase has been due to growth in Hispanic residents and students.

Implemented between 1995 and 2000, the Choice Plan in the North Carolina Winston-Salem/Forsyth County School District (WS/FCS) divided the county-wide school district into eight zones and allowed families to choose between 4-5 elementary schools and/or 2-3 middle schools in each zone. Between 1993 and 2002 the district schools became segregated. In 1993, all of the regular elementary and middle schools, with the exception of three community-supported neighborhood schools, ranged between 22% to 56% minority students. By 2002, the elementary and middle schools ranged between 13% and 99% minority students—eleven schools with more than 90% minority students (Jones-Sanpei 2006b). This created a unique situation to study the impact of attending segregated schools on student test scores as students moved in and out of increasingly segregated schools.

The original Choice Plan contained a provision for maintaining a racial balance among the schools in the district. However, two 1999 cases in the 4th Circuit restricted the ability of school boards to consider race in student assignments—*Eisenburg v. Montgomery Public Schools* (1999) and *Tuttle v. Arlington* (1999). The U.S. Supreme Court will hear two cases in 2006 (*McFarland v. Jefferson Co. Schools* and *Seattle School District No. 1*) that may further impact the use of race in student assignment decisions.

During the first years of the Choice Plan, the district implemented the Equity Plus Program with the goal of reducing the achievement gap in test scores between white and minority students. Approximately seventeen schools in the district (30%) were initially designated Equity Plus Schools based on the percentage of their students who receive free or reduced-price lunch (over 75% for elementary schools, over 50% for middle schools). The number of Equity Plus Schools increased over time. These schools offer smaller class sizes, with as few as 18 students in each kindergarten, first- and second-grade classroom. The average class size for third through fifth grades was 20 students. Teachers at Equity Plus schools also received a bonus of 20% of the local teacher pay supplement (2002). Unfortunately, because of the close correlation between the percentage of minority students and the percentage of students receiving free or reduced lunch, the effect of the Equity Plus program could not be included in the final model.

Research Design

Data

The unit of analysis in this research is the student. The identification strategy used is similar to one used by Hanushek, Kain, and Rivkin (2002) in a study of Texas schools, where the pattern of racial composition for successive cohorts is used to identify their fixed effects. The value-added growth model used in this study assumes that annual changes in test outcomes, measured at the end of the school year, are a function of student characteristics shown in the test scores from the previous year and the school peer environment, measured at the beginning of the school year, as influenced by the implementation of school choice in the district. This is a significant assumption in that it assumes family, neighborhood, and school non-peer characteristics are constant. Ideally, a complete vector of factors, including school resources, teacher effectiveness, organizational issues, community resources, racial and socioeconomic student body composition, curriculum, family background, student demographics, student behaviors, aspirations, and any other variable that may affect educational outcomes, would be included in education program evaluations. However, due to lack of data the complete vector is never available. Studies of school effectiveness often include school-level variables such as school structure (public, private, charter), size, location, social composition, and academic organization (curriculum, tracking, graduation requirements) (Lee 2000). The current study includes only public schools and their social composition.

The data used for this analysis are from the North Carolina Education Research Data Center (NCERDC). The NCERDC is a repository for all public education data in North Carolina. The students were matched from year to year with a unique student identifier supplied by NCERDC for that purpose. The data were then restricted to students attending public elementary and middle schools during grades 3 through 8, the years for which end-of-year standardized exams were reported. High school students were not included in the study because the end-of-year exam format changes after middle school and because high schools are less segregated than the smaller elementary and middle schools.

Table 1 contains descriptive information at both the student and the school level for the matched population, the cohort population, and the cohort sample. Students in all grades between 3rd and 8th are required to take end-of-grade tests in reading and math. The eight-year mean end-of-grade math score for the almost 26,000 students was 159.63 with a range between 100 and 208, and a standard deviation of 16. The eight-year mean end-of-grade reading score was 154.51 with a range between 117 and 187, and a standard deviation of 11. Fifty-four percent of the students were white, 37% were black, and 5.65% were Hispanic.

The average number of observations per student was 4.82, with a total number of 117,407 observations over a six-year period. On average, each student attended 2.17 schools. Over the eight-year study period, 46.27% of the total student population attending the 58 elementary and middle schools included in the study were minority students and 36.44% were students using free or reduced lunch.

The data were further restricted to include only those students with continuous exposure to the schools over the period of the study. This includes approximately 60% of the students that sat for at least three 3rd through 8th grade end of year exams between 1995 and 2002. First, the data were restricted to students attending the target district public schools continuously from 3rd through 6th, 7th, or 8th grade in order to limit the influence of other school systems and unknown peer groups. For example, some of the students left to attend charter schools and later returned to the traditional public schools. Other students not included in the analysis were students retained after 3rd grade, students who moved into the area after 3rd grade, or students who left the public schools between 3rd and 6th grade. These students were not included in the analysis in order to have consistent cohorts that progressed from 3rd to 8th grade and to minimize the effect of other school systems and unknown peer groups. Thus, the students included in the analysis are those most likely to be impacted by the school choice implementation policy. The cohort sample demonstrated some statistically significant differences from the total population (Table 1), although most of the differences appear minor. The test scores were slightly higher, fewer minority and male students were included in the cohort population, and on average the cohort students attended 2.23 schools within the WS/FCS district compared to 2.17 for the total population. This restriction will bias any findings of the study upward, providing an “upper limit” of the impact of racial segregation. For example, if the analysis shows negative impacts of attending segregated schools in this population with less geographic and school-type mobility, then the impact may be higher in a more transient population.

