8-2001

Charter schools : why states and communities select them, and their effect on educational outcomes

Matthew Rex Metzgar

To the Graduate Council:

I am submitting herewith a dissertation written by Matthew Rex Metzgar entitled "Charter schools : why states and communities select them, and their effect on educational outcomes." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Economics.

Robert Bohm, Major Professor

We have read this dissertation and recommend its acceptance:

Matthew Murray, Donald Bruce, Thomas Boehm

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

To the Graduate Council:

I am submitting herewith a dissertation written by Matthew Metzgar entitled "Charter Schools: Why States and Communities Select Them, and Their Effect on Educational Outcomes." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Economics.

Robert Bohm, Major Professor

We have read this dissertation
And recommend its acceptance:

Accepted for the Council:

Interim Vice Provost and
Dean of the Graduate School

CHARTER SCHOOLS: WHY STATES AND COMMUNITIES SELECT THEM, AND THEIR EFFECT ON EDUCATIONAL OUTCOMES

A Dissertation

Presented for the

Doctor of Philosophy Degree

The University of Tennessee, Knoxville

Matthew Rex Metzgar

August 2001

ACKNOWLEDGMENTS

I would like to thank the many people that helped me achieve this goal. Much thanks to the intellectual Big Three – Robert Bohm, Matthew Murray, and Donald Bruce. I would also like to thank Thomas Boehm for his insight and input.

Thanks to my parents and family who have supported me throughout out this years. Thanks to Denise for putting up with many missed dinners and many late nights. And thanks to all my buddies who have helped me throughout.

For inspiration, I would like to thank Steven Seagal and Jean-Claude Van Damme, whose visions of courage and integrity have guided me throughout the years. I would also like to thank my friends on all of Knoxville's highways who have provided me with great stories and laughs over the years.

ABSTRACT

This dissertation investigates the issue of school choice in education, and its effectiveness in improving student outcomes. Specifically, this dissertation studies charter schools, and analyzes the charter school concept in three ways. First, the state choice to pass charter legislation is analyzed. Second, the regional choice to enact a charter school is studied. Third, the effect of charter schools on educational outcomes is analyzed.

A theoretical model is developed which determines the factors that affect the charter school choice at the state and regional level. An educational production function is used to model the effect of a charter school on educational outcomes.

Data are gathered from national and state educational agencies. Binary choice models are utilized for analyzing the state and regional choice. Self-selection is tested for in the outcome model to see if communities have self-selected charter schools.

Both the state and regional choice models show that there are statistically significant factors which influence the charter school choice. However, when tested for self-selection is not statistically significant. Charter schools are found to have a positive relationship with the district high school dropout rate in the full sample, and a negative relationship with test scores in two states. These results apply only to charter high schools and represent the initial period of the charter movement only. These results caution policymakers in the use of charter schools to improve educational outcomes.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.0 Preamble

This chapter introduces the reader to school choice and the charter school phenomenon. The purpose of the dissertation is stated, and the related issues are introduced. Finally, the contents of the dissertation, the contributions it makes, and the overall structure of the document are described.

1.1 Education and School Choice

School choice is one of the most powerful ideas in education reform today. *US News and World Report* reports on the "high-voltage political and legal debate" that has encompassed the education establishment.[1] The title of a recent book, "The School Choice Wars" (Merrifield, 2001), suggests the passion and conflict that surrounds this issue. School choice continues to make headlines in major newspapers across the country, such as the *Wall Street Journal* and the *Washington Post*.[2] But why all the controversy? Is school choice needed, and what can it do?

School choice is defined as the ability of households to select the public and sometimes private school of their choice. The idea of school choice actually dates back many years. One of the first modern proponents was Milton Friedman, who suggested the idea in his book, "Capitalism and Freedom" (1962). The theory was simple: the

[1] See US News and World Report, "More Growth in Charter Schools", Sept. 11, 2000.
[2] For example, see "The not-so-ugly duckling (arguments in favor of charter schools)" in The *Wall Street Journal*, May 4, 2001, and "To Each Its Own; Are charter schools providing customized education, a breakdown in curricular coherence or both?" in *The Washington Post*, April 8, 2001.

government had a "monopoly" on the education market. If control were left to market forces instead, choice and competition would lead to improved educational outcomes. An educational system guided by market forces would lead to better students, satisfied parents, and lower costs (for more recent discussion, see Machan, 2000).

Critics have argued that this system will have detrimental effects, such as an increase in racial and economic segregation (most recently, Smith and Meir, 1995; Ascher, Fruchter, and Berne, 1996). There is also the issue of high-cost students, such as special education or disabled students, and how they would be educated in such a system (see Rothstein, 1999). A system of school choice that involves private schools, as with vouchers, creates additional church-state questions that have not yet been legally resolved (Sugarman, 1999). In short, critics believe school choice will bankrupt the public school system, leaving the poorest and most disadvantaged students behind (Hennig, 1994).

School choice gained momentum in the 1980s from what was perceived as a failing public education system. "A Nation At Risk", perhaps the most famous indictment of American schools, touched off a controversy with its publication in 1983 (U.S. Department of Education, 1983). The publication, written by the National Commission on Excellence in Education, described the "mediocre educational performance" of US students, and how American preeminence in education was "being overtaken by competitors throughout the world". The mainstream media published numerous articles on this report, and researchers have disagreed about the findings (see Berliner and Biddle, 1995; Hanushek, 1996). Regardless, the idea that US students were falling behind was entrenched in the public consciousness (Good and Braden, 2000).

By the 1990s, school choice became a reality. Public school choice, which had actually already existed for decades in some areas, expanded greatly. Voucher programs were enacted in Cleveland and Milwaukee, and private organizations also began to experiment with private school vouchers. The first charter school opened in 1992, and they are now more than 2,000 charter schools operating nationwide.

The school choice debate continues across the nation. Various forms of choice initiatives appeared on the 2000-year election ballots, such as voucher programs in Michigan and California. President George W. Bush supports the use of federal money for voucher programs, and has promised to increase the number of charter schools nationwide. School choice is an idea that needs to be taken and studied seriously.

School choice can be divided into three main categories: vouchers, public school choice, and charter schools. As mentioned, many school choice programs are already in place across the country.[3] Charter schools have been the most common reform used during the most recent decade. Charter schools now serve over 500,000 students throughout the country. Thirty-eight states have passed legislation that allows charter schools, the most recent state being Indiana, which passed its charter law in May 2001.

Charter schools work by creating a local "charter" or contract with a local education agency. This contract contains specific performance objectives that must be met if the contract is to be renewed. Performance objectives include standardized test scores, performance assessments, parent surveys, and behavioral indicators, for example. Charter schools are publicly funded, as are traditional public schools, but their financing

[3] A comprehensive list of school reform initiatives can be found at: www.edreform.com.

usually depends on the number of students they can attract. Charter schools are designed to bring a new structure of accountability in public education.

A comprehensive study of the charter school choice and its systematic effect on performance has not yet been undertaken. This dissertation addresses this gap in the existing literature. Charter schools continue to grow in number across the country. From a movement that started with one charter school in 1992, there are now over 2,000 charter schools nationwide - a virtual explosion in growth over a nine year period. As this expansion continues, it is important to have a thorough understanding of the related economic and public policy issues.

The purpose of this dissertation is to contribute to the literature on school choice by specifically focusing on charter schools and their effects on educational outcomes. I study the charter school concept at three levels: 1) the state choice to pass charter legislation, 2) the regional choice to enact a charter school, and 3) the impact of a charter school on public education quality within the region.

1.2 Theoretical Issues

As a component of the public education system, charter schools are analyzed as a partial public good. Analyzing charter schools then entails the problems associated with the study of public goods. The primary concerns are efficiency, defining the product that is being consumed, and describing the actual "market" for the good.

Education in the United States is publicly provided for the most part, as approximately 90% of all students attend public schools. Public schools have existed in the US in some form or another since the Declaration of Independence. The high cost of education, combined with the fact that young parents often have limited wealth, makes

education a candidate for a collective choice mechanism, a program where citizens are taxed and majority rule determines the output of the good. This mechanism allows the costs of educating children to be spread over the lifetime.

Efficiency issues aside, a prime justification for education as a publicly provided good is to alleviate inequalities that might develop from a private market. Poorer families may be unable to afford to educate their children if all education was privately provided. A private educational system could also become stratified, where the schools charging higher tuition would provide a higher quality education to their students. These concerns provide an argument for financing education publically, where there will be equal opportunity for all children.

Questions arise as to the efficiency properties of public education. First, there are households that choose to opt out of the public system by sending their children to private school. This suggests that these households are not satisfied with the quality of education received in their local public schools. For the patrons of the public education system, there are questions as to all aspects of its efficiency – economic efficiency, productive efficiency, and allocative efficiency.

1.2.1 Efficiency

In terms of economic efficiency and spillovers, it appears that public education would be beneficial. A well-educated society is better off than a poorly-educated one. More education is correlated with higher wages, for example (Mayer and Peterson, 1999). A well-educated society as a whole should also promote economic growth and technological development (Bils and Klenow, 2000). From this perspective, education appears to produce entirely positive spillover benefits.

However, the issue is less clear when it comes to productive efficiency. Productive efficiency is producing the desired good at the least cost. The various equity arguments provided a rationale for government *financing* of education, but perhaps not government *production* of education. A tax system could be implemented to finance education via the government, but not produce it. Of course, this idea is the basis for the many voucher proposals that are currently being debated. The logic is that the private market will do a better job than the government in producing the good.

Empirical studies show that government-produced goods typically cost more than similar privately produced goods (Mueller, 1989). The theoretical reasons for this range from lack of competitive pressure to modeling the government as a revenue-maximizer. The evidence on school financing seems to support the notion of this supply-side inefficiency. Over the past 30 years, per-pupil expenditure has skyrocketed yet evidence of improved outcomes remains sketchy. Hanushek (1996) performed a meta-analysis regarding this topic, and concluded that above a baseline level "money doesn't matter" – that is, increasing per-pupil expenditure will not increase student performance. However, other researchers (Card and Krueger, 1996) disagree, and there is not widespread agreement on this topic. It is important to realize that there is not a simple input-output relationship here, and productive efficiency may not be currently maximized.

There are also questions regarding allocative efficiency. Allocative efficiency is reached when citizens are consuming the amount and/or quality of the good that they desire. When the good is a non-physical good like education, there are questions as to what "product" are the citizens demanding. The "demand for education" suggests a quantifiable product, like years of schooling. However, the number of school years

completed is meaningless without reference to the content and instruction received during those years. Citizens want certain levels of student performance and behavior, not necessarily a certain number of hours spent in school. In other words, households are naturally focused on educational quality, not quantity. Past research has also recognized the implicit focus on the quality, not quantity, of education received (Behrman and Birdsall, 1983).

Analyzing this problem years ago, Bradford, Malt, and Oates (1969) made the crucial distinction between C-outputs and D-outputs. The D-output is that output produced directly by the public sector, while the C-output is the output of primary concern to the citizen-consumer. For example, a local government may produce a number of D-outputs related to public safety: number of police cars used, blocks patrolled, number of police officers, etc. However, the citizen is concerned with a C-output, the level of public safety. This distinction between C-outputs and D-outputs holds for education as well. The local government produces D-outputs: teachers, buildings, computers, etc. However, the citizen is primarily concerned with the C-output, educational quality.

1.2.2 Defining Educational Quality

Specifically defining and measuring educational quality leads to some problems. Previous research has questioned the assumption that all households desire the same amount or level of educational quality (Schneider, et al., 1998; Lee, et al., 1996). Following this lead, educational quality is defined here as a vector with both objective and subjective components. The objective components are those that can be easily quantified such as test scores, teacher experience, and number and type of extracurricular

activities. Subjective components may include concepts such as student discipline, promotion of independent thought, and sense of community. Among objective components, there might be agreement about which components are valued. For example, most families would view an improvement in test scores or another gauge of academic performance as an improvement in quality. However, preferences for many other objective components will differ from household to household. For example, one family may care a great deal about the music program, while another cares more about the athletics.

A recent article by Kleitz, et al. (2000) supports this multi-dimensional view of educational quality. More importantly, Kleitz showed that preferences for academic excellence do not differ across race and income. This verifies that all households, regardless of socioeconomic status, have similar preferences for at least one objective component of educational quality – academic performance. This is an important discovery, as it eases the theoretical and empirical analysis of the education market.

Variations in preferences do exist for other objective components of educational quality, however, as would be expected. These differing preferences create problems when the good is publicly provided, as is the case for education. A common problem for all public goods and publicly provided goods is the resulting unhappy minority if preferences are not homogeneous (Glomm and Ravikumar, 1998). If preferences for the objective (or subjective) components of educational quality are heterogeneous, certain households in a given area will be unsatisfied. Adding in the subjective components of educational quality complicate matters even further. Now households may differ in preferences in subjective aspects of educational quality as well as the objective parts.

Households may value a certain subjective aspect of educational quality, such as student discipline, yet have difficulty in detecting and measuring this component (Schneider et al., 2000; Hoxby, 1998).

As one can see, the study of public education involves facing the same problems involved in the study of other public goods. Additional problems are created due to the fact that public education is a "C-output", and therefore difficult to measure. Fortunately previous research, specifically the work of Charles Tiebout (1956), provides a relatively straightforward way of analyzing this situation.

1.2.3 Tiebout Theory

In his landmark paper, Tiebout presented a pure theory of public goods. He focused on metropolitan areas and the competition among public good providers. Tiebout's theory predicted that consumers would sort into homogenous districts that best suited their taste for public goods. Therefore, Tiebout predicted that the market for public goods would be efficient and each person would consume his or her optimal level of the public good. In effect, each person would reveal their demand by "voting with their feet". By extrapolating his work to the case of educational quality, this theory suggests that an efficient market for educational quality already exists, and allocative efficiency has been obtained.

However, some of Tiebout's assumptions may be unrealistic (see Rubinfeld, 1987). Recent research has focused on these controversial assumptions and studied the theoretical conclusions after altering certain assumptions. For example, Hoxby (1999a) altered the original assumptions of full mobility and perfect information to produce an inefficient outcome. With the altered assumptions, public good providers could seek and

obtain rent, and this new outcome lowered the productive efficiency of the public good. Hoxby also showed how these altered assumptions can lead to a "crowding out" of quality, and lack of allocative efficiency as well. The Tiebout theory will be discussed further in Chapter Two, but it is important for now to note that this theory may produce an incomplete picture of the "market" for educational quality.

1.3 Econometric Issues

The key econometric issue in this analysis is the potential self-selection by states and regions. It could be the case that only states or regions with certain characteristics choose charter schools. If charter schools are effective in these regions, this result cannot be generalized to non-charter regions unless self-selection is controlled for. This sample selection problem is common in program evaluation studies. Care must be taken to choose the proper econometric specification for this potential problem.

Other econometric issues include selecting the proper specification for the state and regional choice to adopt charter schools. Some previous research exists to guide these decisions, though not much (see Hassel, 1999). Modeling the performance effects of charter schools is much more convenient due to substantial research into education production functions (see Hanushek 1979, 1986). An education production function can easily be altered to include effect of charter schools.

1.4 Empirical Issues

A primary empirical issue is selecting the appropriate outcome measure. Charter schools may be effective in improving some outcome measures, but not others. A set of outcome measures is most preferable. Previous research utilizes many different educational outcomes, such as test scores, dropout rates, student attitudes, attendance

rates, or college continuation. Other major research has studied the effect of education on labor market performance, the role of education in increasing job satisfaction, and the effect of education on voting behavior (see Hanushek, 1979, for references to all these studies).

Data limitations will be paramount in the selection of outcome measures and other variables. Due to their unique structure, charter schools do not have to report all the data that traditional public schools report. Data are virtually non-existent for charter schools in a few states. These data considerations will greatly affect the empirical structure of the performance analysis.

1.5 Existing Research on Charter Schools and School Choice

Though charter schools are a separate branch of school choice, it is useful to look at the overall school choice literature. Vouchers and public school choice represent different levels of choice and competition than do charter schools, but they are all based on the same premises.

Vouchers represent an extreme method of reforming the educational system. Theoretically, they come closest to simulating a private market for education. Vouchers seek to separate the government financing of education from the government production of education as discussed earlier. Vouchers usually consist of a check for approximately the average amount that the public school system spends on a child. Then, housheolds can use this check towards the tuition at a private school of their choice. Vouchers highlight the efficiency gains from the private sector that may exist in education.

There is a large literature on the effectiveness of vouchers. Unfortunately for purposes of analysis, there are only two major voucher programs in existence: Milwaukee

and Cleveland. The larger Milwaukee plan has been subject to much analysis and debate. Witte (1995) originally showed that the voucher program had no effect on student performance. Later, Green, et al. (1997), claimed that the voucher plan was increasing test scores for the voucher students. Later, Rouse (1998) analyzed the data and showed that voucher students were making small gains in math, but none in reading. In 1997, the voucher plan expanded to include religious schools. Analysis of the voucher plan became substantially more difficult after that since many of the students at the religious schools did not take the state-mandated tests.

The Cleveland voucher program started in 1995 and included religious schools. Metcalf (1998) studied the program and found no significant gains. However, Peterson, et al. (1999), evaluated the program and concluded that there were significant test score gains due to the program. The Cleveland program has been beset by legal challenges since its inception. Currently, the program is awaiting a Supreme Court trial that will decide its fate, and possibly that of all voucher programs. Clearly, future study along with further experimentation is needed to evaluate the effectiveness of voucher programs. The available data allow no generalizations as to how vouchers effect student performance.

Public school choice obviously highlights the outcome of greater choice. A wider variety of choices should provide greater parental satisfaction, and also some benefits of greater competition. These gains could be limited, however, as public school choice plans do nothing to change the total supply of schools in existence. Public school choice does offer more choices, but there are still barriers to entry in the market. The efficiency gains from public school choice plans are limited as well, since these plans do nothing to

engage the private sector. Choice plans may also lead to more sorting and produce an unequal distribution of benefits (Epple and Romano, 1998)

A variety of public school choice plans have been in place for years, ranging from magnet schools to inter and intra-district school choice. There is a substantial literature on this subject. However, early studies of public school choice rarely controlled for self-selection adequately (Henig, 1999). Better-structured and more recent studies show some success for public school choice programs, such as magnet schools. Crain and associates (1992) show performance gains for magnet school students in New York City. Teske and associates (1998) show gains for students in choice programs in East Harlem. Gamoran (1996) shows that public school choice is associated with improved outcomes. A recent paper by Cullen, et al. (2000) also shows how an open enrollment program benefits students. Overall, the literature suggests that public school choice leads to small but significant gains for choice students, and that it does not harm the students who do not opt out of their assigned school. Public school choice remains an attractive, though perhaps limited, option to reform public schools.

Charter schools represent another method to secure market-like outcomes. First, they have the potential of offering greater choice, since the vast majority of charter schools are newly created entities (a small minority of charter schools are converted from existing public or private schools). From this change in supply, greater competitiveness should result. Charter schools will compete with existing public schools for students and also for the taxpayer money that follows the student. Charter schools also provide hope for more gains in productive efficiency. When these schools are "chartered", specific performance objectives are part of the contract. If these objectives are not met, the

charter is not renewed. Now the public school is faced with an ultimatum of sorts: produce results or have the charter revoked.

Most of the studies on charter schools look at their effect on charter students.[4] Recent studies on charter school students show conflicting results. A California analysis of 17 charter schools showed no effect on student achievement (Wells, 1998). A study of Michigan charter students showed they were performing worse than their public school counterparts (Eberst and Hollenbeck, 2001). Conversely, a study of charter schools in Texas shows that charter schools have been effective in improving outcomes for minority and "at-risk" students (Texas Department of Education, 2000). A study of Colorado charter schools showed stronger performance on standardized tests for charter students (Colorado Department of Education, 2000). It appears that the effect of charter schools on their students may differ across states, though this is not conclusive.

A second branch of charter research studies the effect of charter schools on neighboring public schools. Teske and associates (2000) show that even though traditional public schools may not be facing financial pressure as expected, these schools do respond to charter schools in terms of educational quality. An Arizona study also showed that public schools were responding with "slight to moderate changes" in their schooling (Millman, et al., 1999). However, a study by Bettinger (1999) showed that student outcomes in competing public schools might actually deteriorate due to charter schools. Good and Braden (2000) summarize the research to say, "the competitive impact of charter schools on other public schools ... appears negligible."

[4] A list of major charter school research is available from The Center for Educational Reform (2000a).

Clearly, more research on both components of the charter school effect is needed. The existing studies offer little assurance as to the effectiveness or competitiveness of charter schools. The large and growing number of charter schools offers an opportunity to study this phenomenon.

1.6 Contents and Structure

This dissertation specifically contributes to the school choice literature in a number of ways. First, the question of why states pass charter legislation is addressed. This is a very interesting political economy question, with a number of local and state factors most likely contributing to the decision. This effort expands on previous research that studied the charter school choice at the state level. Previous research by Hassel (1999) suggests that certain state characteristics lead to the passage of charter school legislation. Here, a number of specific factors are tested for their relationship with the passage of charter legislation. The modeling options for the state choice also include a duration model to account for the time-dependent choice.

Second, the question of why local communities adopt charter schools is analyzed. This is also an interesting political economy question, though the decision-making structure is much different here. In this analysis, an altered Tiebout model is used to determine the charter school choice at the regional level. This application of the altered Tiebout model has further benefits as to describing the structure of regional decision-making. This section also discusses the legitimacy of the Tiebout model and its use in public economics. This model determines the specific factors that lead a given region to enact a charter school. It also discusses potential mechanisms as to how these factors affect the local charter decision.

Third, this dissertation explores the performance effects of a charter school on different educational outcomes. This step is crucial for future public policy analysis regarding charter schools. The mechanisms between charter schools and educational outcomes are thoroughly described and discussed. Further, this step also contributes to a wide body of previous research addressing which factors affect educational outcomes. This third step of the analysis provides comprehensive results as to how charter schools and other variables affect different educational outcomes.

In sum, this dissertation represents a thorough and complete study of the charter school concept. This paper addresses the many questions involved with charter school research: how and why are they selected, and what impact they have on educational outcomes. By achieving these goals, this dissertation represents a sizeable contribution to the school choice literature and the continuing debate on how to reform America's public school system.

The structure of the dissertation is as follows. Chapter Two addresses the theoretical issues and concerns by developing models for the state and local decision to adopt charter schools. This chapter also builds upon previous research regarding education production functions, and models the effect of charter schools on educational outcomes. Chapter Three presents the primary econometric issues involved with these specifications, focusing on the issue of self-selection. Different techniques for controlling for self-selection are discussed, and the appropriate method is chosen. Chapter Four describes the data and corresponding empirical issues that surround this analysis. Chapter Five presents the results of the empirical analysis. Chapter Six presents the conclusions and general remarks.

CHAPTER TWO

THEORETICAL ANALYSIS

2.0 Introduction

This chapter develops the theoretical framework for the charter school concept. It develops models for the impact of charter schools on regional educational quality, the regional choice to adopt a charter school, and the state level decision to pass charter legislation.

2.1 Effects of a Charter School

Charter schools are designed to bring a greater degree of accountability to public schools. They look to improve upon the current system of public schooling by making schools responsible for specific student performance objectives. Due to their special nature, charter schools may provide a higher level of educational quality for their students than traditional public schools. The presence of charter schools may also affect other private and public schools in the surrounding area. The effect of charter schools can be thought of in two initial categories: within-school effects and spillover effects on neighboring schools. The within-school effects consist of the effects that charter schools have on their own students. The spillover effects are effects on neighboring schools due to the increased competition brought about from charter schools.

2.1.1 Within-School Effects

Charter schools can provide either higher, lower, or the same educational quality as neighboring schools. However, the structure of charter schools holds them accountable for the achievement of their students. Schools typically use a number of

different assessment techniques to measure improvement in student performance. For example, seven assessment techniques are common to schools in most states: standardized testing, which includes criterion-referenced and norm-referenced assessments, performance assessments, student portfolios, student demonstrations, parent satisfaction surveys, student interviews, and behavioral indicators.

These assessments should serve to guide the charter school towards an increased level of educational quality. This is one of the main hypotheses of charter advocates, that they will produce higher educational quality than traditional public schools. A charter school's survival depends on improving upon these components of educational quality, whereas a traditional public school's does not. If a charter school is to be successful and continue operating, it must produce positive changes in outcome measures.

As mentioned in the last chapter, educational quality is a vector of objective and subjective components. Charter schools are mainly designed to improve upon objective performance measures, but many assessment packages include subjective components as well. From a public policy perspective, determining which of these components are changing is a paramount concern. If charter schools attract students with more free time and less strenuous academic work, it would be hard to view this as an increase in educational quality. This is especially true in light of the research by Kleitz et al. (2000), showing that all households value academic excellence.

Though charter schools are designed to improve student performance, it is also possible that charter schools could have no effect on performance. This could happen for a variety of reasons. It may be that the assessment package of the school is relatively easy to satisfy and does not maximize student performance. Also, even though charter

schools are supposed to be free of much regulation, the actual charter could contain restrictions on curriculum and class structure, thereby constraining any experimental instructional techniques. In addition, a charter school could simply not succeed in its mission. It may turn out that the charter school can do no better than the traditional public school, that the public schools are simply doing the best possible under the given conditions.

A charter school could conceivably lower student performance as well. A charter school may be started with the best of intentions, but the staff and administration may lack the necessary experience to start and operate a new school. Some schools may even be subject to fraud and mismanagement, as has been discovered in a few cases (Center for Education Reform, 2000a). A further difficulty could be the lack of start-up funds. This was cited as a major difficulty by almost 50% of those people involved in starting charter schools (U.S. Dep. of Ed., 2000b). This is especially true for a newly created entity as compared to a converted pre-existing public or private school. This funding crunch could limit instructional facilities and have a negative impact on student performance.

One other factor is that of peer effects. The presence of a charter school will involve sorting, and this could take place on the basis of student ability. Once sorting has taken place, a charter school could then have either a positive or negative impact on its students simply due to peer effects. This change could be independent of the quality of instruction that the students receive.

Overall, it appears that charter schools could lead to a wide variety of changes in their students' performance. From a theoretical perspective, a reasonable hypothesis is

that charter schools should have a positive impact on outcome measures for the students attending them. That is what charter schools are designed to do: improve student performance through accountability. Though there may be difficulties and limitations, the motivations pushing towards higher educational quality appear to outweigh the negative factors. The biggest threat for a charter school is extinction if the performance objectives are not met. This extreme pressure suggests that charter schools will struggle and persevere to meet their performance objectives, and provide a higher level of educational quality than traditional public schools.

From an empirical perspective, evidence on the effectiveness of charter schools is inconclusive. The review of charter school research in Chapter One suggested the effect of charter schools on their students varies from state to state. Also, effects of the competitive relationship between charter schools and neighboring schools remain unidentified.

2.1.2 Competitive Spillover Effects

A main hypothesis of the last section, that charter schools will provide higher educational quality than traditional public schools, leads naturally to the following: that public schools (and possibly private schools) may respond to this new competition from charter schools.

Charter schools and traditional public schools compete for students. Perhaps more importantly, school administrators compete for the funding that follows the student. The system that most states follow is that if a student attends a charter school, that school is given the average per pupil expenditure for a student in that state. Consequently, for each student that they lose, the public school will have that amount subtracted from their

budget. What results is a direct competition for funding between charter schools and regular public schools. This competition for dollars, if it is indeed taking place, will be the engine that drives the competition for students. This is similar to the competition for students and dollars when public school choice is employed.

The question of whether schools compete for funding depends on their financing structure, and charter schools and traditional public schools differ in this regard. The financial structure of charter schools is radically different than that of regular public schools for two main reasons. First, their budget is directly dependent on their level of enrollment. Second, in most cases the school administrators have a great deal of control over spending. This is in contrast to traditional public schools, where the local budget is often set by the central agency, and teacher salaries may be paid according to a schedule. All this suggests that, theoretically, charter schools will aggressively pursue both students and dollars.

Traditional public schools may choose to directly compete for funding by altering educational quality, but may also pursue other options. The funding issue is a primary concern, though it doesn't always work as it should in theory – a public school does not always lose funding when they lose a student. Research shows that public schools may be able to retain their funding due to legislative compromises or by other means (Teske, et al., 2000). The funding formula is complicated, and is a mix of local, state, and federal dollars. If a public school loses funding from one area, it may be able to increase funding from another area.

However, there may be non-financial reasons for a public school to compete. First, there could be concern about the school's reputation in the community. Second, the

school might seek to retain the best students and teachers. Third, a public school may compete in order to keep other charter schools from starting in that area.

All this suggests that competition may be a viable response from public schools. If a public school does choose to compete, it is assumed that they will do this by increasing educational quality. They may do this by hiring better teachers, providing more services to students, or other means. This type of competition is the kind desired by advocates of charter schools and school choice in general. Schools may also compete in terms of non-academic objective components of educational quality. For example, a school could invest in new football uniforms, new paint on the walls, or better cafeteria food. A school may also alter some of the subjective components of educational quality, though these are, of course, hard to measure.

Public schools also have other methods of responding to charter schools besides competition. Hassel (1999) lists five such options: 1) use the courts to derail or restrict charter schools, 2) use subsequent legislation to derail or restrict charter schools, 3) use other bureaucratic measures to sabotage charter schools, 4) respond to fiscal stress not by improving but by threatening to cut back on popular programs, and 5) ignore or peacefully coexist with charter schools.

The first two options represent political responses to charter schools. These political responses are not theoretical conjecture, but have in fact been documented (Loveless and Jasin, 1998). The legislation governing charter schools is critical for their development. Restrictive charter legislation or local policies can hamper both the development and creation of charter schools (see Hassel, 1999). The third option represents more underhanded techniques, such as harassment or concealing student

records. Again, these instances have happened and been documented, and this is a viable if unethical response for public schools (Loveless and Jasin, 1998).

The fourth and fifth options represent some interesting applications of economics. The fourth option is reminiscent of the "Bureaucrats Versus Voters" hypothesis put forth by Romer and Rosenthal (1979). In this theory, the local school board is able to circumvent the preferences of the voters by offering extreme packages. For example, voters may be forced to choose between an inflated budget and a barebones budget, when they actually prefer an average-sized budget. In a similar way, public school officials can use funding issues as leverage against charter schools. They can pit popular programs against charter schools as a way to diminish their attractiveness. It is hard to interpret whether there are real tradeoffs involved or this is more political gamesmanship.

The fifth option may be a result of the relationship between public goods and preferences. In areas where preferences are heterogeneous, the public good may be preferred by the majority but leave a minority dissatisfied (Glomm and Ravikumar, 1998). In the median voter model, the distribution is more extreme with only the median voter being on his/her demand curve (Borcherding and Deacon, 1972). In the case of public schooling, the level of educational quality provided by public schools may satisfy the majority of households while leaving an "unhappy minority". If charter schools are designed to serve these populations, then sorting will take place according to preferences. If the system works in this way, public schools may not respond at all; they will be happy to unload their "unhappy customers" on charter schools.

Public schools then have three main options in response to a charter school: 1) they may compete for students by increasing the level of educational quality supplied (or

level of certain components), 2) they may pursue political or nefarious options to diminish or limit the effectiveness of charter schools, or 3) they may not compete at all, if charter schools are serving minority populations that aren't satisfied by traditional public schools.

The first option is the main assertion made by those in favor of charter schools: that the competition will increase educational quality in neighboring public schools. The second option is more of an unintended side effect of competition, where sellers try to sabotage each other. The third option is intriguing, suggesting that the presence of choice by itself may better serve the public, regardless of any competitive spillover effects.

Some initial predictions might be drawn from research on how public schools respond to public school choice. Public school choice is in some ways similar to charter schools for the obvious reasons of choice and competition. As mentioned in Chapter One, the results are mixed, but overall point to positive outcomes. Some research shows small, but consistent gains for public choice students (Lankford, 1995; Cullen, et al., 2000). Other recent research contends that public school choice substantially benefits students (Hoxby, 1999b). Unfortunately, the empirical evidence cannot provide any more guidance for generating hypotheses.

Charter schools may also have an effect on neighboring private schools. In fact, some charter schools are converted from previously existing private schools. Newly established charter schools may also draw from the private school population. When charter schools draw from private schools, their regional impact includes competition with both public and private schools.

How will private schools respond to competition from charter schools? Private schools are not competing with charter schools for the purse of public funds, yet they are still competing for students and the tuition dollars. When a student leaves a private school to attend a charter school, there is a direct loss of revenue for the private school. Tuition and endowments are the major forms of revenue for a private school. If a private school does lose a student to a charter school, they may not be able to reclaim lost funding by other means as a public school may. Peacefully co-existing, if in fact the private school is losing students, is not a realistic option. Private schools may pursue political options to restrict charter schools, or may in fact increase educational quality as a means of direct competition. Clearly, private schools will respond in some fashion if they are losing students to charter schools. Unfortunately, no research has been performed on the relationship between private and charter schools.

2.2 Unit of Analysis

The next step is to analyze the relationship between charter schools and neighboring schools. Charter schools draw their students from neighboring schools and vice versa. When trying to determine the impact of charter schools, it is important to look at the cumulative student population being served. Analyzing only the charter school students or only the public school students (and/or private school students) does not give a complete picture of the charter school impact. All students attending private, public, and charter schools in the area should be included in the analysis.

A further issue is that of students who are not currently attending any school. Charter schools are sometimes designed to serve special populations, populations that may have already dropped out. For example, Arizona has a charter school for pregnant

teenagers. Therefore, it is conceivable that a charter school may draw from the group of students who have already dropped out of school. Any analysis should then include all students of school age in its population.

Therefore, the total number of school age children in a given region is the appropriate unit of analysis. A major benefit to a regional analysis is that it avoids the problem of correcting for student sorting. For example, let's assume a charter school opens and that a group of high-performing students withdraws from the public school and enrolls at the charter school. All else being equal, average test scores will decrease in the public school and increase in the charter school. However, the average for the region may stay the same. In this example, charter schools would have no real effect except for sorting. Studies looking at the two separate groups would have to control for the student self-selection. A regional level of analysis avoids this problem by using a wider scope.

Regional analysis answers some questions but not others. Previous research has studied the components of the charter school effect separately: first, the effect of charter schools on their own students, and/or second, the effect on neighboring schools (Bettinger, 2000). A regional analysis instead studies the overall impact of a charter school. A weakness is that it does not specify which individual components are producing any possible change. This is a key issue that will be discussed in later chapters.

An important issue is clearly defining the limits of a regional area. In many states, charter schools are under the umbrella of the local school district. In these cases, only students from that school district can attend the charter school. In other states, a charter school forms its own pseudo-school district, one without any geographical base.

Theoretically, students from all over the state can attend this type of charter school. Realistically, only students from a certain geographical area will attend this school. Determining the boundaries of this geographical area is difficult. This decision will ultimately be a function of household wealth (to facilitate travel costs), household preferences for educational quality, and the opportunity cost of leisure. This assessment will be different for different families, and the boundaries of the regional area will be dependent on the individual household decisions. Specifically defining the boundaries of a region is essentially an empirical question and is addressed in Chapter Four.

2.2.1 Potential Regional Effects

Combined with the assertions previously made, some initial conclusions can be drawn for the effect of charter schools in a regional area. Putting together two positive hypotheses, that charter schools will increase educational quality for their students, and that neighboring schools will respond to this by increasing educational quality, the conclusion is simple – charter schools will improve the overall educational quality for the region.

An interesting alternative scenario emerges if the charter school is ineffective in its mission – if it does not improve educational quality for its students. This leads to the intriguing question of whether a public school or private school responds to an inferior charter school. An initial answer might be no, but it is a more complicated issue, and the answers may be different for public or private schools.

The key problem is the time lag necessary for citizens to perceive educational quality. When a charter school opens, there is no measure of its level of educational quality. Households may choose a charter school for its potential, "gambling" that it will

be a better fit for their preference for educational quality. So initially, neighboring schools may lose students regardless of the quality of the charter school. A short-run response for neighboring schools would be defensive. If a public or private school loses students, they will respond in the various ways as described earlier.

Over the long run, the level of educational quality in the charter school will become observable. Then, households can re-select either a public, charter, or private school based on this new information. If a charter school is inferior, it will lose students and may eventually be terminated.

A charter school could also have no overall effect on educational quality within the region. This could be due to the ineffectiveness of the charter school, or due to the fact that neighboring schools could pursue different options other than competition. A charter school could conceivably lower regional educational quality as well. This could happen if it fails in its mission, and the neighboring schools offer no response or deteriorate in quality as well.

2.3 Outcome Model

In order to determine the actual effect of a charter school, the components of educational quality must be measured. Then the presence of a charter school can be related to the different levels or changes in the outcome measures. Typically, outcome measures of student performance, such as student academic performance or student behavior, are used to evaluate programs. The use of outcome measures in evaluating educational quality presents some problems. First, some outcomes are difficult to measure. Test scores are designed to measure student knowledge and comprehension. However, test scores may be increased if teachers "teach for the test". In this case, an

increase in test scores will not be met with an increase in student comprehension. Test scores may also be viewed as a measure of student ability, though value-added test scores can address this problem. Second, some outcome measures have vague interpretations. For example, an improvement in attendance rates says nothing about whether or not the students are learning any material. Outcome measures like this represent different measures of educational quality, and are subject to interpretation.

Beyond these problems, there will be varying preferences for the other objective components of educational quality. An increase in one type of output measure may be desired by one household but not another. For example, outcome measures such as the number of sports offered or the number of art classes offered will be desired in different quantities by different families. In addition, the subjective components cannot be accurately measured in most cases. The task of selecting appropriate outcome measures is difficult and will be taken up in a later chapter.