The data were then randomly separated into 4 subsamples. A descriptive analysis (Appendix A) revealed that the four subsamples were not significantly different in terms of minority status, gender, or usage of free and reduced lunch at the student level, although there were some differences at the observation level due to the large number of observations. The models below were created using one sample (Table 1), and then verified using the other three.

It should be noted that this is a case study of one school district that imposed a rigorous strategy for controlled school choice. Limitations of this study reduce its generalizability to elementary and middle school students who sustain their education within a particular school district. The institutional environment and compensating programs are unique, limiting generalizability while providing a better understanding of the factors and programs that contribute to the findings. Also, a complete vector of student, family, neighborhood, and school factors that may impact educational outcomes is unavailable; the unobserved heterogeneity will increase the potential for specification error. However, despite these limitations, this study contributes significantly to the segregation literature by means of a unique opportunity to test a value-added academic outcome model in a rapidly resegregating school district.

Methods

Modeling student test score growth trajectories over time and within schools requires a multilevel model with random variation. Raudenbush and Bryk (2002) have made major contributions toward developing procedures to analyze nested data by using hierarchical linear modeling. Multilevel approaches can produce a more precise understanding of the complex multi-level relationships (Heinrich and Lynn 2000) that exist in education policy situations—for example, improved estimation of individual effects, cross-level effects, and partitioning multi-level variance and covariance components (Raudenbush and Bryk 2002). The two-level model used in this study includes individual growth trajectories at level-1 and the student characteristics at level-2. The percentage of minority students in each school is included in level-1 as it changes each year. This is different than the traditional school effects model, which for longitudinal studies is a three-level model (time, student characteristics, school characteristics) (Rumberger and Palardy 2005). The parameters at each level-1 become the outcome variables in level-2. In this way, the variation among student test scores over time becomes a dependent measure to be explained by individual student characteristics and changes in school racial composition over time (Lee and Bryk 1989).

Equations 1 and 2 show the nested model with two levels of analysis—time (t) and student (i) (Raudenbush and Bryk 2002). Because the school characteristics of race and Equity Plus designation were time-varying, they were included in level-1.

At level-1, the test score mastery of student (i) at time (t) is represented as depending linearly on time, time-varying school (Sch) characteristics, an interaction effect, and a random error term.

(1) $Y_{ti}=\pi_{0i}+\pi_{1i}time_{ti}+\pi_{2i}Sch_{ti}+\pi_{3i}Sch_{ti}*time_{ti}+e_{ti}$

The time-varying school characteristics of interest include the percentage of minority students in the school that student (i) was attending at time (t) and Equity Plus status. An interaction effect between the percentage of minority students in a school and time was also included in the level-1 model to test the impact of school minority status on test scores as the students progressed from 3rd through 8th grade. The error term, e_{ti}, is assumed independent and normally distributed with a mean of zero and a constant variance.

At level-2, the intercept (baseline differences among all observations in the differential) and slopes of level-1 coefficients are represented as depending on student (i)'s characteristics and a random error term.[2]

$$
\begin{aligned}
(2)\quad & \pi_{0i}=\beta_{00}+\beta_{01}Gender_i+\beta_{02}Grade3age_i+\beta_{03}Race_i+r_{0i} \\
& \pi_{1i}=\beta_{10}+\beta_{11}Race_i+r_{1i} \\
& \pi_{2i}=\beta_{20}+\beta_{21}Race_i+r_{2i} \\
& \pi_{3i}=\beta_{30}+\beta_{31}Race_i+r_{3i}
\end{aligned}
$$

Student characteristics include gender, race, and the age of student (i) at time (0) when the student sat for the 3rd grade end-of-year exam. The error terms are assumed normally distributed with a mean of zero and a constant variance. The error term for each model captures the deviation of the level-1 coefficient (π) from the level-2 coefficient (β).

Results from hypothesis testing of fixed effects, random coefficients, and variance-covariance components suggest that some covariates do not contribute significantly to the models. For example, attending an Equity Plus school did not significantly impact either the reading or the math test scores of the students. This finding could also be influenced by the high correlation between schools' racial composition and free and reduced-lunch usage. For these reasons, the Equity Plus covariate was not included in the final models. Gender, however, did contribute to the reading model but not to the math model. Neither gender nor age contributed to the slope, nor interacted significantly with the school racial composition. Therefore, they were only included in the intercept equation.

Findings

To interpret the results, some information about the North Carolina standardized exam is necessary. The North Carolina ABC's accountability program measures growth in the aggregate as students progress from grade to grade. Several other states and cities use growth models in their accountability systems as well, focusing on academic gains rather than raw achievement scores. End of grade reading and mathematics tests are given for grades 3 through 8. High school growth is based on end of course exams. A school-level study of 37,000 fifth grade students by Ladd and Walsh (2002) found that schools serving low-income and minority students operate at a disadvantage under this system as basis for rewards and sanctions for school personnel. A review of other accountability systems based on growth models indicates growing use of these models but significant measurement and implementation difficulties (Goldstein and Behuniak 2005). However, this analysis uses just the raw scale scores to calculate an individual growth model for each student, not as a measure of school effectiveness.

The mathematics and reading results are reported as scale scores, with the 2000 mean scores being 146 (math)/143 (reading) at grade 3 and 176 (math)/164 (reading) at grade 8. The raw scores are not designed to allow cross-grade comparisons as the test content, range of scores, and achievement level cutoffs differ for each grade. However, the dependent variable (scale score) for this analysis was centered at the cutoff between achievement level II (inconsistent mastery, minimally prepared for the next grade) and achievement level III (consistent mastery and well prepared for the next grade). In other words, a 0 indicates that the student was performing on the border of being minimally prepared for the next grade.

In addition to the dependent variable, two of the independent variables were centered. The percentage of minority students in each school was centered on 40%, a proposed tipping point where the percentage of minority students in a school affects the future enrollment of non-minority students (Kahlenberg 2001). The students' ages were centered on the age of the average 3rd grade student—9.15 years old on the end of year exam day. These modifications were made to aid in interpreting the data.

Descriptive Results

Figures 1 and 2 show the mean reading and math test scores, centered on the mastery cutoff, for seven cohorts of students in WS/FCS, as they progressed through 3 to 6 years of education. The mean reading test scores (Figure 1) were relatively flat in 3rd and 4th grades, with a jump in 5th grade for all the students, a decrease in 6th grade back to the 4th grade level, and then a gradual increase through 7th and 8th grades. The racial achievement gap remains consistent through the initial grades, but then appears to decrease somewhat during the 7th and 8th grades. The mean math test scores (Figure 2) show an inconsistent nonlinear increase between 3rd and 6th grade and a decline between 6th and 8th grade for all race groups.

The unconditional means models provide important information regarding the overall test score means and the variation over time, between students, and between schools. The fully unconditional model, with no predictor variables specified at any level, permits the estimation of the proportion of variation that is across time (t) and within schools among students (i) (Raudenbush and Bryk 2002). The models indicate that the overall mean reading score was 6.46 points above the mastery cutoff and the overall mean math score was 9.89 points above the mastery cutoff. The unconditional means model allows us to evaluate numerically the relative magnitude of the within-school and between-school variance components (Singer and Willett 2003). The intraclass correlation coefficient (ICC) describes the proportion of the total outcome variation that lies between students. The reading ICC was 0.80 and the math ICC was 0.78, indicating that most of the total variation in test scores is attributable to differences between students rather than over time within the same students. The ICC and the results from the unconditional growth models, are not always reported in studies using individual growth models (e.g., Carbonaro and Gamoran 2002; Roderick and Nagaoka 2005); however, a frequently applied rule is that an ICC over 0.10 is nontrivial and indicates a need for multilevel analysis (Lee 2000). School effect studies have reported ICCs from 0.09 (between school) to 0.23-0.40 (within-school) (Lee and Bryk 1989; Lee and Loeb 2000).

The unconditional growth models provide information regarding the initial status of students and their change over time, or slope. The estimated initial status, or 3rd grade test score, was 5.66 points above mastery for the reading scores and 7.05 points for the math scores. The average growth rate, or annual change, was 0.40 points in reading test scores and 1.49 points in math test scores. The level 1 residual variance was 14.32 for reading and 18.52 for math, summarizing the scatter of each student's data around her own linear change trajectory. The residual variance for the unconditional growth model was less than that of the unconditional means model for both reading and math. For reading, 12% of the within-student variation in test scores was systematically associated with linear time. For math, 32% of the within-student variation in test scores was systematically associated with linear time. Because the null hypotheses for the variance components can be rejected, we know that some important within-student variation still remains, suggesting that the model fit could be improved by introducing substantive predictors into the level-1 submodel. These substantive predictors may include classroom and teacher effects that vary over time, such as student-teacher relations as used in a study of school effects on drop-out behavior (Lee and Burkam 2003).