The next step is to determine what other factors in a region will affect outcome measures. By discovering and controlling for these other factors, the true effect of the charter school on selected outcome measures can be ascertained. This entails developing an overall theory of factors affecting outcome measures, with charter schools as one possible candidate.

The most common approach is to develop an educational production function. Hanushek (1979) provided a thorough analysis of the necessary components of this production function. The general conceptual model is:

$$OUTCOME = f(B,P,S,I),$$

where OUTCOME is an outcome measure or set of outcome measures, B is a vector of family background influences, P is a vector of peer influences, S is a vector of school inputs, and I is a vector of innate abilities. This production function attempts to represent all possible influences on student outcomes.

Existing research highlights different aspects of the production function and its relationship with student outcomes. For example, Jaggia and Kelly-Hawke (1999) conclude that family background and the stability of the community are the main factors affecting student performance. Some research has focused almost exclusively on the family and community component, even wondering if schools "make a difference" at all (Summers and Wolfe, 1977).

The effect of school inputs on student performance has been a controversial and highly studied aspect of the production function. As mentioned in Chapter One, much research has focused on the school inputs, specifically class size and per pupil expenditure, as the crucial factors for student development. There is still widespread disagreement among researchers about the impact, if any, of varying levels of school resources on student outcomes. (Hanushek, 1986, Card and Kruger, 1996)

Innate abilities represent a much more difficult component to measure. Previous test scores and student performance could be thought of as a proxy for innate ability. To this extent, many researchers have used a "value-added" approach, by studying how test scores change over time in response to different interventions (Bettinger, 2000). Peer influences are also difficult to measure, though they are often included in theoretical research (Epple and Romano, 1998). A few empirical studies have been able to address

peer effects by utilizing micro-level student data (Zimmer and Toma, 2000; Henderson, Miezkowski, and Sauvageau, 1978).

These four components represent a comprehensive educational production function. If accurately measured, these components should be able to explain variation in student outcomes. Therefore, along with the possibility of a charter school, a regional educational production function takes the form of:

$$OUTCOME = f(B,P,S,I,C)$$

Where C represents the presence of a charter school or not.

The educational production should determine the effect of a charter school on regional outcomes. However, there may be the issue of regional self-selection. For example, if charter schools tend to develop in urban areas and are effective there, this success may not necessarily translate to rural areas. It may be that areas with certain needs or characteristics are more likely to choose charter schools, thus skewing the outcome results. In order to account for this potential problem, the regional choice to adopt a charter school must be analyzed. Then this information can be used to account for any self-selection in the outcome model.

2.4 Regional Choice Model

The regional choice to adopt a charter school is primarily a political economy decision. It is by definition a regional choice since it involves parents, students, teachers, and often the local board of education. Therefore, the decision to adopt is a collective choice based on a wide variety of factors. For now, a given area or region is assumed to be making the decision regarding whether to enact a charter school. Determining the boundaries of a region will be discussed in the next chapter.

Before narrowing the analysis to a specific model, it is helpful to discuss the large number of factors that may affect the charter decision. A categorical list includes the following:

1) Current educational quality of the regional public school system, such as student expenditure and class size
2) Structure of the local school finance, reflecting the degree of subsidization in the state
3) Minority student populations
4) High-cost students, such as disabled or special education students
5) Socioeconomic characteristics, such as income and housing
6) Regional demographics, such as household characteristics
7) Presence of private schools
8) Local political factors, such as percentage Republicans or Democrats
9) State factors, such as general state characteristics and the type of charter legislation passed by the state

One method of analyzing the above list of factors would be to study each factor and see why it might lead to the adoption of a charter school. However, this type of analysis makes an "a priori" assumption about the current public educational system: that public schools cannot achieve allocative efficiency when certain factors or characteristics are present. Allocative efficiency exists when each household is consuming the level of educational quality that they prefer (Schneider et al., 2000). A major assertion of this section is that charter schools represent a non-equilibrium outcome in the "market" for public education. In other words, charter schools would not be needed if the market for

educational quality was efficient and all preferences were satisfied. Of course, this assertion rests on the assumption that public education can achieve allocative efficiency under certain circumstances. The basis for this particular assumption is the original Tiebout model presented below. This is an important point and will be developed more fully in the following section.

Therefore, certain factors from the above list will be analyzed in the context of how they affect the local market for educational quality. The presence of certain factors - heterogeneous student population, high-cost students, socioeconomic characteristics, and regional demographics – might only lead to the adoption of a charter school if they "disrupt" the market for educational quality and leave preferences unsatisfied.

To think of it differently, are charter schools something that is needed in every community, or only in communities with certain characteristics? Are charter schools needed due to "global" failures in the public education market, or are educational markets not functioning properly in certain areas? And if so, then why do the characteristics of these regions cause problems in the local education market, leaving preferences unsatisfied?

Upon further study then, the factors affecting the regional choice to adopt a charter school fall into four general categories: the local education market (in terms of public educational quality), presence of private schools, politics, and state-level influences. Each category will now be studied in turn.

2.4.1 The Local Education Market

The local education market is analyzed by initially considering only public education. Private schools will be discussed later in this section. For now, it is enough to

suggest that private schools may be a by-product of allocative inefficiency within the market for public education.

The local education market can be theoretically split into supply and demand components. The suppliers are the local public schools and the demanders are the local households. The "good" being supplied is educational quality as was discussed earlier, and the "price" is usually represented by a tax-price paid through local taxes. Though separating the supply and demand factors is nearly impossible empirically, this framework can provide some useful theoretical notions.

Developing a theoretical market for local educational quality has its difficulties, though. An initial problem with this framework is the subjective components of educational quality. Items such as "discipline in the classroom", may be important to households but also very difficult to quantify. Without having a direct choice mechanism in place, it is difficult to determine what households are actually demanding. This problem of preference revelation is common to research studying the demand for local public goods.

The "price" for educational quality is another difficult issue. There is obviously no direct price since public schools are free to all students. A tax-price (usually paid through local property taxes) is often used as a proxy, but this variable has problems. First, if the tax-price is paid through the local property taxes, different households will be paying different dollar amounts for the similar educational quality. For example, a small town with one public high school will draw varying amounts of the tax-price from households of different income levels, and students there will receive similar educational

quality. Second, there may be supply-side inefficiencies where increasing the tax-price paid may not result in higher educational quality.

2.4.1a Demand-Side Approaches

Many methods exist for revealing the citizen demand for public goods. One method is through the use of surveys. Researchers simply ask householders what their preferences are for the public good. This approach has been specifically used in studying the demand for education (Bergstrom, Rubinfeld, and Shapiro, 1982). The obvious criticism for this method is that the questions are hypothetical; consumers do not have to verify their preferences through payment.

Another popular demand-side approach is the median voter model. Usually, the preference of the median voter is a function of household income, household tax-share, and other demand variables (Bergstrom and Goodman, 1973). Other demand-side factors usually include the poverty level, racial heterogeneity, and similar socioeconomic characteristics. These factors are all common in papers using this approach to study the local demand for education (Barlow, 1970).

The main difficulty with the median-voter model is separating the many potential influences of a factor into either the category of supply or demand. For example, income levels may affect educational quality through both the channels of demand and supply. If empirical results show a positive relationship between income and say, test scores, it is impossible to know the exact structure of this relationship. A demand-side argument would say that higher income households demanded a higher level of educational quality, and public schools responded, thus leading to higher test scores. A supply-side argument would say that higher income households have better-behaved, more motivated children

that are easier to educate, thus leading to higher test scores (holding educational quality supplied constant). The problems of separating the factors affecting supply and demand functions for local public goods have been documented in the literature (Bradbury, et al., 1984). Attempts have been made to separate the two, but the results do not seem convincing to this author (Baum, 1986; Schwab and Zampelli, 1987). These papers still use the tax-price as a proxy for the price of local public goods. The fact that households pay varying amounts of this "price", and that the tax-price may not always reflect the true cost of the public good make this approach unappealing (Mueller, 1989).

A more comprehensive demand-side approach begins with the work of Charles Tiebout (1956). Tiebout developed a pure theory of public goods that lead to allocative efficiency. The original Tiebout model contained a number of assumptions:

1. Full mobility of all citizens.
2. Full knowledge of the characteristics of all communities.
3. Availability of a range of community options spanning the full range of public good possibilities desired by citizens.
4. Absence of scale economies in producing the public good and/or smallness of the optimum scale of production relative to the population size.
5. Absence of spillovers across communities
6. Absence of geographical constraints on individuals with respect to their earnings

Tiebout's theory predicts that citizens would sort into a large number of areas, where preferences for the public good are the homogeneous in each area. If these

assumptions are met, Tiebout predicted that the market for local public goods would have allocative efficiency in consumption.

The core of Tiebout's theory is that citizens will reveal their preferences by "voting with their feet". By using this as a choice mechanism, the Tiebout method circumvents the problems of other demand-side approaches. Instead of hypothesizing about what factors affect demand, Tiebout uses citizens' behavior as a way of reflecting their true preferences. There is no need for a "median-voter" since all the voters in the area have the same preferences. By applying the Tiebout theory directly to that of public education, some interesting hypotheses develop.

In terms of public education then, each region should be supplying exactly the level of educational quality that the citizens in that region prefer. If a consumer was unhappy, he would simply "vote-with-his-feet" and move to a different area. According to this theory then, the market for educational quality in the public system should exhibit allocative efficiency. If this theory is true, it naturally leads to the question of why charter schools are needed. If public education effectively serves the citizens in every area, charter schools would not be needed since all preferences are satisfied. The development of charter schools then suggests that Tiebout's theory may not be an accurate representation of reality – or in other words, some of the theory's assumptions may be suspect (also see Rubinfeld, 1987).

This assertion is also solidified due to the existence of private schools. Again, private schools would not be needed in a Tiebout world (see Vasquez and Seaman, 1985). The current presence of private schools, along with the fact that they have co-existed with

public schools since the development of public education, further suggests that Tiebout's theory is not a fully accurate representation of either the present or the past.

Fortunately, recent research has revealed some of the problems with Tiebout's model and is striving to develop an altered Tiebout model that more accurately represents the workings of public goods. Specifically, recent research has focused on the combination of Tiebout and politics in the production of local public goods (Nechyba, 1997; Epple and Romano, 1998). This type of research recognizes that there are political incentives to the local public good providers, yet salvages much of the Tiebout theory to explain consumer behavior.

Hoxby (1999a) developed a detailed version of an altered Tiebout model. The Hoxby model altered some key assumptions and replaced them with more realistic assumptions - for example, replacing perfect information and full mobility with imperfect information and partial mobility. Another distinguishing feature of the model is that political incentives are included. Agents are modeled as rent-seekers. This assumption has its origins in the public choice school of thought (Niskanen, 1971). However, before analyzing how this altered Tiebout model affects the market for educational quality, it is necessary to pursue some background theory on public goods and publicly provided goods.

2.4.1b Public Goods, Publicly Provided Goods, and Efficiency

Education is a good that offers private returns to the consumer. This could be in terms of higher wages or improved skills. However, the consumption of education also generates externalities. A better-educated society should be better off than a poorly educated one; this could be in terms of less crime and more economic development, for

example. Without government intervention, it is likely there would be still be consumption of education. In terms of efficiency, the level of consumption might be sub-optimal; everyone could be made better off by additional transactions. These externality effects of public education provide a rationale for government financing of the good. For K–12 public education in the US, it is completely subsidized and free to all to students. Higher education is slightly different as it is partially subsidized by both state and federal tax dollars. K-12 education may be completely subsidized due to additional concerns about equity.

Education has public good properties in the sense that it produces externalities that will impact society, but is not a pure public good. The marginal cost of educating an additional child is greater than zero, and there is also no technical difficulty in excluding certain individuals. In this sense, education could be viewed either as an impure public good, or a private good that generates externalities. The externalities generated by education are non-rival in consumption – one person's consumption of the externality does not reduce another's consumption. Mueller (1989) also showed the similarity between public goods and externalities in terms of the Samuelson efficiency conditions.

For externalities, the market does not usually provide an efficient outcome because consumers set the good's marginal cost equal to their private marginal benefit. They ignore the social benefits of the good when they make their decision. Since education has both private and social benefits, efficiency will be obtained when total marginal benefits (private and social combined) equal the marginal cost.

2.4.1c Tiebout and Efficiency

Tiebout's original theory showed that the market for public goods would be efficient under his assumptions. The next step is to determine if the Tiebout theory will work for an impure public good, in our case public education.

Hamilton (1976) showed that if public education is funded by a property tax and the original assumptions of the Tiebout model still hold, private allocative efficiency will be obtained. Zoning is a crucial ingredient to Hamilton's model. Zoning allows the complete sorting by preferences. Zoning effectively turns the local tax-price into a head tax, as it was originally in the Tiebout model.

However in order to achieve efficiency, the spillover effect must be internalized as well. Hoxby (1996) showed that households would also sort Tiebout-style on the basis of human capital spillovers. In other words, households are aware of the social benefits that come from living near other educated households and include this information in their decision-making process. In essence, households will sort on the basis of the entire "package" of benefits that an area offers through its public education system. This package contains both the private benefits and social benefits to public education in a given area.

With a local property tax system, efficient zoning, and the original Tiebout assumptions, the efficiency conditions for public education will be met. Each person will determine what level of educational quality to consume by theoretically setting the marginal social benefit equal to their marginal cost. The next step is to see how the altered, and perhaps more realistic, Tiebout model affects these efficiency results.

2.4.1d Allocative Efficiency in the altered Tiebout model

In the altered Tiebout model discussed earlier, Hoxby showed that complete sorting will not take place. Hence, preferences will be heterogeneous in some areas, and allocative efficiency will not be obtained. If this is true, it leads to the hypothesis that in areas where certain factors cause allocative inefficiency, charter schools will be more likely to develop. The next question is whether this heterogeneity of preferences will be uniform across all regions, or more concentrated in some areas than others. The specific ways in which factors affect allocative efficiency, and in turn the adoption of charter schools will now be analyzed.

First, Hoxby's earlier work (1996) showed that liquidity-constrained households may have unsatisfied preferences for educational quality. Low-income households may not be able to pay the tax-price in areas that match their preferences for educational quality; hence, they will not be able to effectively sort into districts that satisfy their preferences. Therefore, charter schools may be more likely to develop in low-income areas where preferences for educational quality might not be met.

Second, a movement away from local property taxes towards centralized school finance will weaken the incentive mechanisms in the Tiebout model, as Hoxby's altered model and other research shows (Glaesser, 1996). With the bond between local tax-price and educational quality weakened, local control is undermined and preferences for educational quality may not be satisfied (for discussion of this issue, see Hoxby, 1996). Therefore, charter schools may develop in areas with a high degree of centralization in finance.

Other factors may affect productive efficiency through supply-side considerations. Tiebout did not develop a complete theory of supply, so to speak. Rather, Tiebout predicted that profit-seeking entrepreneurs would compete to provide local public goods, thus providing the desired goods at the lowest average cost.

2.4.1e Supply-Side Considerations

Tiebout's theory did not put much emphasis on how public goods or publicly provided goods would actually be supplied. He assumed that cost conditions would be the same within a given area, but may vary from region to region. For example, if water is the publicly provided good, it may be more difficult to produce in some areas as compared to others, but within each area cost conditions would be the same.

The public provision of education complicates issues on the supply-side. Some areas may have higher cost conditions in general. This would not generally provide problems in the original Tiebout model. However, Hoxby's altered model shows that an area with high-cost conditions (where the cost of educating a student is above-average) can undermine the productive efficiency of the public education. Productive efficiency is defined as producing the quality of education preferred at the least cost.

High-cost conditions cause problems for two reasons: first, citizens do not generally have perfect information about cost conditions, and second, public good providers are modeled as rent-seeking in her model. Since citizens do not know exactly how much it costs to educate a particular student, rent-seeker bureaucrats can use the higher-than-average cost conditions to inflate the budget. This may also "crowd out" quality, as Hoxby showed. Therefore, any factors that adversely affect local cost conditions potentially undermine productive efficiency, and may leave citizens with

unsatisfied preferences. This lack of allocative efficiency may then increase the likelihood that an area with such conditions will adopt a charter school.

The factors that adversely affect local cost conditions will be mixed and complex. A high percentage of high-cost students, such as special education students, will surely drive up overall costs for an area. General socioeconomic and demographic conditions will also affect the cost conditions for each area. A heterogeneous student population could also increase costs, because a wide variety of instructional techniques may be needed. In short, cost conditions depend on the characteristics of the student body and area population, and the area's general demographics.

2.4.1f Summary of Local Education Market

This section showed certain area characteristics cause either allocative inefficiency and/or productive efficiency in the regional educational market. The main factors are the presence of liquidity-constrained households, the centralization of school finance, and above-average cost conditions. In areas where these characteristics are present, citizens are not consuming the level of educational quality that they desire. Hence, these areas may select charter schools as a way to obtain the desired quality.

2.4.2 Private Schools

The presence or possibility of private schools can certainly affect the choice to adopt a charter school. Working from the altered Tiebout model, private schools will serve the portion of the population whose preferences are not being satisfied. This can in turn affect the charter school decision. If all population segments can be satisfied through the assortment of public and private schools available, charter schools may not

be needed. If all preferences are not satisfied, this may increase the likelihood that an area will adopt a charter school.

One exception to this deals with the financial ability to pay for private school. A low-income household may have a very strong preference for educational quality, but be unable to afford private school. This type of situation may also then increase the likelihood of a charter school being created.

Generating hypotheses as to how the presence of private schools will affect the charter school decision is difficult. On one hand, if students are unsatisfied with public schools but are satisfied in private schools, this may lessen the demand for charter schools. However, if households with these preferences view charter schools as substitutes for private schools, the hypothesis may change dramatically. Households now may desire the tuition-free charter schools if they provide similar educational quality to the private schools in the area.

2.4.3 Politics

The political environment will also play a role at the local level. Charter schools often need the approval of the local board of education to open. Therefore, the political tastes of the residents will be important for the local decision. Political tastes include general conservative and liberal tendencies, and also official membership in a political party. Beyond formal politics, there must be a critical mass of area residents to start a charter school. The general political tastes of the area may ultimately determine whether a charter school gets enacted or not.

At the state level, research has shown that charter schools tend to be favored by Republicans more so than Democrats (Hassel, 1999). Therefore, a reasonable hypothesis

would be that Republicans would also support them at the local level. While politics is a complicated issue, some measure of the political leanings of a community can provide useful information for this model.

2.4.4 State Factors

There may also be state-level influences that affect the regional choice. For example, the type of charter legislation passed at the state level may have a direct effect on the regional decision. Charter legislation is widely different from state to state. Some states give heavy financial and administrative freedom to charter schools, while other states may allow charter schools, but regulate them in such a way as to dissuade districts from starting them. For example, Arkansas passed its legislation in 1995, but only 4 charter schools have been started in that state. The blame falls on the restrictive charter legislation passed in that state; restrictive because any charter schools are regulated much the same as traditional public schools. Studies have been performed that analyze the "strength" of state charter laws; strength is defined as an index of ten major components that contribute to charter school development (Center for Educational Reform, 2000c). The strength of the law passed should have a relationship with the number of charter schools started in that state. So while the regional choice may initially appear to be independent of the state choice, the issue is more complex than it appears.

Other general state factors may also skew the regional choice. It could be that all areas in some states are fundamentally different than areas in other states, due primarily to state-level influences. For example, all regions in Mississippi may be fundamentally different than those in California. They could be different in terms of historical or

geographical factors that are difficult to detect. These intangible or hard-to-measure differences in each state may also affect the regional choice.

2.4.5 Choice Model

To summarize, a region chooses to enact a charter school based on the following function:

$$REGION = g\,(LOW, CENT, HCOST, PRIV, POL, STATE)\,,$$

where the district decision is a function of its percentage of low-income households (LOW), the degree of centralization in school finance (CENT), above-average cost-conditions (HCOST), the presence of private schools (PRIV), local politics (POL), and state-level influences (STATE).

The object of developing this district choice model is to determine which factors increase the likelihood that a region will adopt a charter school. Then, this information could be used to account for any self-selection problems within the output model. But in order for the district to have the option to choose, the state must have first passed charter legislation. This state level decision may also have been a non-random process. Perhaps only states with certain needs or characteristics pass charter legislation, as may be the case with the regional choice to adopt a charter school. This state level self-selection must be addressed and accounted for if the regional and performance results are to be fully generalized.

2.5 State Choice

The state decision to pass charter legislation is a political economy decision, much like the regional choice to adopt a charter school. No single factor will cause a

state to pass charter legislation. There are potentially many factors that will lead a state to pass charter legislation.

The first step is to determine the type of framework to be utilized. The regional choice was simplified by grouping a few factors under the heading "local educational market", and then analyzing that market. At the state level, the "market" for educational quality is not very clear at all. For example, a state does not directly "supply" educational quality, instead it provides funding for districts and passes legislation intended to improve quality. Typical state decisions would include determining the overall state level of funding for education, how to balance this funding across districts, and whether to pass new laws or restrictions. How the demand side of the market at the state level works is also unclear. Citizens primarily demand educational quality at the local level; however, they realize that decisions at the state level can affect the local quality. There may also be spillovers from educational quality in other regions of the state. It could be asserted that citizens express their preferences through voting for their local representatives, or voting on state referendums. However, citizens may be more or less interested in state-level business depending on the level of their local educational quality.

The regional choice model specifically used the Tiebout model, but that model will be inappropriate here. Sorting may take place across states, but this happens much less due to travel costs and other concerns. The Tiebout theory is clearly inappropriate as the primary model of the state level educational market.

Given the limitations of using any kind of market for the state level, a model of a generalized nature is the logical choice. The model presented here will seek to find the

specific factors that are related to a state passing charter legislation. Due to the modeling limitations, the exact way these factors affect the decision is open to some interpretation.

An initial list of possible factors would include the following:

1) the state's general socioeconomic and demographic characteristics
2) the state's political environment
3) the current quality and financial structure of the state's educational system

These categories can serve to guide the development of the model.

2.5.1 General Characteristics

A state's general characteristics will surely affect the decision. Fortunately, previous research provides a starting point for this task. Hassel (1999) has studied the general background factors involved in a state adopting charter legislation. His empirical results suggest that there are specific statewide characteristics that lead a state to pass charter legislation. These factors range from population to median income, for example. Research also shows that general factors can predict a state's "innovativeness" (Gray, 1973).

This category should include demographic as well as socioeconomic characteristics. Both sets of factors may affect the state level decision. Also, these factors will impact the regional educational markets which then affect the quality of the overall state system.

2.5.2 Politics

The level and type of publicly provided goods at the state level appears to be heavily dependent on which political party has the most influence (Maranto, et al., 1999). Hence, the political environment should also be included in the model. Earlier research

shows that charter schools are more favored by Republicans than Democrats at the state level (Hassel, 1999). Therefore, the composition of the state legislature and also, the party of the governor in power may determine a bill's legislative success or failure.

2.5.3 State Level Educational Quality and Finances

Whether a state's residents are satisfied with its educational quality depends primarily on the level of quality they receive at the regional level. Hence, the number of citizens with unsatisfied preferences at the state level is the sum of "unhappy customers" at all the regional levels. From the regional choice model, it was proposed that areas exhibiting certain characteristics were more likely to have citizens with unsatisfied preferences. These characteristics were a high percentage of low-income households and centralized finance. Therefore, the percentage of low-income households in the state should be represented in the model. The other factor generating "unhappy customers" was the degree of centralized school finance. Research showed that a more centralized finance system altered the Tiebout model and caused allocative inefficiency. As previously mentioned, when tax dollars are raised and spent locally, there should be a stronger incentive mechanism to regulate quality (Glaeser, 1996). Therefore, the degree of centralization in school finance at the state level should be contained in the model as well.

Summarizing, a state will decide on charter school legislation based on the following function:

$$STATE = h\,(G, P, LOW, CENT)\,,$$

where passing charter school legislation depends on a state's general characteristics (G), political environment (P), and the percentage of low-income households in the state (LOW), and degree of centralized finance (CENT).

2.6 Summary

This chapter developed a series of three equations representing the charter school choice process. First, a regional outcome model was developed that will attempt to determine the true impact of a charter school on regional educational quality. Second, a regional choice model was developed to discover which factors influence the regional choice to adopt a charter school. Finally, a state level model was constructed to determine which factors influence the state decision to pass charter legislation.

CHAPTER THREE

GENERAL ECONOMETRIC METHODS

3.0 Introduction

When we see a charter school affecting educational outcomes, this is actually the final stage of a three-step process. First, state legislatures and governors decide whether to pass charter legislation or not. Second, residents in each region choose whether to adopt a charter school or not (conditional upon the state passing legislation). Third, once enacted, a charter school may then impact the educational outcomes for that area.

Therefore, the equations developed in the last chapter actually comprise a system of equations:

$$OUTCOME = f(B, P, S, I, C)$$

$$REGION = g(LOW, CENT, HCOST, PRIV, POL, STATE)$$

$$STATE = h(G, P, LOW, CENT)$$

If these equations were independent, one could estimate each equation separately to produce the unbiased and efficient parameter estimates. However, at a general level there is a strong possibility of interrelationships between the three equations. The regional choice and outcome models have an endogenous relationship, since the C variable in the outcome equation represents the regional choice to adopt a charter school. There may also be relationships between the regional choice and state choice models, and between the outcome model and state choice models. If there are dependent relationships

between the three equations but they are treated as independent, the results of the region and outcome models will be biased and inconsistent.

The model is conceptualized as follows:

$$OUTCOME = \beta'\mathbf{x} + \varepsilon, \quad (1)$$

$$REGION^* = \alpha_1'\mathbf{v}_a + u_a, \quad (2)$$

$$REGION = 1 \text{ if } REGION^* > 0 \text{ and } 0 \text{ otherwise}$$

$$STATE^* = \alpha_2'\mathbf{v}_b + u_b, \quad (3)$$

$$STATE = 1 \text{ if } STATE^* > 0 \text{ and } 0 \text{ otherwise}$$

where ε, u_a, and u_b have a trivariate normal distribution with variances σ^2, 1, and 1, respectively and correlations γ_a, γ_b, and ρ_{ab} (γ_a is the correlation between ε and u_a, γ_b is the correlation between ε and u_a, and ρ_{ab} is the correlation between u_a and u_b). The error terms are included for measurement or specification errors. The *REGION** and *STATE** variables are threshold variables. It can be observed when a state or region passes a certain threshold and adopts legislation or a charter school; however, it is difficult to observe how far below or above the threshold the state or region is. The *REGION** and *STATE** variables are not directly observable, only the binary choice variables *REGION* and *STATE*.

3.1 Sample Selection

The purpose of estimating this system of equations is to determine the effect of a charter school on outcome measures. The main difficulty in estimation is caused by the selection problem at both the state and regional choice levels. This problem falls under

the more general category of sample selection that was originally studied in Heckman (1979). Maddala (1983) also has discussed a more general array of sample selection problems.

The outcome model contains two specific sample selection problems. First, some data are censored since many states have chosen not to pass charter legislation. Second, within states that have enabled charter schools, communities may have self-selected charter schools. If these censoring and self-selection problems were not present, the outcome model could be estimated by Ordinary Least Squares (OLS). This simple procedure would then show the relationship between charter schools and outcome measures.

However, for our purposes, states do not select charter legislation until the related variable STATE* crosses some threshold, and regions do not choose to adopt charter schools until the corresponding variable REGION* crosses some threshold. If this self-selection is not controlled for, serious biases may be present in the outcome equation. The general solution to this selectivity problem relies upon an auxiliary model of the process generating STATE* and REGION*.

The dual self-selection problem in the model presented here can be addressed in two ways. The first would be to treat the decision process as sequential. First, the state chooses to pass charter legislation, and then individual regions choose to adopt. This would essentially be a double selection rule process. The impact of a charter school in a given region would then be contingent on an ordered choice: the initial state level choice to pass legislation, and the subsequent regional choice to adopt. This framework of multiple selection rules has been addressed in previous works (see, for example, Catsiapis

and Robinson, 1982; Venti and Wise, 1982). This technique essentially involves estimating a series of independent probit equations.

Unfortunately, this technique is not appropriate for estimating this particular system. The studies previously cited treat the selection rules as independent – in other words, ρ_{ab} was assumed to be zero in these studies. In the system of equations here, there is a strong probability of dependence among the selection equations. Regional characteristics may exert influence on state level decisions; geographically, the state is only the sum of its regions. Also, state level factors may influence the regional choice. There may be overall state characteristics that do not appear in the regional choice model, but may affect the regional decision. An obvious example is the strength of the charter legislation passed at the state level. A "weak" charter law may lessen the chances that regions will adopt charter schools. These state level influences must be accounted for in the regional model and vice versa.

A more general approach would be to estimate the two equations as a bivariate probit model, with simultaneous selection rules.[5] This type of model, where choices are made by two joint decision-makers, was first studied in Poirer (1980). The Poirer model assumes that the error terms of the two equations are correlated, and corrects for this bias. Tunali (1986) also uses this approach in the case of multiple selection rules that are

[5] As it turns out, the distinction between the sequential probit model and the joint decision model is one of interpretation only. Green (1998b) showed that the log-likelihood functions for the two models are the same.

dependent. Unfortunately, this type of framework is not appropriate for the system being analyzed here, as the unit of observation for each decision differs. For the system presented above, the state is one unit of observation and the region is another. It would be incorrect to assume that each region is making a state level choice. The decision to pass charter legislation is ultimately made by the state legislature and the governor. Only a portion of the legislature represents the interests of a given region. A system of majority rule in state legislatures allows for regional decisions that differ from the ultimate state decision. For example, if the region is used as the unit of observation and a state does pass charter legislation, it then appears that each region has agreed with this decision even though that may not be the case.

Therefore, neither the traditional double-selection rule model nor the bivariate probit model is appropriate for this system of equations. The traditional double-selection rule model does not account for any dependence between the selection equations. The bivariate probit is designed for two equations with the same unit of observation. Hence, a compromise is needed to explain any results. The state equation is estimated separately as a binary choice model, representing the choice to pass charter legislation or not. Then, the region and outcome equations will be estimated together as a selection model. This compromise results in a loss of generality - the outcome results cannot be generalized to regions in states that have not passed charter legislation.

The next question is what specific type of selection model will be used for the region and outcome equations. This mainly involves the choice of whether to include observations from both the charter and non-charter regions or to include the charter regions only. Using only the charter regions would produce a censored sample, and

estimation procedures can easily adjust for this. The other option is to use both the charter and non-charter regions in the form of a "treatment effects" model. This latter option is the one chosen here, since data are available for both charter and non-charter regions.

The treatment effects model has been previously used in the returns to education literature (Willis and Rosen, 1979) and is well suited to program evaluation studies. This model uses an indicator variable, *C* (for Charter) in this case, which is assumed to indicate the presence or absence of some treatment. After accounting for any potential self-selection, the coefficient on the indicator variable is used to evaluate the effectiveness of a particular program.

In summary, this system of equations will be estimated in two separate parts: a binary choice model for the state equation, and a treatment effects selection model for the region and outcome equations. The exact specification of the selection model to be used was presented in Maddala (1983) and also detailed in Greene (1998a). There are two techniques for estimating selection models such as the treatment effects model: the Heckman two-step and Maximum Likelihood Estimation. Heckman's two step, or 'Heckit' estimation method, is based on the method of moments and consistent, rather than efficient, estimation. The computations used in the estimation procedure are common to the literature and are discussed in Heckman (1979).[6]

[6] In general terms, the Heckman two-step consists of a probit selection equation that corrects for sample selection problems in the outcome equation. More discussion on the Heckman two-step is available in Heckman (1979) and Greene (1981).

An alternative and superior technique is that of maximum likelihood estimation. Maximum likelihood estimation (MLE) is able to achieve efficient estimates by estimating the selection equation and outcome equation simultaneously. This technique utilizes full-information maximum likelihood estimation, and is used to produce the baseline results of the selection model.

3.2 Binary Choice Models

The state equation is estimated with a probit model.[7] This model determines which factors lead a state to pass charter legislation. The regional choice model is also estimated with a probit model. The probit model has been traditionally used for selection procedures (Barnow et al., 1982; Heckman 1979). The selection procedure accounts for the correlation between ε and u_a, and in doing so produces unbiased and efficient parameter estimates for the outcome equation.

The regional choice and state choice models represent contributions to the literature in themselves. The state model builds upon existing research on what factors cause a state to pass charter legislation (Hassel, 1999). The regional choice model is a new addition to the charter school research. This model can be used to predict which areas may choose charter schools in the future.

3.3 Measurement Issues

One measurement problem is determining the boundaries for a given region. The decision to adopt a charter school is defined as a regional choice because it involves local

[7] The logit model is another choice for binary models. The probit model is chosen here since it appears most of the data are near the means. The probit model is also chosen for its use in the selection model.

teachers, parents, and administrators. However, defining the exact boundaries for this area is difficult.

First, citizens from other areas may support the adoption of a charter school even though they don't reside in that particular area. Households may be altruistic, and care about the education that other children in the state receive. The motivation could also be based on spillover effects, that if a charter school opens somewhere else, it may increase the likelihood that the home community will open a charter school. Households may believe that charter schools in general will improve educational quality in the state – a rising tide lifts all boats, so to speak. Generally, the boundaries for the region making the charter choice will be determined by preferences for educational quality and perceived spillover benefits.

This problem of determining geographical boundaries will also appear in the outcome equation, though the problem is more manageable in this context. Economic theory suggests that the household decision will be determined by preferences for educational quality, travel costs, income, and availability of substitutes.

Households may have high or low preferences for objective measures of educational quality, such as test scores or academic performance. They will also have preferences for the subjective components of educational quality. Each charter school offers a different "package" of attributes that will appeal to certain families. The family must then consider travel costs. In some states, charter schools are part of the local school district, and there is a geographical constraint on who can attend. In other states, charter schools have a wide geographical base, allowing cross-district enrollment. For example, in Arizona a charter district forms a new pseudo-school district - one without

any geographical base. Students from all over the state can attend this school if they desire. In this case, travel costs will be a function of the distance traveled, and also of the opportunity cost of the household time spent in travel. Income will be a factor in the travel cost function, as a poor household may not be able to afford the time or money it takes to transport a student.

Income will also affect the types of substitutes available. A charter school competes with neighboring public and private schools. If a household is liquidity-constrained, private schools may not be an option. Both public and charter schools charge no direct tuition, so the competition between the two should be primarily in terms of educational quality. Also, an area already has a given mix of private and public schools before a charter school is created. Therefore, this variation should affect the charter school decision as well.

Another measurement issue for the outcome model is one mentioned earlier - that while a regional analysis measures the overall impact of a charter school it does not say which component is producing the change. For example, if a charter school causes region-wide outcome measures to improve, this could be due to any of five scenarios: 1) outcomes for charter school students have improved while public school student outcomes have stayed the same, 2) outcomes for both charter and non-charter students have improved, 3) outcomes for charter students stayed the same, but outcomes for public school students improved, 4) outcomes for charter school students have improved, outcomes for public school student have decreased, but the increases outweigh the decreases, and 5) outcomes for charter school students have decreased, outcomes for

public school student have increased, but the decreases outweigh the increases. This is an important point for any policy analysis based on this research.

3.4 Selecting Outcome Measures

A major issue in analyzing educational reform is the selection of appropriate outcome measures. Hanushek (1979) listed the various types of outputs for education production functions that have been used in economic research. The primary outcome measures are test scores, dropout rates, student attitudes, attendance rates, or college continuation. Another major thread of research has studied the effect of education on labor market performance. Additional research has studied the role of education in increasing job satisfaction, effect of a mother's education on the learning of young children, the effect of education on political socialization and voting behavior, and the relationship between education and criminality. (See Hanushek, 1979, for references to these studies.)

Though there are many different outcome measures, certain measures are particularly suited for quantitative analysis. For example, although test scores, attendance and dropout rates all have some degree of subjectivity, this can be minimized. Once a measurement formula is set, there will be minimal error – for example, a machine can grade tests, and a person is either attending class or not. Other measures of educational quality lend themselves to a more subjective framework. For instance, student portfolios are one assessment technique specifically used by charter schools. Measures like these introduce a large degree of human judgment into the process. Primarily subjective measures of student performance, such as student portfolios and student demonstrations, introduce both error and disagreement as to the quality of such

work. The main problem is in setting appropriate criteria; what makes a "good" student demonstration? In the more objective components, there should be much less disagreement as to the proper criteria and grading processes. Though these objective measures are still imperfect, they remain the primary outcome measures in educational research and are now discussed in turn.

3.4.1 Test Scores

Test scores are the most frequently used outcome measure in education production functions. Test scores have been studied for many decades and continue to be used in recent research (for example, see Nyhan and Alkadry, 1999, Jacques, et al, 2000, Currie and Thomas, 2000, and Unnever, et al, 2000). Raw test scores are often used, but test scores measure much more when they are used in a value-added format. A value-added format takes into account previous levels of ability and knowledge for each student. This type of analysis attempts to pinpoint the contribution of the school to the change in student performance.

Though test scores have been used in a number of studies utilizing the education production function, there is a great deal of controversy surrounding this measure. Hanushek (1979) flatly states, "we find simply a large degree of uncertainty about the appropriateness of test scores as outcome measures." Other researchers view test scores mainly as a screening or sorting mechanism, and attribute differences mainly to student ability and characteristics (Mayer, 1997). Detractors also argue that some teachers may "teach for the test", and that real education is not taking place – only memorization of facts. Despite these qualifications, test scores remain a popular outcome measure in educational research.