The population covariance between true initial status and true change is quantified by, σ_{01}, -4.83 (reading) and -2.77 (math). Reexpressing the reading test covariance as a correlation coefficient (-0.72) suggests that the relationship between a student's true rate of change in reading test scores and her initial status was negative and large. In other words, students that began with higher reading test scores in 3rd grade increased those test scores less rapidly over time than students who initially had lower test scores. On the other hand, the correlation coefficient for the math test covariance was -0.24, suggesting that the relationship between a student's true rate of change in math test scores and her initial math test score was negative and small. In other words, students with higher initial math test scores in 3rd grade had slightly negative slopes compared to students with lower initial test scores. Both of these findings indicate that greater gains over time are being made by students with initially lower test scores—more so in reading than in math—than students with initially higher test scores, suggesting a smaller variance in test scores during the later grades.

Introducing time-varying predictors such as school racial composition in the level-1 model, and student characteristics such as race and gender in the level-2 model explained some of the variation found in the unconditional models. These results are explained separately below for the reading and the math models.

Reading Model

The findings for these models can be separated into three groups: general, student race, and school racial composition. The general findings are consistent with previous research. The intercept for the final reading model indicated that, on average, a white, male student, attending a school with 40% minority students, who was the average age for his grade, scored 8.94 points above mastery on the end-of-grade reading exam (Table 2). A female student, on average, scored slightly higher—9.82 points above mastery. A male black student, on average, scored 0.25 points below mastery, and a male Hispanic student, on average, scored 0.04 points below mastery—almost a full standard deviation lower than the white students, on average. A student who was a year older than the traditional age for his grade, on average, scored 2.09 points lower than his peers, or 6.85 points above mastery.

The student race findings over time indicate that the racial achievement gap in reading is slowly decreasing in this district. With each additional year of schooling, white students, on average, increased their reading scores by 0.18 additional points. Black and Hispanic students, however, on average increased their reading scores each additional year by 0.53 and 0.98 respectively, significantly higher than the white students, demonstrating a decrease in the racial achievement gap over time. There was no significant difference in the change over time between male and female students. Figure 3 shows the predicted values of reading test scores centered on the mastery cutoff by student race during the six grades included in the study. During this time, there was a noticeable decrease in the racial achievement gap.

The findings regarding the effect of school racial composition do not support the hypothesis and suggest that a greater percentage of minority students in a school does not significantly affect student achievement growth over time. The findings do confirm the existence of an initial school achievement gap. The initial test scores of students attending schools with over 40% minority students were lower than their peers attending schools with fewer minority students. For every additional 1% of minority students in a school, white students' initial average reading test scores decreased by 1.26 points—approximately a tenth of a standard deviation. Black students, in contrast, had 3rd grade test scores 1.19 points higher than the white students for each additional 1% of minority students. Hispanic students performed even better, with scores 1.57 points higher than the white students for each additional 1% of minority students in the school. These racial differences, however, were not statistically significant at the 0.10 level. The changes over time were very small and not significant, suggesting that attending a school with higher percentages of minority students did not adversely impact student test scores compared to attending a school with fewer minority students. Similarly, there were no significant interactions between student race and the school racial composition over time.

Estimates of the variance explained by the model indicate that 12% of the variance within students was explained by time. The final model explained 29% of the variance in initial status and 17% of the variance in slope compared to the unconditional growth model.[3]

Math

Again, the findings for the math model can be separated into three groups: general, student race, and school racial composition. The intercept for the final math model indicated that, on average, a white, male student, attending a school with 40% minority students, who was the average age for his grade, scored 9.98 points above mastery on the end-of-grade math exam (Table 2). There was no significant difference between male and female students with respect to math scores. A black student, on average, scored 0.60 points below mastery (-10.58 below the average white student), and a Hispanic student, on average, scored 2.29 points above mastery (-7.69 below the average white student). A student who was a year older than the traditional age for his grade, on average, scored 2.78 points lower than his peers, or 7.2 points above mastery.

Again, the student race findings over time indicate that the racial achievement gap is decreasing in this district. With each additional year of schooling, white students, on average, increased their reading scores by 4.18 additional points above mastery—38% of a standard deviation. Black and Hispanic students, on average, increased their reading scores each additional year by 4.43 and 4.67 points respectively, significantly higher than the white students, indicating a very slight decrease in the racial achievement gap over time. Figure 4 shows the predicted values of math test scores centered on the mastery cutoff by student race over time, showing growth over time, a nonlinear trend, and a very slight decrease in the racial achievement gap.

The findings regarding the effect of school racial composition on math test scores do not support the hypothesis and suggest that the percentage of minority students in a school does not impact student math test scores over time. Unlike the reading test scores, the initial math test scores of students attending schools with over 40% minority students were not significantly different than their peers attending schools with fewer minority students. Furthermore, there were no significant racial differences in the intercept, or 3rd grade math test scores, nor were there significant differences by percentage of minority students in the school in slope, or changes in math test scores over time.

Estimates of the variance explained by the model indicate that 32% of the variance within students was explained by time and 9% by the covariates added in the final model. The final model explained 34% of the variance in initial status and 48% of the variance in slope compared to the unconditional growth model.