3.4.2 Dropout Rates and Attendance Rates

Attendance rates and dropout rates are alternative measures of educational quality, and are also heavily researched. For example, much research in the last decade has focused on the dropout rate: for example, see Case (1999), Lee (1997), Sander (1995), Rice and McVicar (1996), Khandker (1996), Sander (1993), Sander and Krautmann (1995). Attendance rates also continue to be a subject of recent research: see Al-Samarrai and Reilly (2000), and Mora (1997).

Other recent research focuses on other interesting applications concerning the dropout rate. For example, Loeb and Page (2000) show that raising teacher wages by 10% reduces high school dropout rates by 3% to 4%. Other research focuses on the connection between poverty and the dropout rate (Galster, et al, 2000). There are also numerous studies concerning education policy in developing countries, and the concern for high dropout rates (Tan, 1999; Randall and Anderson, 1999). Other studies focus on reducing dropout rates for minority populations, a group that many charter schools try to serve (Ladd, 1999; Mora, 1997).

Dropout and attendance rates provide a mix of strengths and weaknesses. A main problem is that they do not directly measure academic performance. Attendance rates report how often a student attends class, dropout rates measure whether the student is in or out of school; but just because a student is in school does not mean they are learning anything. Attendance rates provide a snapshot in time, while dropout rates suggest a more permanent state. However, neither provides a direct gauge of a student's academic performance. These and other criticisms of the dropout and attendance rate have been

discussed in the literature previously (for example, see Hanushek, 1979, and Bishop, et al., 2000).

Dropout rates are perhaps more important due to their link with long-term economic success. One of the justifications for public education is to foster economic growth. When a student drops out of high school, this can severely limit future earnings. This is a substantial problem in many developing countries, and is often a focus of economic research (Behrman and Deolalikar, 1991).

3.4.3 Postschooling Outcomes

Postschooling outcomes usually focus on continuing education or wage attainment. Most of the research on postschooling outcomes consists of longitudinal studies. These studies analyze individual data both during and after schooling. Recent research continues to study postschooling outcomes; see Newman and Harkness (2000), Smyth (1999), and Ganderton and Santos (1995). Postschooling outcomes are an important way to analyze educational reforms. They represent a school's contribution to a student's long-term economic and social success.

3.5 Appropriate Outcome Measures

All of the primary measures listed above provide methods of analyzing the effect of charter schools. However, some measures are perhaps more appropriate than others for this particular context. Charter schools are often started to serve minority or special populations (U.S. Dept. of Ed., 2000). These special populations may have lacked appropriate attention and instruction in traditional public schools, and often become disenchanted with public schooling. This would suggest that dropout rates and/or attendance rates may be appropriate outcome measures for analyzing charter schools.

However, the majority of charter schools are started with the dream of realizing an "alternative vision of schooling" (U.S. Dept. of Ed., 2000). A large part of this alternative vision will surely be academic performance. Therefore, test scores may be an appropriate measure as well. Postschooling outcomes are also important to any educational reform. If a student performs well in school but fails in the real world, then that type of education is a failure in many respects. In summary, it appears that charter schools are started for many different reasons, and that a set of outcome measures is probably most appropriate for analysis.

3.6 Summary

This section discussed and selected the appropriate specifications for the three major equations. The sample selection problem was analyzed and an appropriate method to test for this was chosen. Finally, appropriate outcome measures were discussed along with their specific strengths and weaknesses.

CHAPTER FOUR

DATA AND ESTIMATION TECHNIQUES

4.0 Introduction

This chapter details the selection of variables for the outcome, regional, and state models. This chapter also details the data sources that are used in this project. The data are then analyzed, and additional measurement and estimation problems are discussed.

4.1 Selecting the Outcome Model Variables

The unit of observation for both the outcome and regional choice model is based on the surrounding geographical area. As mentioned in the last chapter, economic theory can guide us to determine the boundaries of this area. However, micro-level data are needed to determine each household's preferences and travel cost functions for calculating the exact boundaries. The school district is chosen as a proxy for this region. While imperfect, this measure is a better fit than the county, which is essentially the only other workable alternative in terms of data. There are substantial data available at the school district level. Therefore, the regional choice and outcome models use the school district as their unit of measure. All other variables with the exception of the political variables are also available at the school district level.

The next choice is the selection of the outcome measure. The previous chapter discussed appropriate outcome measures. Test scores are one appropriate option; however, multiple problems exist with the data. First, test scores are available in some states but not others. Second, many states use different testing systems for analysis. Third, some states have changed their testing system during the decade charter schools

have existed. Fourth, test results for charter schools are often separate from the school district in which they reside. When these results are presented in terms of percentages, calculating a cumulative district average becomes difficult. This set of problems severely limits the usage of test scores as a primary outcome measure.

Postschooling outcomes are also an important outcome measure. The method of analysis consists of longitudinal study with student-level data. Unfortunately, this type of data is not widely available for charter school students or public school students. Attendance rates are also an option for the outcome equation. However, attendance data are virtually non-existent for charter school students. Charter schools do not have to report all the conventional information that traditional public schools do.

I focus my analysis on the high school dropout rate. A dropout is initially defined as a student who was enrolled at any time during the previous school year, was not enrolled on October 1st of the following school year, and who had not completed school, transferred to another secondary school, or left school because of death, illness, or temporary discipline action. The dropout rate is the number of dropouts for a year divided by the number of students enrolled on October 1st of that year. As discussed earlier, this measure has its strengths and weaknesses. All states surveyed keep records of dropout rates. Therefore, this variable provides a measure that is available across time and states. Specifically, the district high school dropout rate is the measure chosen.

In addition to the examination of dropout rates, test scores are analyzed for two states: Florida and Wisconsin. In these two states, charter schools are part of the local school district, and therefore cumulative district results are available. With these cumulative results, I study the impact of a charter high school upon academic

performance in a school district. These results will be presented as a complement to the work on dropout rates, covering the same time period as the dropout rate sample.

For the outcome equation, the independent variables are selected from the educational production function derived in Chapter Two: family background influences, peer influences, school inputs, innate abilities, and the presence of a charter school.

Family background influences can certainly affect student performance. The outcome measure is the district high school dropout rate, so the characteristics of the school district are of interest. District variables representing an average family's background are: percent of children below the poverty line, percent of children labeled "at-risk", percentage of non-white students, percentage of householders with a high school diploma, and median household income. An at-risk child is defined as a child 6 to 19 years old who is not a high school graduate, living with a mother who is not a high school graduate and who is divorced or separated, and is below the 1989 poverty level. These five variables give some indication of what the average family conditions are for a given school district. Percent of children in poverty or at-risk, and percent of non-white students are predicted to have a positive relationship with the dropout rate. Level of educational attainment and median income are predicted to have a negative relationship with the dropout rate. Another variable, Agency Locale Code, represents the degree of urbanization in an area, ranging from 1 to 7, where 1 is the most urban.

Peer influences are difficult to objectively measure. Certainly, there may be spillover effects from grouping high or low performing students together. Specifically measuring these within-school peer effects requires micro level data. However, there may be district wide peer influences as well. A large group of low-performing students

in a district could have a negative spillover effect on other students in the district. While these effects may be real, measurement is still an obstacle. Peer effects are usually thought of in terms of performance, but there are peer effects for behavior as well. Variables measuring aggregate district characteristics may indirectly detect peer effects. These aggregate variables cannot specify exactly where or how these peer effects may be taking place, however.

School inputs are much easier to measure, and there are many options available. Previous theory and economic research guide the choices of three key variables: current per pupil expenditure, student/teacher ratio, and percent revenue from local sources. Current Per Pupil Expenditure has been the subject of extensive study for its impact on student performance (Card and Krueger, 1996; Hanushek, 1986). Student/teacher ratio, and indirectly class size, has also been a focus of economic research (Lazear, 1999). A third school input variable is the percent of total revenue from local sources – for each school district, this is the share of total revenue that comes from local sources. This represents an indirect form of "inefficiency" in the production function. Research shows that reliance on local property taxes will make public good providers more responsive to citizens' preferences (Glaesser, 1996). This variable can also be interpreted differently. A low-income or low-wealth district may end up being subsidized by the state, and thus have a lower percentage of total revenue. Separating these two effects may be difficult in the empirical work.

The fourth category, innate abilities, contains additional measurement problems. Test scores would be an obvious choice to measure ability; however, as mentioned above there are multiple data problems. Instead, one variable will be used to represent low-

ability students: percentage of students with an individualized instruction plan (special education).[8] This variable is predicted to have a positive relationship with the dropout rate. Measurements of students with average or above-average abilities cannot be accurately calculated for this project.

The other factor in the education production function is the possible presence of a charter school, and a dummy variable is used to represent this. However, charter schools are designed to serve different grade levels; some serve grades K-12, some 9-12, or other configurations. For the charter variable, only charter high schools are counted in this sample. It would not be appropriate to say that a charter elementary school affects the high school dropout rate directly, at least not in the limited time period studied. Hence, the outcome equation will specifically measure the impact of charter high schools on the district-wide high school dropout rate. Approximately 40% of all charter schools serve high school students (U.S. Dept. of Ed., 2000). Therefore, it is important to note that this is a partial testing of the charter school concept, and the results are only valid for the effectiveness of charter high schools. The charter variable is predicted to have a negative relationship with the high school dropout rate.

4.2 Selecting the Regional Choice Variables

For the regional choice equation, variables represent the possible factors derived in Chapter Two: low-income households, the degree of centralization in school finance, above-average cost-conditions, the presence of private schools, local politics, and state-level influences.

[8] This includes students having a written Individual Education Program (IEP) under Public Law 94-142 (Part B) or the Individuals with Disabilities Education Act (IDEA). This does not include gifted and talented students.

First, it is important to note that many of the variables appearing in the regional choice equation also appear in the outcome equation. Many of these variables have effects on both measures. However, these factors affect the measures in different ways since one measure is an outcome variable and one is a political decision. In any given school district, many characteristics will affect both of these processes.

The presence of low-income households is thought to increase the probability that a region will adopt a charter school. The measure is straightforward and is represented by the percentage of low-income households in a school district. The degree of centralization in school finance was also discussed as a possible factor in the regional choice, a factor which would decrease the likelihood of observing a charter school. This will be represented by the percentage of total revenue from local sources.

Above-average cost conditions are hypothesized to increase the desire for a charter school. These conditions will be represented by three variables mentioned earlier: percent of children below the poverty line, percent of children labeled "at-risk", and percentage of non-white students. Students who come from poor households or who are at-risk may be more difficult to educate. The percentage non-white represents level of minority students in a school district. When a school population is more diverse, more instructional methods may be needed to reach all students, thus driving up costs. This is not a perfect measure of student body heterogeneity, since a school district may be heavily non-white but a high percentage of a single ethnic group.

The presence of private schools in an area may affect the charter school choice. Unfortunately, private school data are not available at the school district level for most states. Therefore, the presence of private schools will not be accounted for in this model.

Not including private schools introduces a potential omitted variable bias. Fortunately for the purpose of analysis, the percentage of students in private schools is small (10%) and is virtually non-existent in some areas. Still, there is the potential that an important independent variable is missing from this specification.

Local politics will almost certainly play a role in the charter school decision. Republicans favor charter legislation more than Democrats at the state level (Hassel, 1999). Therefore, a logical assumption is that Republicans will favor the adoption of charter schools at the local level as well. Unfortunately, political data are not available on the school district level, only the county level. The political variable (Percent Republican) is defined as the percentage in the county voting Republican in the last Presidential election. For two states in the sample, the boundaries for the county and school districts coincide – Florida and North Carolina. In all other states in the sample, the boundaries differ, and the county variable is a proxy for the actual school district voting record.

State-level influences could certainly be a factor in this local decision. For example, the type of charter legislation that is passed can certainly affect the district choice. There may be many other unknown state-level factors that affect the district choice, ranging from state history to state wealth. These state-to-state differences should be included in the district choice model. A general approach is to include state dummy variables. This state fixed effects approach will account for the exogenous variation across states.

Also, variables representing the current condition of a region's public education system should be included. Again, I use the current per pupil expenditure and the

student/teacher ratio. Two other variables control for general area characteristics. These are median household income and the Agency Locale Code. These variables control for other demographic and socioeconomic factors that may affect the district choice.

4.3 Outcome and Regional Data Sources

The first choice for district level dropout data is the NCES (National Center for Education Statistics) *Common Core of Data*. This database provides extensive school district data for each school year, dating back many years. Upon further scrutiny, substantial amounts of data are missing for dropout rates. The NCES only uses data that fits their particular dropout formula. Some states report dropout data that differs from the NCES formula on any of the three major sources of nonconformity: an alternative reporting calendar, the reporting of summer dropouts, and the reporting of adult GED students.[9] Due to this stringency, using data only from the NCES does not permit a nationwide analysis of the charter school concept.

In order to facilitate a nationwide analysis, data are obtained from individual state departments of education. [10] In some states, like Arizona, charter schools form a new school district, one without any geographical base. The dropout data are available separately for the local school district and the charter school district. In these instances, I summed the dropout data from the two districts together and recalculated a district high

[9] Information concerning the NCES dropout formula and further discussion is available at: http://www.nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2000305.

[10] The data for outcome measures was often not in electronic format and had to be entered by hand into the data set.

following states: Arizona, Colorado, Massachusetts, Michigan, Minnesota, North Carolina, Ohio, Pennsylvania, and Texas. The result was a unique data set that was not previously available in any format. There are some questions of consistency for the dropout data, and these questions are addressed quantitatively in Chapter 5. The main concern is how the differing dropout formulas affect the overall results.

The rest of the district level data come primarily from two sources: the National Center for Education Statistics (NCES) and from individual state departments of education. Political data come from "USA Counties -1998" published by the US Census Bureau. My sample covers the school years 1992-93 through 1997-98.[11] This master data set contains over 33,000 district-time observations, containing data on 11,058 school districts.

The original sample of school districts was trimmed for a variety of reasons. First, some school districts only contain elementary schools, and contribute no data for dropout rates. This resulted in a loss of 2,153 school districts. Second, some districts have missing demographic data from the NCES files, resulting in a loss of 2,482 school districts including 8 districts with charter high schools.[12] Third, Alaska is not included

[11] Minnesota passed the first charter law in 1991, and opened the first charter school in 1992. Therefore, the 1991-92 school year is not included due to missing charter data for that year in Minnesota. Therefore, the sample period begins in 1992-93.

[12] Many of these "lost" school districts were not school districts in the normal sense. The NCES applies school district status to different entities, such as school boards, all special education students, or state level organizations.

because no political data are available at the county level, resulting in a loss of all of its 53 public school districts including 5 districts with charter high school. Due to these limitations, the total number of observations is 16,714 comprised of 6,370 districts within 27 states, covering a maximum of six school years, and containing 148 charter high school districts.

States are only included for the years after they had passed charter legislation. For example, Texas passed their charter law in 1996; therefore, Texas is only included in the 1996-97 and 1997-98 school years. The 1997-98 school year was the most recent data available for all states at the time of this study, and marks the endpoint of the sample.[13]

Test score data are analyzed for Florida and Wisconsin, and again focuses on the effect of charter high schools. Florida uses the High School Competency Test (HSCT). Test score data are available from school year 1995-96 through the current school year, 2000-01. Since Florida passed its charter school law in 1996, the sample will consist of the school years 1996-97 and 1997-98, corresponding to the last two years of the dropout sample. Data are presented as the percent passing both the math and verbal components of the exam.

Wisconsin uses the Wisconsin Knowledge and Concepts Examinations (WKCE). These tests are given annually to students at grades four, eight, and ten. The WKCE measures achievement in reading, language, mathematics, science, and social studies

[13] For two variables, the data values for the last year in the sample are not currently available. The variables are the district current expenditure per pupil and percent of total revenue from local sources. Data for these variables are not available for 1997-98, so the data from 1996-97 is used for the missing values. While this is an unfortunate compromise, these values do not dramatically change from year to year. Also, the year dummy variables will help to adjust for these static values.

using multiple-choice and short-answer questions. Students also provide a rough draft writing sample. The focus will be on the results from grade ten students. Wisconsin passed its charter legislation in 1993, and district-wide test results are available from that year through the last year of the dropout sample, 1997-98. However, testing vendors changed during that time period, with a different testing procedure for the last two years. Test score data for 1993-94, 1994-95, and 1995-96 are presented in terms of an Average Grand Composite Score (AGCS) for each district. This number is simply a raw number, and is not in terms of percentages. Test score data for 1996-97 and 1997-98 are presented in terms of a National Percentile Rank for both a Reading and Mathematics exam.

4.4 Analyzing the District Data

The summary statistics for all the district level data appear in Table 1 (all tables and figures can be found in the Appendix). It shows that the average district dropout rate is around 3%. The Percent IEP variable is approximately 1%, showing the extremely small number of special education students. The Agency Local Code variable is slightly above 5, suggesting the average school district resides in small town or rural area. The Local Revenue variable is around 42%, showing that the average school district receives substantial revenue from state and federal sources.

Table 2 presents summary statistics for school districts with a charter and school districts without a charter school. An asterisk marks those variables with means that are significantly different in charter districts as compared to non-charter districts. Looking at the table, seven out of the eleven variables have significantly different means across the two samples. These seven variables mainly represent average family or environmental

characteristics. Therefore, it appears that charter schools do tend to develop under specific circumstances. This evidence strengthens the case for district self-selection.

Comparing the charter and non-charter districts, the difference in the mean dropout rate is astonishing. Charter districts have an average dropout rate of approximately 5.5% while non-charter districts have a dropout rate of 3%. This large discrepancy suggests that either charter and non-charter districts are fundamentally different in terms of their schooling outcomes, or that charter schools are significantly affecting the dropout rate. Two other variables of interest are the Agency Locale Code and the Percent Non-White. The mean Agency Locale Code (ALC) for charter districts is 3.14, while the mean ALC for non-charter districts is 5.24. This shows that charter schools tend to develop in more urban areas. Also, the Percent Non-White in charter districts is double the percent in non-charter districts. This suggests that charter schools tend to develop in areas with a high percentage of minorities. This is not surprising - as mentioned earlier, many charter schools are targeted for minority or special populations.

Table 2 includes all district-year observations. To give a clearer picture of the differences, a cross-section of observations from school year 1997-98 is analyzed in Table 3. Clearly, the trends are the same in this year as in the overall sample. In addition, the mean for the Percent Republican variable is significantly different in the sample stratification. There are still major differences in variable means comparing charter to non-charter districts. To truly assess independent effects, a multivariate framework is needed.

4.5 Selecting the State Variables

The theoretical model presented earlier generates some factors that should affect the state decision to pass charter legislation. These were a state's general characteristics, its political environment, the percentage of low-income households in the state, and degree of centralized finance.

A state's general characteristics are represented by the total state population, median household income, the percentage of householders with a high school diploma, and the percent of the population that is non-white. These variables serve to capture the general population characteristics that may affect the state charter decision. All four of these variables are all predicted to have a positive relationship with the passage of charter legislation.

The political environment is represented by two variables: a dummy variable signaling if the state legislature is controlled by Republicans (Republican Legislature) and a dummy variable signaling if the governor in power is a Republican or Independent (Governor Republican). As Hassel (1999) pointed out, charter school legislation tends to be favored by Republicans. These variables allow the testing of this hypothesis.

The presence of low-income households is also hypothesized to affect the state charter decision. This is represented by the percentage of households below the poverty line, and is predicted to have a positive relationship with the dependent variable. The degree of centralization in school finance is also thought to be a factor in the charter decision, by reducing the likelihood of charter legislation. Therefore, the state funding percentage of total local spending is included as a proxy.

Also, the overall condition of the state's current educational quality could be an important factor in the charter school decision. This will be represented by the following variables: current expenditure per pupil, student/teacher ratio, and the percent of the student population in private schools. These variables give some description of the state's current public education system and the potential competition from private schools.

4.6 State Data Sources

The state level data come from a variety of sources. The educational data, including the private school data, come from the National Center of Educational Statistics (NCES). Political data are drawn from the U.S. Census Bureau and The Council of State Governments. Population and income data come from the U.S. Census Bureau. This sample covers all fifty states plus the District of Columbia for the years 1991-92 through 1997-98. Minnesota passed the first charter legislation in 1991, so this marks the beginning of the sample. School year 1997-98 was the last year of data available at the time of this study. All states are included for each year in the sample.

4.7 Analyzing the State Data

The summary statistics for the state data are presented in Table 4. The state analysis was justified due to the possible self-selection at the state level that truncated the district sample. Therefore, it would be informative to compare variable means in states that have passed charter legislation to variable means in states that have not. Table 5 stratifies the sample into charter and non-charter states. The variables with significantly different means are marked with an asterisk in Table 5. Seven of the eleven variables are significantly different in the charter sample as compared to non-charter sample.

A few variables exhibit large differences in their means. The mean state population is much higher in charter states, by almost two million. This could be due to a few reasons. One interpretation is that schools may be overcrowded, and that citizens are viewing charter schools as a way to reduce class size. Another interpretation is that the more populated a state, the more chance there will be for a critical mass to develop to support charter legislation. Also, the political environment in charter states appears to be different. The likelihood of having a Republican legislature is much higher in charter states, with the dummy variable having a mean of 0.36 in charter states and 0.23 in non-charter states. The likelihood of having a Republican (or independent) governor in office is also much more likely in charter states, with a mean of 0.63 for the governor dummy variable in charter states as compared to a 0.46 mean in non-charter states.

Table 6 presents a cross-section of the sample, representing the last year of the sample. Variable means are stratified into charter and non-charter states again. The results are similar to those from the overall sample. It appears that there are significant differences in charter states versus non-charter states, though the differences aren't quite as striking as they were at the district level. Still, the number of variables with significantly different means motivates the multivariate work to determine which variables affect the charter decision.

4.8 Data Issues/Estimation Problems

For the outcome model, a MLE treatment effects selection model was chosen as the appropriate technique. This method will produce the baseline results of the analysis. However, a cross-section analysis makes the assumption that all observations are independent. In panel data, such as the data analyzed here, this is obviously not true.

There will be observations for the same district over different time periods. Hence, the panel data provide additional problems due to unobserved heterogeneity across observations.

This heterogeneity across units is the central issue for choosing appropriate techniques. The two most common approaches for this problem are the fixed effects and random effects models (Greene, 1998). Both the fixed and random effects model insert an additional term into the regression, say α_i. The fixed effects model designates α_i as a group specific constant term, while the random effects model designates α_i as a group specific disturbance term. The additional error term in the random effects model represents the extent to which the intercept of the *i*th cross-sectional unit differs from the overall intercept. The Hausman test can determine whether the random or fixed effects model is more appropriate for a given situation. It is important to note that the fixed effects model picks up only group fixed effects. Year dummy variables can also be inserted to account for the time variation in the sample.

For the purposes of the specific model presented here, the ideal selection model would consist of a fixed or random effects probit, with the selection results being passed to a fixed or random effects regression. If the equations are run simultaneously as Hausman and Wise (1977) suggest, the results will be produced by a full-information maximum likelihood technique. Unfortunately, current statistical packages cannot compute these results. Crucial matrix calculations cannot be calculated for panel data, and the maximum likelihood technique cannot be utilized. Hence, an alternative method of correcting for censoring in panel data is of interest.

The Heckman two-step can be estimated with a random effects probit, and also a fixed or random effects regression that utilizes the information produced by the selection equation. The two-step procedure can account for random effects in the first stage and fixed or random effects in the second stage, yet the estimates will not be efficient. However, these estimates are of interest and will be reported in the next chapter to serve as a robustness check on the MLE results.

It is important to note that each of these techniques represents a second-best choice in this case. Both methods have their strengths and weaknesses. The baseline results are those produced from the MLE selection procedure, and they are consistent and efficient but potentially biased. The Heckman two-step will lack the efficiency of the MLE results but will account for fixed and random effects. Each method provides a different trade-off in the analysis.[14]

Another problem is a direct result of the variables used in the district and outcome models. Almost all of the variables that affect the district choice will affect the district dropout rate. If all of the same variables are used in both the district choice and outcome equation, there will be an identification problem for this system of equations. This is much less of a problem when using the MLE technique, since the equations are run simultaneously. When using the Heckman two-step, which runs the equations separately, an instrumental variable approach is needed. With this method, an independent variable is selected that should affect the charter school choice, but have no effect on the dropout rate.

[14] As mentioned, one way to improve the MLE results is to include year dummy variables to pick up time fixed effects. While this still misses district fixed effects, it can improve upon the existing MLE procedure.

The variable selected is the political composition of the district, specifically the percentage of citizens voting Republican in the last Presidential election. The political composition of a district should affect the choice to adopt a charter school; as mentioned previously, Republicans tend to favor charter schools more than Democrats. However, there is no direct theory that a district's political composition should affect the district high school dropout rate. Therefore, this variable should serve as an effective instrument that will properly identify this system of two equations.

For the state equation, the data being analyzed are also panel data. An appropriate technique used for panel data of this form is a random effects probit (Guilkey and Murphy, 1993). Therefore, this technique will be used to produce the baseline parameter estimates for the state choice equation. An alternative technique to analyze the state choice is a duration model. This type of model is convenient for estimating the length of time a person or entity stays in a specific condition before leaving that condition. In the specific model here, the duration of the time spent without charter legislation will be of interest. The duration model offers a different way of analyzing the state charter choice and is estimated in the next chapter.

4.9 Summary

This chapter focused on the data sources, and also the selection of appropriate variables for the state choice, district choice, and outcome models. Both the state and the regional sets were described in detail. Additional data and measurement problems were also discussed.

CHAPTER FIVE

EMPIRICAL RESULTS AND INTERPRETATION

5.0 Introduction

This chapter presents the results of the multivariate analysis for the state, district, and outcome equations. The state charter choice is analyzed with both an MLE probit, a random effects probit, and duration model. The district choice is analyzed with a MLE probit and a random effects probit model. The outcome equation is tested for self-selection, and the appropriate technique and results are discussed.

5.1 State Probit Analysis

An MLE probit and also random effects probit were both performed to determine which factors propel a state to pass charter legislation. The results of these probits and their coefficients are presented in Table 7. These probit models also generate marginal effects coefficients, which describe the change in the expected probability of passing charter legislation (Charter = 1) with respect to a unit change in the independent variable. These coefficients are computed as a partial derivative, and are computed as changes around the mean of the independent variable.

The MLE probit shows three variables that have statistical significance: Educational Attainment, State/Local, and Governor Republican. The coefficient for the Educational Attainment variable is positive, showing that a higher percentage of households with a high school diploma, the more likely charter legislation is to pass. This is not at all surprising, as higher educated households may prefer different levels of

educational quality than other households. The State/Local variable is negative and statistically significant, with a marginal effects coefficient of –0.469. This shows that the less a state involves itself in local finances, the more likely charter legislation will pass. This result may seem counter-intuitive since the charter legislation choice is being decided at the state level. Perhaps when local financial control is greater, greater control of the educational quality through charter schools is also desired. An alternative explanation is that voters support both the level of centralization and the likelihood of charters, and that there is no conflict between the voter's preferences and the central agency's preferences.

The Governor variable (when the Governor is a Republican or Independent) shows a positive coefficient and is highly statistically significant. This corresponds to the earlier observation that charter schools seem to be favored by Republicans. In addition, the composition of the state legislature does not have a statistically significant effect on the passage of charter legislation. This result is surprising, especially in view of the significance of the Governor variable. Perhaps the veto power of the governor's office makes the composition of the state legislature less critical for the charter decision.

The random effects probit generates somewhat different results than the MLE probit. The Educational Attainment, State/Local, and Governor Republican variables are statistically significant again and have the same signs as the MLE probit. The marginal effects coefficient for the Educational Attainment variable is quite large, the largest of any marginal effects coefficient at 1.253. This suggests that a 1% increase in the average percentage of householders with a high school diploma increases the chances of charter legislation passing by 125 percentage points. This is an extremely large coefficient and

underlines the importance of household educational attainment for the passage of charter legislation.

The marginal effects coefficient for the State/Local variable is moderate in comparison with an estimate of –0.793. For the Governor Republican variable, the marginal effects coefficient is smaller, with an estimate of 0.085. This suggests that the change from a Democratic to Republican or Independent governor increases the probability of charter legislation passing by approximately 9 percentage points. These marginal effects coefficients give an idea of the differing magnitudes of the variables' effects on the passage of charter legislation.

The Student/Teacher Ratio variable is also positive and statistically significant. This suggests that states with high Student/Teacher Ratios may have a greater need for charter schools. Charter schools may be an indirect method to reduce class size. This can be related to the research on class size and student performance, which show smaller classes promote better student performance (Lazear, 1999). Alternatively, larger class sizes may mean there is more heterogeneity in each class, and therefore different tastes for educational quality. The Current Expenditure Per Pupil variable is also positive and statistically significant with a marginal effects coefficient of 0.249, showing an increase of $1,000 in per pupil expenditure increases the likelihood of charter legislation passing by 25 percentage points. This result is open to interpretation, and could be a result of either demand or supply factors. One explanation could be that areas have a higher demand for educational quality, and are willing to spend more money to obtain it. If the higher expenditure cannot generate this quality as some research suggests, charter schools may become an attractive option. An alternate explanation would concern the production

of educational quality. It could be that in states with high student expenditure, this is mainly a result of a state population that is more expensive to educate (perhaps due to a heterogeneous student population). Since charter schools may allow for more sorting and therefore indirectly lower the average cost of education (a homogeneous student body may be less costly to educate), they may be more preferred in these particular states.

The Population variable shows a positive relationship, suggesting that charter school legislation is more likely to pass in states with relatively large populations. One explanation is that the larger a state's population, the more diverse the population, and part of that diversity will include the desire for charter schools. Also, a large state population increases the likelihood that a critical mass could develop to support charter schools. The marginal effects coefficient for the Population variable is only 0.009 however, suggesting that an increase of one million in the state population increases the probability that charter legislation passes by 1 percentage point. While this variable has statistical significance, it does not appear to have much economic significance in this model.

The Poverty variable, representing high-cost students, turns out to be statistically insignificant. The Median Income variable also turns out to be statistically insignificant. Hence, it appears that income levels in a state are not a statistically significant factor. The Percent Non-White variable and the Percent Private variable are both statistically insignificant. The statistical insignificance of the Percent Private variable is surprising, since economic theory predicted there would be some sort of competitive relationship between private schools and charter schools.

Overall, these results from the random effects probit suggest that there are specific factors that lead a state to pass charter legislation. The statistically significant factors are the party of the Governor in office, the Student/Teacher ratio, the state population, the educational attainment of households, the per pupil expenditure, and the degree of centralization in school finance.

The results of the random effects probit exhibit differences when compared to the MLE probit, but overall are similar. The random effects probit provides a different and more comprehensive way of analyzing the data, correcting for the correlation between error terms within a group. This appears to be an important factor in these pooled data, as the results of the random effects probit generate more statistically significant variables than the MLE probit. The ρ (rho) term in the random effects probit, which represents the share of variation explained by random effects, is quite high at 0.963. This suggests that the random effects model is the proper specification for this equation compared to the MLE probit.[15]

To see if any one particular year of data was primarily responsible for the results, yearly cross-sections were analyzed for 1994 through 1997. These results appear in Table 8. The probits for the years 1992 and 1993 were excluded since they lacked sufficient variability in the charter variable to obtain any meaningful results.

The single year probit analyses do not provide much more information for the state choice model. The 1994, 1995, and 1996 cross-sections all have only one

[15] This high rho term also suggests that the estimates are sensitive to number of quadrature points used to maximize the log-likelihood function. As a check, the random effects probit was performed with Laguerre quadrature points of 20 and 68 (the default setting is 40 points), and the results are nearly identical to those of the baseline random effects probit.

statistically significant variable in each regression. The 1994 and 1995 probit models both show the State/Local variable being significant, while the 1996 probit shows the Median Income variable as being statistically significant. The 1997 probit has no statistically significant variables, providing no additional information for the analysis.

Overall, these cross-sections show that no one single year of data is determining the overall results. This is quite surprising, since both the MLE probit and the random effects probit generated a number of statistically significant variables. These questions as to how these variables affect the state charter choice throughout the overall time period are addressed in the next section.

5.1.1 Duration Analysis

A different method of analyzing the state choice is to employ a duration model. Duration models focus on the length of time a person or entity stays in a specific state or condition before leaving that state. In this case, the focus will be on the length of time before a state passes charter legislation. A life table for the data is presented in Table 9. The life table shows calculations of sample hazard and survival rates. These rates are also plotted in the below in Figures 1 and 2.

The life table presented in Table 9 calculates survival and hazard rates for one-year intervals of the sample (the sample period was extended to 2001 for these calculations). The hazard ratio gives the conditional probability that a state will adopt charter legislation given that the spell has lasted to time *t* already. The related survivor rate gives the conditional probability that this spell (a state not having charter legislation) will continue. These life tables, while not containing exogenous variables other than time, help to sketch the basic shape of the hazard function.

To provide a more rigorous analysis, a Weibull loglinear model is used to analyze the state charter choice. The results are presented in Table 10, along with the plotted estimated survivor and hazard functions in Figures 3 and 4. This model controls for other parameters besides time, and also allows the covariates to change over time. In this case, the coefficients represent the effect of the independent variables on the expected spell duration.

Looking at Table 10, none of the variables are statistically significant. Curiously, the Weibull loglinear model provides no additional information concerning the state charter choice. Combined with the fact that the yearly cross-sections probit models produced little in the way of statistical significance, this suggests that the sample period may not have been long enough for time to be a major factor. The random effects probit analyzes the pooled data to account for the state specific disturbances. These state specific disturbances seem to be much more important than the time variable for the overall state choice results. In other words, any modeling specification that does not account for state specific idiosyncracies may be inappropriate.

5.2 District Probit Analysis

An MLE probit model was estimated to determine the district choice factors that are statistically significant. This is the first step of the selection procedure that will estimate the outcome results. The MLE procedure treats each observation as being independent. However, since the data being analyzed are panel data, this assumption is not necessarily true. Therefore, some adjustments were made to account for the heterogeneity among observations. Year dummy variables were inserted for each year of the sample (minus one for statistical purposes), and state dummy variables were also

inserted. However, some states have no charter schools, or just one or two. In order to avoid multicollinearity between the charter variable and the state dummy variable, only states with a certain number of charter observations were given a state dummy variable. The cutoff point was four charter (district-year) observations.[16] The results of the probit are presented in Table 11 along with the marginal effects coefficients. The marginal effects coefficients describe the partial derivative of adopting a charter school with respect to a unit change in the independent variable.

Looking at Table 11, many of the variables show statistical significance. The Agency Locale Code had a high level of statistical significance, with a negative coefficient. This shows that charter schools develop more in urban areas. In urban areas, there are higher population densities, and hence may be more citizens with a preference for charter schools. Charter schools may also allow for more sorting in major metropolitan areas. However, the marginal effects coefficient for this variable is only −0.003, suggesting a one-unit change in the Agency Locale Code increases the probability a district will adopt a charter school by less than one half of a percentage point (see Table 4 for a description of the Agency Locale Code variable). While this variable is statistically significant, it does not seem to be significant in an economic sense.

The Percent IEP variable turns out to be statistically insignificant. It was hypothesized that having a larger percentage of high-cost students may increase the desire for a charter school. That appears not to be the case in this sample. However, the Percent Poverty variable was highly statistically significant with a positive point estimate.

[16] Therefore, observations from the following states had dummy variables: Arizona, California, Colorado, Connecticut, Florida, Georgia, Massachusetts, Michigan, Minnesota, North Carolina, New Jersey, New Mexico, Texas, and Wisconsin.

Liquidity-constrained households were thought to be in favor of charter schools since some may not be able to purchase the educational quality they desire. This result affirms that having a high percentage of poor households increases the probability of observing a charter school. Additionally, the marginal effects coefficient is the highest of any variable, with an estimate of 0.016. This suggest that a 1 percentage point increase in the poverty rate increases the probability of a charter school being observed by approximately one and a half percentage points.

The Local Revenue variable is also positive and statistically significant, with a marginal effects coefficient of 0.005. A reliance on local finance creates a stronger mechanism for school quality. Earlier, it was hypothesized that centralized finance would weaken this mechanism and therefore increase the chances of a charter school being adopted. The results of the Percent Local variable suggest the opposite: areas with a high degree of local finance are more likely to adopt a charter school. One interpretation of this may be that there are supply-side inefficiencies, such as those mentioned in the Hoxby model, that only a charter school, can correct. Another interpretation is that if finances are heavily centralized, local citizens may become less active in education reform. A third interpretation is that when a school district has more local control, they may choose to adopt a charter school if needed.

The Percent At-Risk variable turns out to be statistically insignificant. This is also true for the Percent Republican variable, which was designed to be an instrumental variable. However, the instrumental variable technique is needed only for the Heckman two-step, which is a single-equation technique. The MLE procedure runs both the selection and outcome equations simultaneously, actually using the asymptotic

covariance matrix as an initial instrumental variable, to produce consistent and efficient results.

Percent Non-White is statistically significant and has a positive coefficient, with a marginal effects coefficient of 0.005. This suggests that charter schools will tend to develop in areas that have larger minority populations. This strengthens earlier hypotheses about the costs of educating a heterogeneous student body. Alternatively, this could mean that minorities are more likely to demand charter schools, that their preferences for educational quality are not being met in the public schools.