Interpretation

The results of this study, although limited to a single North Carolina county and school district, confirm previous research regarding the persistence of a racial achievement gap (Jencks and Phillips 1998). Hispanic students consistently score 4-8 points lower on math and reading tests than white students, and black students consistently score 6-10 points lower, almost a full standard deviation. The study also finds that in this district, significant but small reductions in the racial achievement gap are occurring during 3rd through 8th grade (Figures 3-4; Table 2). These findings are consistent with a 2006 report on the racial achievement gap in North Carolina, which indicates that the racial achievement gap for grades 3-8 has been reduced from 30% in 2000-2001 to 21.6% in 2004-2005 (Reid 2006). A study by Clotfelter, Ladd, and Vigdor (2006) also found shrinking racial achievement gaps in North Carolina public schools, with Hispanic students gaining more than black students. The results from this study indicate that Hispanic students' test scores, on average, annually increased 0.50 points in math and 0.98 points in reading more than the average white student's test score annual increase. Similarly, black students' test scores, on average, increased 0.25 points in math and 0.53 points in reading each year, also compared to the average white student. However, despite the progress there is still a sizable racial gap in the 8th grade test scores. While a positive change over the course of 6 years is promising, the racial gap in initial status must change in order to have long-term societal results. Even if school effects are completely eliminated through school reform, social policies that address the circumstances of student and family inequalities that affect learning will be necessary to reduce the gap in initial status.

These results also confirmed existing research on the gender achievement gap. Female students, on average, scored 0.88 points higher on the initial reading exam than male students. However, there were no significant changes in these differences over time in the reading test scores. Neither the initial mathematics test scores nor changes over time showed significant differences between males and females. These findings are consistent with other research showing a gender difference in reading, but a much smaller gender difference in math (National Center for Education Statistics, Nation's Report Card, 2005). The finding that older students do worse on exams is supported by research on early grade retention, showing that the majority of students who have been retained (prior to third grade) do not do as well as their average peer in subsequent years (Randolph, Rose, Fraser, and Orthner 2004).

Extending the study further to test the impact of attending a school with higher percentages of minority students during 3rd through 8th grade indicated that there was no significant impact on either math or reading test scores over time. The hypothesis that students' learning growth rates vary as a function of the percentage of minority students in a school is not supported by this analysis. There was a slight positive effect in reading for white students, while there was a slight negative effect in math. Interestingly, black and Hispanic students fared worse over time than white students in reading, but better in math. However, these findings were not significant. These findings are surprising considering the number of studies finding a significant peer effect on achievement scores.

These findings may be consistent with Rumberger's and Palardy's (2005) study that used multilevel modeling and NELS data to estimate the effect of attending segregated schools. They found that socioeconomic segregation was more influential than racial segregation, and that in most subjects school process variables such as teachers' expectations, homework hours, advanced courses, and school safety explained all of the estimated effects of socioeconomic composition on achievement growth. Not having access to these variables, one can surmise that the combination of using data from stable, student cohorts and the additional school and teacher resources provided by the district under the Equity Plus program may have reduced the expected effect of higher minority status in these schools on student achievement growth. However, unlike the Hanushek, Kain, and Rivkin (2002) study that used panel data on Texas students to disentangle school racial composition effects and found a "higher percentage of Black schoolmates has a strong adverse effect on achievement of Blacks," the current study found no interaction effect between the race of the student and the percentage of minority schoolmates.

One of the major limitations of this study is that in relating student trajectories to their school environments it is necessary to limit the analysis to students who remained within one district's noncharter, public schools. These are, by definition, less transient than students not included in the study. Although the difference is small (see Table 1), the fact that fewer male and minority students were included in the cohort population is a limitation to the study. Another limitation is that the only available outcome measures are academic achievement test scores. Other additional outcome measures that could be used if the students were followed through high school, are drop-out and graduation rates. Futhermore, there are multiple purposes to education in addition to academic learning and test scores which should be reflected in multiple outcome measures (Jones-Sanpei 2006a). It is possible that a longitudinal study following students into their post-high school careers would find long-term impacts such as higher college graduation, occupational attainment, and integrated workplaces from attending segregated schools that is not revealed in a cohort analysis of test score outcomes (Braddock, Dawkins, and Trent 1994; Trent 1997).

Conclusions

One of the major controversies in education policy today is over the educational impacts of school choice. Proponents of school choice see it as a way to introduce market practices into public education, thereby encouraging schools to become more efficient and effective. Opponents of school choice are concerned that it will result in further segregating public schools and increasing the gap in school performance between majority and minority students. Understanding the impact of segregation on all students is essential to implementing successful education policies such as school choice that have the potential to impact the racial composition of public schools.