Of the two variables representing school system characteristics, Current Per Pupil Expenditure and Student/Teacher Ratio, only the Student/Teacher ratio variable is statistically significant. The marginal effects coefficient is 0.005, suggesting a slight increase in probability for a charter school developing if there is a marginally higher Student/Teacher ratio in the district. Overall, these results show that there are significant factors related to a school district adopting a charter school: Agency Locale Code, Percent Poverty, Percent Local Revenue, Percent Non-White, and the Student/Teacher ratio.

An additional way of analyzing the district choice would be to perform a random effects probit. The MLE procedure does not fully account for the heterogeneity across observations, even though year and state dummy variables were inserted. The random effects model inserts an additional group-specific error term to correct for this dependence across observations. Also, this procedure is the first step of the Heckman two-step approach, which is used as an alternative technique. The results of the random effects probit along with the marginal effects coefficients appear in Table 12.

The results are somewhat similar to the MLE probit performed earlier. Agency Locale is again statistically significant and negative. Percent Non-White is highly statistically significant again with a positive point estimate. Student/Teacher Ratio, which was statistically significant in the MLE probit, is significant and positive here also.

Perhaps the biggest surprise is the Percent Republican variable, which was insignificant in the earlier MLE probit. Now the Percent Republican variable is nearly significant at the 5% level, with a t-statistic of 1.93. The marginal effects coefficient of Percent republican is 0.008. While this variable was insignificant in the MLE probit, it is statistically significant here, and is an effective instrumental variable for the Heckman two-step approach.

It should be mentioned that while both the MLE and random effects probits generated statistical significance for many variables, the marginal effects estimates for these variables remained relatively low. This suggests that even though there are statistically significant factors that affect the district choice, these factors do not seem to be economically significant. This information weakens the hypothesis that there is self-selection at the district level – that only districts with certain characteristics are selecting charter schools and that this is biasing the results of the outcome equation.

5.3 Performance Equation

Results from an OLS regression on the dropout rate are presented in Table 13, along with the fixed and random effects regressions. Due to the panel data being unbalanced, a Hausman test could not be performed to determine if the fixed or random effects model is appropriate. This is a simple OLS regression with year and state dummy variables, covering 27 states over six school years. The point estimate for the charter

schools variable is relatively large at 0.009 and highly significant. If the model is specified correctly, this result shows a strong positive relationship between charter schools and dropout rates, roughly a 1 percentage point increase in the district dropout rate the year a charter school is adopted.

However, the probit model from the last section showed that certain factors are important for districts choosing charter schools. This suggests there may be self-selection at the district level that would bias the outcome results. To test for self-selection, an MLE treatment effects model is estimated. The results appear in Table 14. The district probit results are slightly different than earlier results appearing in Table 11, since the MLE re-estimates the probit model when estimating the outcome equation. The ρ (rho) term, representing the correlation between disturbance terms across equations is statistically insignificant. This asserts that self-selection is not an issue in evaluating the performance equation. Another test of self-selectivity, using the Heckman two-step, also shows no evidence of self-selection and is detailed in the next section. A third piece of information, that the marginal effects coefficients for the district probit are not significant in an economic sense, also shows that district self-selection is not an important factor.

If self-selection is not present, the results of the OLS procedure in Table 13 describe the relationship between charter schools and the dropout rate. Again, the results show a positive relationship between charter schools and the dropout rate. Also, the results of the fixed and random effects regressions show very similar results to those of the OLS for all variables. This suggests that district fixed or random effects are not crucial for the results. The results of the MLE procedure also show similar results, with

the coefficient on the charter variable virtually identical at 0.010. The MLE procedure verifies the OLS estimates of the charter variable coefficient.

Other point estimates from the OLS are of interest as to how they affect the dropout rate. The results show statistical significance for most variables, the exception being the Local Revenue variable. The Agency Locale Code is statistically significant with a point estimate of –0.002. This shows the more urban the area, the higher the dropout rate. Historically, urban areas have higher dropout rates but this could be due to the combination of lower income and minority populations that often appear in urban areas, and minority populations are already controlled for in this model (Rumbereger, 1987). The independent effect of Agency Locale Code could be due to peer effects in behavior, a negative spiral that increases the dropout rate. This effect could also reflect tastes for education, or possibly that children from liquidity-constrained households seek wage-earning opportunities earlier in life. The Percent IEP variable is statistically significant with a point estimate of 0.056. This shows a positive relationship between the number of IEP students and the dropout rate. This is entirely plausible, as IEP students are among the most difficult students to educate and may be more likely to drop out. An alternative explanation is that IEP students drive up costs, which "crowds out" quality and leads other students to drop out.

The Percent Poverty variable is statistically significant with a point estimate of 0.048. This shows that the higher percentage of poor households in an area, the higher the dropout rate. This is consistent with previous findings that lower income is associated with a higher dropout rate (Kolstad and Owings, 1986; Rumberger, 1987). Children from poorer households may be more difficult to educate, and also these

households may not be able to afford to live in areas with high educational quality. These households may also have different or lower preferences for educational quality. The Percent At-Risk variable has the highest point estimate of 0.102, and the result is highly statistically significant. This result should be no surprise, since students are labeled "at-risk" because they are at risk of dropping out or having academic problems. The Percent Non-White variable is significant with a point estimate of 0.022. This shows that the prevalence of minority populations increase the dropout rate. This could again be attributed to supply-side considerations, where a heterogeneous student population is more difficult to educate. Alternatively, minority populations may have different preferences for educational quality. Regardless, the positive relationship between minority populations and the dropout rate concurs with previous research (Rumberger, 1983; Plisko and Stern, 1985).

The two variables representing local school conditions, Current Per Pupil Expenditure and Student/Teacher Ratio, both are statistically significant. The expenditure variable has a negative point estimate of –0.001. This is reasonable, since it shows that higher per pupil expenditure will lower the dropout rate. This would strength the view that "money matters", and that higher per pupil spending can improve student outcomes – at least behavioral outcomes. However, the point estimate is very low, suggesting an increase of $1,000 in per pupil expenditure would lower the dropout rate by only one tenth of a percentage point. The Student/Teacher Ratio variable has a positive point estimate of 0.006. This is also reasonable, suggesting that a decrease in the Student/Teacher Ratio will lower the dropout rate. This point estimate is also small, but

the finding does support previous research into class size and performance (Rees and Mocan, 1997; Lazear, 1999).

5.3.1 Analyzing the MLE results

Though district self-selection does not appear to be an issue, the results of the MLE procedure initially presented in Table 14 are of interest. The point estimate for the charter school variable has increased to 0.0102, and is statistically significant. Other variables show similar results to the OLS procedure. In fact, the signs, magnitude and significance of the other independent variables are almost identical to those of the OLS regression.

In the MLE regression, state year dummy variables were inserted to pick up time fixed effects. Another way to analyze these time effects would be to perform yearly cross-sectional analyses. This can determine if any particular year is driving the overall results, or if self-selection is present in any one year. This was done for years 1995-1997, and the results are presented in Table 15. These results are not much different from the panel results. The point estimate for the charter variable remains about the same, ranging from 0.006 to 0.010, though none of these estimates are significant. The signs and magnitudes of the point estimates for the other variables remain very similar to the panel results.

Another way to analyze the MLE results is on a state-by-state basis, to determine if self-selection is present in certain states. The results of separate state analyses appear in Table 16. States with sufficient variability in the charter variable are analyzed. For Minnesota, Texas, and Wisconsin, the point estimate for the charter variable is positive and significant. Interestingly, Colorado has a negative point estimate that is statistically

significant. The remaining states all have statistically insignificant point estimates. The ρ (rho) term, which measures autocorrelation, is statistically significant in the Colorado, Minnesota, and Texas. This possible self-selection can explain the negative sign on Colorado's charter coefficient in the MLE results. Self-selection may be present in Minnesota and Texas as well, though this does not seem to affect the coefficient of the charter variable much in either state. Generally, the point estimate of the charter variable appears to hold across states - there is not one particular state driving the results. This further substantiates the results of the panel MLE procedure.

Overall, these corrected results tell a similar story as the original OLS estimates. It appears that charter schools have a positive relationship with the high school dropout rate, roughly a 1 percentage point increase in the district high school dropout rate when a charter school is adopted. This would appear to be bad news for policymakers interested in utilizing charter schools. This result is not constant across all states, however. Next, the baseline OLS results are further scrutinized.

5.3.2 Analyzing the OLS Results

Another way to analyze the performance data is by performing regressions for the year-by-year cross-sections. This can determine whether specific years are crucial to the overall results. The results of this analysis are presented in Table 17. The charter variable remains positive in each year of the sample, and is statistically significant in five of the six years. The point estimate for the charter variable ranges from 0.005 to 0.047. The high point estimate of 0.047 is for the 1992-93 school year when there were very few charter high schools. The estimates for the other variables remain similar to those of the

panel results. These single-year results show that no particular year is driving the overall results for the charter variable.

The data can also be analyzed separately for each state. This can determine if effects are constant across states, and also if all states have similar results. The results of these single state analyses are presented in Table 18.[17] States with sufficient variability in the charter variable were selected for analysis. Surprisingly, Arizona, Colorado, Florida, Georgia, and Massachusetts all show a negative point estimate for the charter variable. However, most of these point estimates are quite small in magnitude, and none of the results are statistically significant. California, Michigan, Minnesota, and Wisconsin all show positive and statistically significant point estimates for the charter variable. These four states may be driving the panel results for the charter variable. Connecticut and Texas both show positive but statistically insignificant point estimates for the charter variable. For the other independent variables, state-by-state results show some variability, though nothing extremely different than the panel results. These results show that the effect of charter schools may differ across states, and that even among the states that selected charter legislation, there may be substantial differences within these states.

In this section, the MLE treatment effects model determined that self-selection was not statistically significant, and therefore should not generally bias the results of the performance equation. This result is tested for robustness in section 5.3.4.

[17] Year dummy variables were inserted where appropriate. Also, the Agency Locale Code variable was removed from the Florida OLS and MLE due to high multicollinearity with the Charter variable.

5.3.3 Data Consistency

There were also questions of consistency for the dropout data, mentioned in Chapter 4. This was due to the fact that the dropout data came from different sources, with agencies using slightly different formulas to calculate the dropout rate. To check for consistency, dropout data are analyzed in two different categories: data from the NCES, and data from the individual state departments of education. Separating out the two sets of data is difficult. Many states slightly altered their formula to meet NCES reporting standards for school year 1996-97.[18] However, the 1996 cross-section analyzed earlier showed no substantial differences from the other years. The data for California, Michigan, Florida, North Carolina, South Carolina, and Texas never met NCES guidelines during the six years of the sample. Therefore, one way to check the consistency of the data is to analyze those 6 states and also the remaining 21 states separately. The results of this analysis appear in Table 19. The coefficient on the charter variable is virtually identical, 0.015 versus 0.013, and is statistically significant in both regressions. This suggests that the disparity in state dropout calculations has no effect on the overall results.

5.3.4 Alternative Methodology

The Heckman two-step is another option that can test and correct for self-selection. As mentioned in the last chapter, the Heckman two-step uses a probit selection equation to produce a selection term, referred to as the Inverse Mills Ratio (IMR), that is included as a regressor in the outcome equation. Heckman (1979) suggested a *t*-test for

[18] For more information, see: http://nces.ed.gov/pubs2001/2001022.pdf.

test for the statistical significance of this term in the outcome equation should determine if there is a self-selection problem. In this situation, a random effects probit is used to produce the IMR, and it is inserted into an OLS regression, including district fixed and random effects. Dummy variables for years and states are included to account for time and state fixed effects. The results of the Heckman procedure, with district fixed or random effects, are presented in Table 20. The Hausman test could not be performed to determine whether the fixed or random effects model is more appropriate, due to the unbalanced nature of the panel data.

The point estimate for the Inverse Mills Ratio is insignificant, further asserting that self-selection is not an issue. If self-selection is not a problem, then the results of the Heckman procedure should be similar to those of the original OLS regression, and they are quite similar. The point estimate for the charter variable remains positive at 0.021 and is significant. The results for the fixed and random effects are similar, with both point estimates at 0.019. This suggests that a charter school will increase the district dropout rate by approximately 2 percentage points. This also substantiates the results of the MLE procedure. Both techniques produce a positive and significant coefficient for the charter variable, ranging from approximately 0.01 to 0.02.

Estimates for the other variables in the Heckman procedure are very similar to those obtained from the OLS regression. One exception is the Percent IEP variable. In the OLS regression, the point estimate is 0.056 and is statistically significant. In the Heckman procedure, the point estimate is –0.035 and is statistically significant. The conflicting results for this variable weaken any potential interpretations of the point estimate.

The fixed and random effects regressions show estimates that are similar to those from the OLS regression. This again suggests that district fixed and random effects do not play a major role in these regressions. However, many of the year and state dummy variables have statistical significance. Therefore, while the group fixed or random effects do not appear to change the results, the year and state fixed effects are important for the integrity of the estimates.

5.4 Initial Conclusions

The results of the uncorrected OLS show a point estimate of 0.009 for the charter variable. Self-selection was tested for, and found to be insignificant. The results of the MLE procedure shows a similar point estimate of approximately 0.010, and the Heckman procedure shows a slightly larger point estimate of approximately 0.020. The results of the MLE and Heckman procedure do not substantially deviate from the uncorrected OLS. This further affirms that self-selection is not a major factor in the outcome equation.

These results suggest that charter schools are not effective in lowering the district high school dropout rate, and may, in fact, be increasing it. This might also suggest that charter schools are not focused on the dropout rate, and are in fact focusing on other goals as per their charter. Interpretation of this crucial finding will be thoroughly discussed in Chapter Six. To provide a more complete analysis, district test scores are analyzed in the following section.

5.5 Other Outcome Measures

District test score data are analyzed for two states, Florida and Wisconsin, due to the many data limitations discussed earlier. Summary statistics for the test score data are presented in Table 21. Florida uses a High School Competency Test, and the results are

reported in terms of the Percent Passing both components of the exam. Wisconsin changed testing procedures during the sample period. For 1993-94 through 1995-96, Wisconsin reported district scores in terms of an Average Grand Composite Score (AGCS), which is simply a raw number for each district. For 1996-97 and 1997-98, Wisconsin reported Reading and Math scores in terms of a National Percentile Rank.

The results of an OLS regression for the Florida scores are presented in Table 22. The point estimate for the charter variable is positive but insignificant. However, self-selection may be an issue in this particular state, and the MLE treatment effects model is employed. The results of the MLE procedure are presented next to the OLS results. The ρ (rho) term, representing the correlation between disturbance terms across equations, is statistically significant suggesting self-selection is an issue. After correcting for self-selection, the coefficient on the charter variable is negative and significant at the 10% level. The point estimate is –0.051, suggesting a decrease of 5 percentage points for the number of students passing the exams. The other significant variables in the MLE procedure are the Poverty variable and the Nonwhite variable. These results verify earlier panel results concerning the effect of income and levels of minority populations on student performance.

The results of an OLS regression on the AGCS Wisconsin test scores are presented in Table 23. The coefficient for the charter variable is positive but statistically insignificant. To test for self-selection, the MLE is performed again. The charter variable point estimate remains positive but is still statistically insignificant. The ρ (rho) term is also statistically insignificant, suggesting that self-selection is not a factor in the results. It appears that there is no relationship between charter schools and AGCS test

scores during this three-year period of the sample. Almost all other variables in the OLS regression are statistically significant. The Agency Locale Code, Percent IEP, Poverty, At-risk, and Nonwhite variables all have the same sign as those from the overall results concerning the dropout rate.

Results of an OLS regression on Wisconsin test scores in the later part of the sample are presented in Table 24. The point estimate for the charter variable is positive but statistically insignificant for both the Reading and Math Scores. The MLE procedure is again performed to test for self-selection, and these results are presented in Table 25. In this case, the rho term is statistically significant for both the Reading and Math score regressions. Correcting for self-selection, the point estimate for the charter variable is negative and significant in both regressions. The point estimates are almost identical, with an estimate of –0.015 in the Reading score regression and –0.0103 in the Math score regression. These results show that once self-selection is corrected for, charter schools have a negative relationship with the Reading and Math scores in Wisconsin, approximately a decrease of 10 percentage points. The other significant variables, Agency Locale Code, Percent IEP, Poverty, At-risk, and Nonwhite, all have the same signs as from the dropout regressions on the full sample.

Overall, this analysis shows charter schools appear to have either a negative or no effect on test scores. Charter schools appear to have a negative relationship with test scores in Florida, where the presence of a charter school lowers the percent passing in a district by 5 percentage points. Charter schools had no relationship with test scores in the early part of the Wisconsin sample. In the last two years of the sample, charter schools have a negative relationship with charter schools, approximately a 10 percentage point

decrease in Reading and Math percentile rank scores. In these two states, charter schools do not appear to be having any beneficial effect on district test scores. However, these results are for two states only, and the findings cannot be generalized to other states in the sample.

5.6 Summary

This chapter presented the empirical findings of this dissertation. There are statistically significant factors related to a state passing charter legislation and also a district enacting a charter school. District self-selection was tested for and found not be statistically significant. Therefore, the analysis of how a charter school effects educational outcomes can be performed with an OLS regression. Charter schools were found to have a positive relationship with the dropout rate in the full sample, and also a negative relationship with test scores in two states.

CHAPTER SIX

CONCLUSIONS

6.0 Introduction

The object of this dissertation was to thoroughly analyze all aspects of charter schools – why they are selected, and how they affect educational outcomes. First, the state choice to adopt charter legislation was studied. Second, the local choice to enact a charter school was analyzed. Third, the effect of a charter school on outcome measures was studied. This chapter summarizes the results of this analysis, and discusses the policy contributions of this paper.

6.1 State Charter Choice

The state decision to adopt charter legislation was modeled and empirically tested in this dissertation. The results of the state analysis show that there are specific factors that lead a state to pass charter legislation. These results serve to verify and expand upon previous research into the state decision (Hassel, 1999).

The most important factors in leading a state to pass charter legislation are the presence of a Republican governor, a high educational attainment level of households, and an educational finance system that relies primarily on local tax revenue. Charter legislation also tends to pass in states with above average population, high student/teacher ratios, and high expenditure per pupil. These state characteristics paint a picture of what type of state is likely to pass charter legislation. The findings that above average population and the presence of a Republican lead a state to pass charter

legislation agree with previous research done by Hassel (1999). The other findings represent new contributions to this branch of research.

The high educational attainment of households and the high expenditure per pupil may both reflect certain tastes for education. These variables may also reflect a household's ability to pay for educational quality. Charter schools offer a different combination of the components of educational quality. If households with certain preferences for educational quality are not satisfied by traditional public schools, charter schools may become an attractive option. Households with a high level of educational attainment may have specific preferences for educational quality, and desire charter schools to fulfill these preferences. These households may also desire charter schools as a way to have more control over educational spending.

Surprisingly, the empirical analysis did not show any relationship between private schools and the passage of charter legislation. If consumers are unhappy with public schools, and they are apparently willing to pay high expenditure per pupil, it would seem that private schools are an appealing option. The empirical results have failed to establish the type of relationship between charter schools and private schools, whether they are complements or substitutes for example. More research at the local level is needed to determine the exact structure of this relationship, if a relationship does exist.