When WSF first implemented the Choice Plan there was concern that it would resegregate the public schools to the detriment of minority students. However, this study shows that at least for the majority of students in 3rd through 8th grades, any potentially negative consequences appear to be mitigated by the additional resources provided to low-income schools. The current study finds no significant impact on student test scores as the schools' racial composition changed as a result of the implementation of school choice. The implications of this finding for policies such as school choice that have the potential to segregate public schools are significant. Other researchers, using different populations and methodologies, have found significant racial and interaction effects (Hanushek 2001; Hoxby 2000). Yet school choice implementation in this district, with its complementary teacher and classroom support strategies, demonstrates that at least in terms of academic test scores, minority students have not been negatively impacted academically—an "upper limit" for stable students with additional resources in low-income schools. Programs like the Equity Plus Program, while it did not appear to contribute to this model and was not included because of the correlation with schools' racial composition, may be a factor in both reducing the racial achievement gap and in compensating for any negative impact on student test scores from attending schools with increasing numbers of minority students.

Overall, the results of this study suggest that at least for students who stay in the public schools, integration is not necessary for student achievement. However, one of the policy questions that should be further reviewed is whether the additional cost of compensating schools with higher rates of low-income students rather than integrating those same schools outweighs the benefits of school choice programs. Furthermore, limitations to this study suggest that there may be a significant impact on test scores for some students that is masked by the stable population included in this analysis. Additional analysis of these students who move between school systems may reveal a "lower limit" or a negative impact from attending segregated schools. Finally, the long-term benefits of integrated schools were not included in the analysis.

In conclusion, this study significantly contributes to our understanding of the factors associated with student academic achievement in an increasingly racially segregated school system. The results indicate that students may not be as negatively impacted as some of suggested. Despite the results of this study, however, the goal of integration should not be summarily dismissed. The effect of stable students attending segregated schools on academic test scores, while important, does not reveal the entire picture. As this district demonstrates, compensating programs is essential and should be established and maintained in districts with segregated schools. The costs of these programs, compared to the costs of integration programs, should be weighed against the benefits of increasing school choice.

Endnotes

[1] For more information on multilevel growth models and multilevel modeling in general, see Raudenbush and Bryk (2002) and Singer and Willett (2003).

[2] Likelihood ratio tests indicated that the random effects contribute significantly to the model.

[3] These pseudo-R^2 measures require caution as there is a potential for a negative pseudo-R^2 when all, or most, of the outcome variation is exclusively either within-individuals or between-individuals (Singer and Willett 2003).

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Table 1: Descriptive Information for Student and School Factors			
	Total	**Cohorts**	**Sample**
Student Factors			
Number of students	25,735	15,272	3,819
Mean Mathscal	159.63	160.20	160.12
Mean Readscal	154.51	155.09	155.06
Asian	1%	0.88%	0.97%
Black	37.37%	36.33%	36.48%
Hispanic	5.65%	4.55%	4.77%
White	54.12%	56.16%	55.62%
Male	51.40%	49.93%	49.18%
Total Observ.	117,407	75,520	18,794
Mean Obs./Student	4.82	5.22	5.20
Mean # Sch. Attended	2.17	2.23	2.24
School Factors			
Number of schools	58	57	57
Minority	46.27%*	45.29%*	45.30%*
Poverty	36.44%*	35.47%*	35.38%*
*annual mean averaged over study period			

Table 2. Fixed Effects from HLM Analyses of Student Test Scores in a Controlled Choice (Resegregating) School District, 1995 through 2002			
	Reference	*Reading*	*Math*
Intercept	(white, male)	8.941*** (0.214)	9.982*** (0.207)
Fixed effects			
Time	(white)	0.179*** (0.030)	4.184*** (0.150)
Time*Time			-0.842*** (0.073)
Time*Time*Time			0.044*** (0.010)
Female	intercept	0.880*** (0.222)	
Black	intercept	-9.187*** (0.299)	-10.583*** (0.327)
Hispanic	intercept	-8.901*** (0.692)	-7.688*** (0.761)
Grade3age		-2.091*** (0.275)	-2.777*** (0.343)
Student Race * Time	Time (black)	0.529*** (0.053)	0.252*** (0.065)
	Time (Hispanic)	0.979*** (0.155)	0.495** (0.186)
School Minority %	(white)	-1.258* (0.573)	-0.194 (0.636)
Student Race * School Minority %	School Min. % (black)	1.185 (0.729)	-1.033 (0.811)
	School Min. % (Hispanic)	1.569 (1.710)	-1.559 (1.913)
School Minority % * Time	(white)	0.215 (0.175)	-0.096 (0.215)
SchoolMinority%* student race*time	Sch Min.%*time (black)	-0.324 (0.231)	0.392 (0.284)
	Sch Min.%*time (Hispanic)	0.002 (0.582)	0.890 (0.708)
Variance Components of Random Effects			
Intercept		58.017***	69.195***
Time		0.451***	0.667***
School Minority%		16.368**	15.845*
School Minority% * time		0.736	2.484*
-2 Res. Log. Likeli.		107,692.7	112,759.8
AIC		107,726.7	112,793.8
ICC (Unconditional model)		0.81	0.78
R^2 (Variance explained):			
Within person (time)		12%	32%
Initial status (model)		29%	34%
Slope (model)		17%	48%
*p<=.10 **p<=.01 ***p<=.001; Numbers in parentheses are standard errors.			

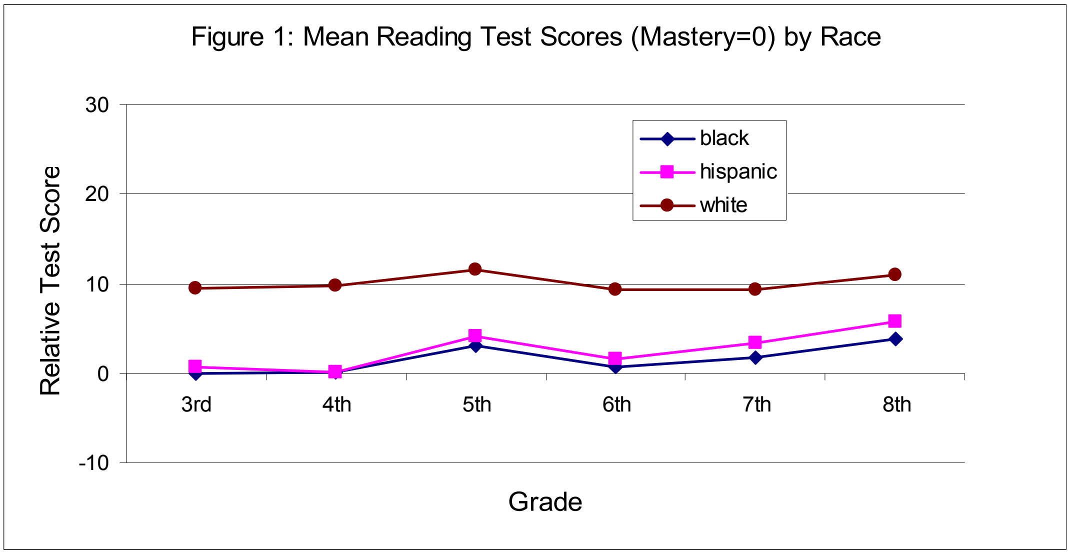


Figure 1: Mean Reading Test Scores (Mastery=0) by Race
30
20
10
0
-10
Relative Test Score
3rd
4th
5th
6th
7th
8th
Grade
black
hispanic
white

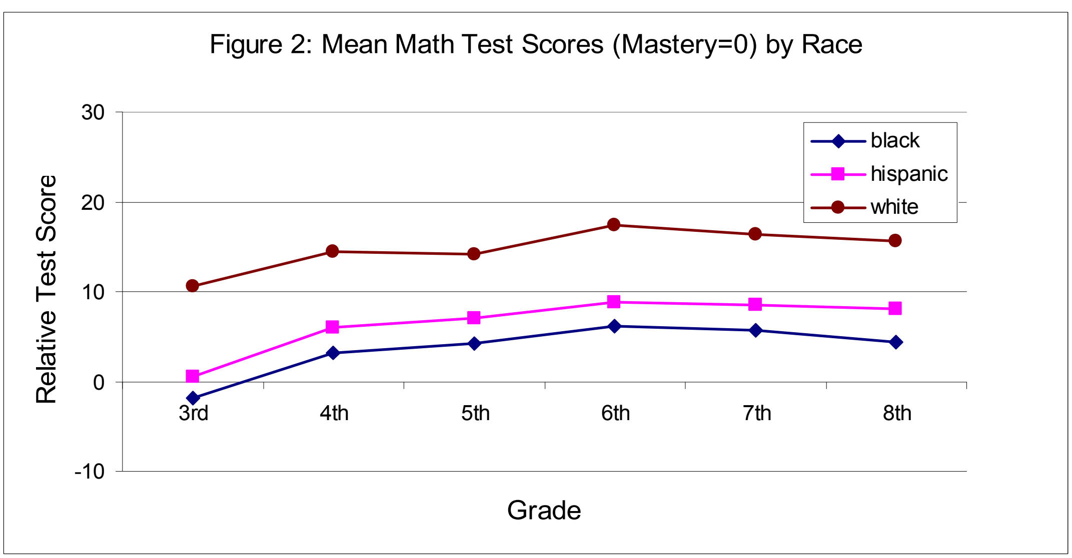


Figure 2: Mean Math Test Scores (Mastery=0) by Race
30
20
10
0
-10
Relative Test Score
3rd
4th
5th
6th
7th
8th
Grade
black
hispanic
white

Figure 3: HLM Predicted Values of Initial Reading Test Scores and Change over Time by Student Race (Mastery=0)

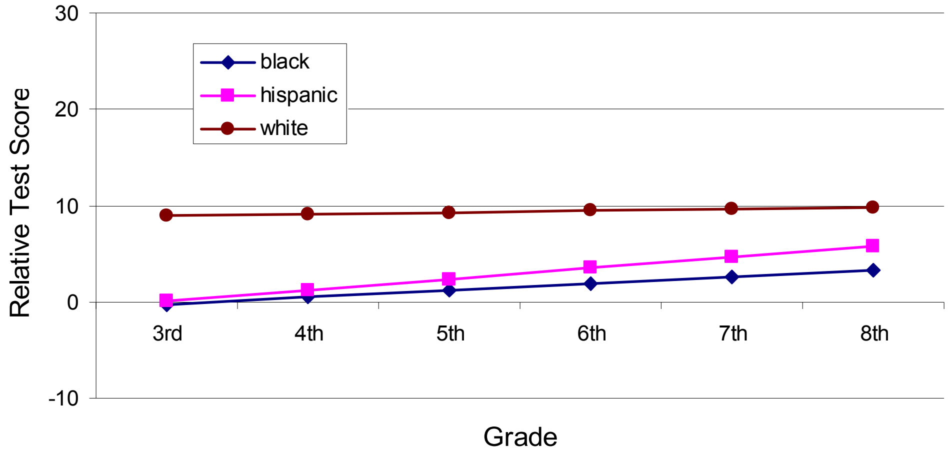
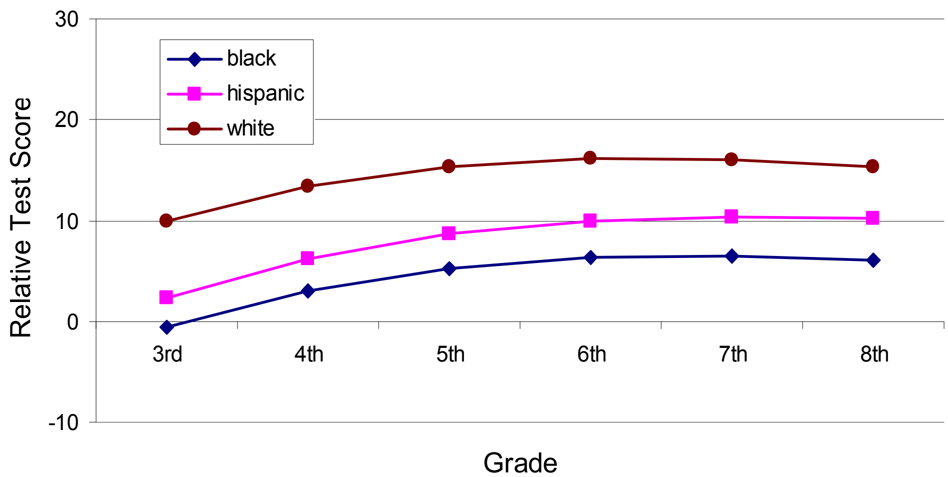


Figure 4: HLM Predicted Values of Initial Math Test Scores and Change over Time by Student Race (Mastery=0)



Appendix A: Sample Variable Means and Statistical Differences				
	Sample 1	**Sample 2**	**Sample 3**	**Sample 4**
Student N	3,819	3,833	3,770	3,850
gender	0.49	0.51	0.50	0.50
race	4.88	4.89	4.94	4.91
Pov1	0.39	0.38	0.38	0.38
Pov2	0.38	0.39	0.37	0.38
Pov3	0.37	0.39	0.37	0.37
Pov4	0.34	0.35	0.33	0.34
Pov5	0.31	0.33	0.30	0.30
Pov6	0.29	0.29	0.27	0.28
Observations N	18,794	18,984	18,658	19,084
Gender*	0.50	0.51	0.50	0.50
Race*	4.90	4.89	4.96	4.93
Poverty*	.35	0.36	0.34	0.34
policy	.79	0.78	0.78	0.79
zone	7.43	7.46	7.51	7.48
spermin	.45	0.46	0.45	0.45
sperpov*	.35	0.36	0.35	0.35
mathscal	160.12	160.21	160.40	160.07
readscal	155.06	155.06	155.24	155.01
numobs	5.20	5.23	5.23	5.23
*Statistical difference between groups at p<0.05.				

Appendix B. Parameter Estimates for Unconditional Models				
	Unconditional Means Model		Unconditional Growth Model	
	Math	Reading	Math	Reading
Mean				
Initial achievement	9.89*** (0.166)	6.46*** (0.133)	7.05*** (0.176)	5.66*** (0.155)
Achievement growth			1.49*** (0.030)	0.40*** (0.023)
Parameter variance				
Within students (level 1)	27.25*** (0.321)	16.28*** (0.193)	18.52*** (0.252)	14.32*** (0.191)
Between students (level 2)				
Initial achievement	97.36*** (2.395)	63.41*** (1.558)	104.90*** (2.703)	81.62*** (2.113)
Achievement growth			1.27*** (0.080)	0.54*** (0.045)
Correlation—Initial intercept/growth			-2.77*** (0.344)	-4.83*** (0.254)
Intraclass correlation coefficient	0.78	0.80		
*p<=.10 **p<=.01 ***p<=.001; Numbers in parentheses are standard errors.				