Another finding is the positive relationship between Republican governors and the passage of charter legislation. This was predicted by the Hassel research showing that Republicans favor charter schools at the state level. The finding that the composition of the state legislature has no effect on charter legislation is somewhat surprising, however. As mentioned previously, it could mean that the party of the governor in power makes the

ultimate decision as to charter legislation, and that the composition of the legislature means little if the governor does not support charter schools.

The analysis also showed that charter legislation is more likely to pass in states with high population. This could simply mean that states with larger populations generate a critical mass of people to politically support charter legislation. This may also suggest that a greater population has more diverse preferences. Alternatively, it could be that small states have public education systems that work better than those in large states. The degree of centralization in state education finance also proved to be important. The results showed that the greater centralization in state finance, the less likely a state is to pass charter legislation. One interpretation is that the lack of local control leads to less interest in actively pursuing education reform. Alternatively, the citizens could prefer both the centralization in finance and the lack of charter legislation.

In sum, these empirical results help answer the question of why certain states pass charter legislation. These findings also show the interrelationships of political and economic factors in passing charter legislation. While statistical relationships for various factors has been developed, stating cause and effect reasons for a state passing charter legislation is more difficult. By continuing to observe and study which states pass charter legislation in the near future, the study of how factors affect the charter school choice will improve. Various states continue to adopt charter legislation, with Indiana passing a charter law in May 2001 and other states seemingly not far behind.

6.2 District Charter Choice

After studying the state level choice, the district choice was analyzed. There appear to be significant factors that lead a school district to adopt a charter school. The

empirical evidence also suggests that charter and non-charter districts are systematically different in their characteristics.

The empirical work showed that several factors are crucial for a district to adopt a charter school. The degree of urbanization is important, such that charter schools are more likely to be observed in areas with a higher degree of urbanization. The interpretation of this finding is difficult. One interpretation is simply that urban areas have a higher overall population, and therefore there might be a sufficient number of households that prefer a charter school. Another interpretation is that there are more diverse preferences within a highly populated area. A third interpretation is that highly populated areas have more troubled schools, perhaps due to historical reasons, and this makes the charter school option more attractive.

The empirical analysis showed that charter schools develop in areas with higher minority populations. It was also shown that the higher percentages of households in households in poverty, the more likely a charter school is observed. Neither of these findings is surprising since many charter schools are designed to serve minority or special populations. Charter schools may also offer a different risk/reward ratio than other school reform measures. If a charter school fails, the charter can be revoked. If other reforms are instituted, they may be difficult to remove. Thus, charter schools may be a better "gamble" for reforming troubled school districts. Another finding was that the more local control in finances, the more likely that a charter school is observed. This result may show that the more financially independent a local school district, the more likely it may act to improve the local educational quality.

In all, the empirical analysis showed that districts with certain characteristics are more likely to enact charter schools. As with the state choice results, it is a mix of political and economic factors that are most important in the decision. Both the state and district choice analyses help answer interesting political economy questions. Policymakers can use this information as to predicting what areas or states have the greatest chance of adopting charter schools. However, the primary focus in this study of charter schools is their effect on educational outcomes. The regional choice model serves an important function in this by helping to determine if there is a self-selection problem within the outcome model.

6.3 Performance Analysis

The performance analysis represents the crux of this study of charter schools and is very valuable in terms of public policy and education reform. This work also contributes to the continuing debate on the effectiveness and appropriateness of school choice. While the state and regional choice models provide interesting information as to how this choice process operates, the results of the performance analysis are crucial to discussing the merits of charter schools.

The performance analysis was initially centered upon the issue of self-selection. From the district choice results, it appeared that the charter school choice was non-random, and that districts were self-selecting charter schools. If this was true, and if this was unaccounted for in the performance analysis, the final parameter estimates would be biased and inconsistent. However, no evidence was found that self-selection was an issue in interpreting the outcome results. An alternate test of self-selection was performed and again it was found not to be a factor. Additionally, this result generally held across time

and across states – self-selection does not seem to be systematically biasing the performance results.

Since self-selection was not an issue in this sample, charter schools were directly tested for their effects on different outcome measures. The first outcome measure tested was the district high school dropout rate. The results overwhelming showed that charter schools were not decreasing the dropout rate, but actually have a positive relationship with the dropout rate. This result concerning the dropout rate also held true across time. The result was not as consistent across states, as a handful of states appear to be driving the results. However, charter schools did not have a negative and statistically significant relationship with the dropout rate in any single state.

How can this negative relationship between charter schools and the dropout rate be explained? It must be initially noted that there is not a strict cause-effect relationship here. As explained in Chapter Three, a district dropout rate has many components. If the district high school dropout rate is increasing, this may be because the dropout rate in charter schools is increasing, the dropout rate in traditional public schools is increasing, or any combination of the two. A charter school may also draw from existing private schools, thus changing the number and average characteristics of students who are now in the public school system.

Some hypotheses can be generated as to how a charter school may have a negative relationship with the district dropout rate. First, a charter school may be focused on goals other than the dropout rate. The actual charter could be focused primarily on academic achievement, and specify no criteria for the dropout rate. In a strange twist,

this focus on academics may inadvertently increase the dropout rate – if there are low performing students, a school might let them drop out to increase average test scores.

Second, the officials operating the charter school may lack the necessary experience to effectively govern charter schools. Citizens who start a charter school may not understand all the complexities that are involved in operating a public school. This inexperience may limit their effectiveness and increase the dropout rate.

A related hypothesis is the freedom and experimentation allowed in charter schools. A charter school could try many new techniques that ultimately are ineffective. Therefore, this early turbulence may appear in the form of a higher dropout rate. After a school has a chance to "fine-tune" its system, dropout rates may return to lower levels.

A charter school may also lower the dropout rate by sorting and peer effects. A charter school may attract a group of high or low performing students. There may now be additional peer effects in both the public and charter school, but the peer effects of grouping the low performing students may bring down the overall district average.

Another explanation is that there is a measurement problem in the empirical specification. It could be that there is self-selection, but detecting it is very difficult, and conventional variables do not measure these factors. If this concealed self-selection could be accurately measured, the results of the outcome equation might be altered.

The results of the performance equation also show how other factors contribute to the dropout rate. The empirical evidence here shows that areas that are more urban have higher dropout rates. The results also show that areas with high levels of poverty and a high number of "at-risk" students have a higher dropout rate. These findings verify not only common sense as to the difficulty in reaching poor or at-risk students, but previous

research (Rumberger, 1987). The results also show that areas with higher minority populations have a higher dropout rate. This finding shows the continuing disparity in outcomes between white and non-white students (Rumberger, 1987).

In addition to the analysis of dropout rates, test scores for two states were analyzed. Data limitations restricted the study of test scores to that of two states, Florida and Wisconsin. Results using high school achievement tests in Florida and Wisconsin show that charter schools are having either a negative or no effect on test scores. This result is surprising, given the focus on academic achievement in charter schools. Test scores are a distinctly different outcome measure as compared to dropout rates. The findings that charter schools have a negative relationship with test scores and a positive relationship with the dropout rate appear to make the case that charter schools are adversely affecting student outcomes. This result is both surprising and subject to qualification, and merits further discussion and debate.

6.4 Discussion and Caveats

The negative effect of charter schools on the dropout rate and selected test scores is startling, and runs counter to the claims that charter schools are "reinventing public education". However, these results must be qualified. First, the time period for the sample is limited, representing the first six years of the charter movement. Given more time, charter schools may prove to be successful in their mission. This is especially true for the many charter schools that were enacted late in the sample period. These first six years may represent the turbulence that goes along with any new reform. As more years of data become available, future research may determine if the negative effect of charter schools on outcome measures was an aberration or a permanent relationship.

Second, these results apply only to charter high schools, as charter elementary schools were not included in the sample. Most of the early charter schools enacted were elementary schools, which are much easier to set-up and administer than a high school. The majority of the charter high schools studied were enacted late in the sample period. Therefore, the effect may take time to distinguish itself, more time than was available in the sample period.

Third, these results apply only for states that have already passed charter legislation. The state choice analysis showed that specific state factors were crucial for the passing of charter legislation. Therefore, self-selection at the state level may be an issue, which can subsequently bias any outcome results. It may be that charter schools are effective in other states with different characteristics. To be more precise, charter schools may be effective in states where preferences for educational quality are more diverse, and potentially unsatisfied. Unfortunately, the empirical work could not correct for state level self-selection in the performance results, though state dummy variables were used in the panel analysis. Therefore, it must be emphasized that the dropout results cannot be generalized to states that do not currently have charter legislation. The finding that charter schools have a positive relationship with the dropout rate only holds true for the thirty states that were studied.

Fourth, they may have been measurement problems involved in detecting self-selection. Self-selection may be taking place, but conventional variables may not be able to detect this. If so, this would alter the results of the outcome model.

The results of the test score analysis must be additionally quantified. Due to data limitations, the results were for two states only and cannot be generalized to any other

states. It should also be mentioned that the test scores in the sample measured levels of achievement, and were not in a value-added format. However, the test score results do coincide with those from the dropout analysis and overall, suggest that charter schools were having a negative effect on district outcome measures during the time period studied.

6.5 Contributions

Charter schools are an important component of school choice. School choice experiments continue to grow in number across the country with charter schools leading the way. The number of charter schools has significantly increased every year, and the trend shows no sign of slowing. The current administration has promised to triple the number of charter schools nationwide by 2006. With charter schools educating an ever-increasing number of students, and also taking an increasing share of local and state budgets, this phenomenon must continually be analyzed. The results here study charter schools at their infant stage, during their first six years of development. These results suggest that charter schools are ineffective in reducing the district high school dropout rate and appear to be increasing it. Additional though limited results also suggest that charter schools are having a negative impact on average district academic performance. These results need to be confirmed over the course of future study.

Further research is needed to verify the results presented here. As more years of data become available, analysis should continue on how charter schools affect the dropout rate and test scores. The study of dropout rates should be easier to implement in the future, as more states and agencies are adjusting their dropout formula to meet federal standards. The study of test scores remains difficult, as there is very little standardization

across the country. Ideally, other outcome measures should also be analyzed. These measures could include labor market performance and continuance of education. By using an assortment of outcome measures, the true effect of a charter school can be more accurately determined.

Additional research should also focus on separating the two effects of a charter school, the within-school effect and the effect on neighboring schools. One of the premises of charter schools, and more generally school choice, is that competition will improve educational outcomes. This theory should continue to be tested empirically, and charter schools currently offer the best opportunity for this analysis.

This dissertation represents a unique contribution to the school choice literature. The idea of school choice continues to make headlines and gain momentum, and truly appears to have the potential to reshape the American public educational system. Charter schools are currently the most widely used component of school choice. The results here suggest that they may not be the best option for improving certain outcome measures, and that future study is needed to verify the effectiveness of charter schools.

BIBLIOGRAPHY

BIBLIOGRAPHY

Ascher, Carol, Norm Fruchter, and Robert Berne. (1996). *Hard Lessons: Public Schools and Privatization.* The Twentieth Century Fund Press, New York.

Barlow, R. (1970). "Efficiency Aspects of Local School Finance." *Journal of Political Economy,* Vol. 78, pg. 1028-1040.

Barnow, Burt S., Glen G. Cain, Arthur S. Goldberger. (1982). "Issues in the Analysis of Selectivity Bias." *Evaluation Studies Review Annual,* Vol. 7, pg. 43-59.

Baum, Donald D. (1986). "A Simultaneous Equations Model of the Demand for and Production of Local Public Services: The Case of Education." *Public Finance Quarterly,* Vol. 14, No. 2, pg. 157-178.

Behrman, Jere R., and Birdsall, Nancy (1983). "The Quality of Schooling: Quantity Alone is Misleading." *American Economic Review,* Vol. 73, No. 5, pg. 928-46.

Berliner, David C. and Biddle, Bruce J. (1995). *The manufactured crisis : myths, fraud, and the attack on America's public schools.* Addison-Wesley, Reading, Mass.

Bergstrom, T.C., D.L. Rubinfeld, and Shapiro, Perry. (1982). "Micro-Based Estimates of Demand Functions for Local School Expenditures." *Econometrica,* Vol. 50, No. 5, pg. 1183-1205.

Bettinger, Eric P. (1999). "The Effect of Charter Schools on Charter Students and Public Schools." Working paper, Case Western Reserve University.

Bils, Mark and Klenow, Peter J. (2000). "Does Schooling Cause Growth?" *American Economic Review*, Vol. 90, No. 5, pg. 1160-83.

Borcherding, T.E. and Deacon, R.T. (1972). "The Demand for the Services of Non-Federal Governments." *American Economic Review*, Vol. 62, pg. 891-901.

Bowman, Darcia Harris. (2000). "Vast Majority of Charter School Studies Show Positive Findings." *Education Week*, Vol. 20, No.10, pg. 18-19.

Bradbury, K.L., Ladd, H.F., and Perrault, M. (1984). "State aid to offset fiscal disparities across jurisdictions." *National Tax Journal*, Vol. 37, pg. 151-170.

Bradford, D., R. Malt, and W. E. Oates (1969). "The Rising Cost of Public Services: Some Evidence and Reflections." *National Tax Journal*, Vol. 22, pg. 185-202.

Card, David and Krueger, Alan B. (1996). "School Resources and Student Outcomes: An Overview of the Literature and New Evidence from North and South Carolina." *Journal of Economic Perspectives*, Vol. 10, No. 4, pg. 31-50.

Catsiapis, George, and Robinson, Chris. (1982). "Sample Selection Bias with Multiple Selection Rules." *Journal of Econometrics,* Vol. 18, pg. 351-368.

Colorado Department of Education (2000). "Colorado Charter Schools Evaluation Study: The Characteristics, Status and Performance Record of Colorado Charter Schools." Colorado.

Crain, R.L., A.L. Heebner, et al. (1992). "The Effectiveness of New York City's Magnet Schools: An Evaluation of Ninth-Grade Performance Using an Experimental Design." National Center for Research in Vocational Education, Berkeley, California.

Cullen, Julie Berry, Brian A. Jacob, and Steven D. Levitt (2000). "The Impact of School Choice on Student Outcomes: An Analysis of the Chicago Public Schools." National Bureau of Economic Research, Working Paper 7888, Cambridge, Mass.

Eberts, Randall W. and Hollenbeck, Kevin M. (2001). "An Examination of Student Achievement in Michigan Charter Schools." W. E. Upjohn Institute for Employment Research, Staff Working Paper, New York.

Epple, Dennis and Romano, Richard E. (1998). "Competition Between Private and Public Schools, Vouchers, and Peer-Group Effects." *The American Economic Review*, Vol. 88, No. 1, pg. 33-62.

Friedman, Milton. (1962). *Capitalism and Freedom.* University of Chicago Press, Chicago.

Gamoran, A. (1996). "Student Achievement in Public Magnet, Public Comprehensive, and Private City High Schools." *Educational Evaluation and Policy Analysis*, Vol. 18, No. 1, pg. 1-18.

Glaeser, Edward L. (1996). "The incentive effects of property taxes on local governments." *Public Choice*, Vol. 89, pg. 93-111.

Glomm, Gerhard and Ravikumar, B. (1998). "Opting out of publicly provided services: a majority voting result." *Social Choice and Welfare*, Vol. 15, pg. 187-199.

Good, Thomas L. and Braden, Jennifer S. (2000). *The great school debate: choice, vouchers, and charters*. L. Erlbaum Associates, Mahwah, N.J.

Gray, Virginia (1973). "Innovations in the States; A Diffusion Study." *American Political Science Review*, Vol. 67, pg. 1174-85.

Green, J.P., P.E. Peterson, et al. (1997). "The Effectiveness of School Choice: The Milwaukee Experiment." Program on Education Policy and Governance, Harvard University.

Green, Richard K. (1997). "Measuring the Benefits of Homeowning: Effects on Children." *Journal of Urban Economics*, Vol. 41, pg. 441-461.

Greene, William (1981). "Sample Selection Bias as a Specification Error: Comment." *Econometrica*, Vol. 48, pp.505-514.

Greene, William. (1998a). *Limdep User's Manual*. Econometric Software, New York.

Green, William (1998b). "Sample Selection in Credit-Scoring Models." *Japan and the World Economy*, Vol. 10, No. 3, pg. 299-316.

Guilkey, David K. and Murphy, James L. (1993). "Estimation and Testing in the Randome Effects Probit Model." *Journal of Econometrics*, Vol. 59, No. 3, pg. 301-317.

Hamilton, B. (1976). "Capitalization of Intrajurisdictional Differences in Local Tax Prices." *American Economic Review*, Vol. 66, No. 5, pg. 743-753.

Hanushek, Eric. (1979). "Conceptual and Empirical Issues in the Estimation of Educational Production Functions." *Journal of Human Resources*, Vol. 14, No.3, pg. 351-388.

Hanushek, Eric. (1986). "The Economics of Schooling: Production and Efficiency in Public Schools." *Journal of Economic Literature*, Vol. 24, pg. 1141-1177.

Hassel, Bryan C. (1999). *The Charter School Challenge*. The Brookings Institute, Washington, D.C.

Hausman, J., and D. Wise (1977). "Social Experimentation, Truncated Distributions, and Efficient Estimation." *Econometrica*, Vol. 45, pp. 919-938.

Heckman, James (1979). "Sample Selection Bias as a Specification Error." *Econometrica*, Vol. 47, pp.153-161.

Henderson, V., Miezkowski, P., and Sauvageau, Y. (1978). "Peer Group Effects and Education Production Functions." *Journal of Public Economics*, Vol. 10, pg. 97-106.

Henig, Jeffrey R. (1994). *Rethinking School Choice: Limits of the Market Metaphor*. Princeton University Press, Princeton, N.J.

Henig, Jeffrey R. (1999). "School Choice Outcomes." In S. Sugarman, F. Kemerer, *School Choice and Social Controversy* (pg.68-110). The Brookings Institute, Washington, D.C.

Hoxby, Caroline M. (1996). "Are Efficiency and Equity in School Finance Substitutes or Complements?' *Journal of Economic Perspectives*, Vol. 10, No. 4, pg.51-72.

Hoxby, Caroline M. (1998). "The Effects of School Choice on Curriculum and Atmosphere." Working Paper, Harvard University.

Hoxby, Caroline M. (1999). "The productivity of schools and other local public goods producers." *Journal of Public Economics*, Vol. 74, No.1, pg.1-30.

Hoxby, Caroline M. (2000). "Does competition among public schools benefit students and taxpayers?" *American Economic Review*, Vol. 90,No. 5, pg. 1209-38.

Jaggia, Sanjiv and Kelly-Hawke, Alison. (1999). "An analysis of the factors that influence student performance: A fresh approach to an old debate." *Contemporary Economic Policy*, Vol. 17, No. 2, pg. 189-198.

Kleitz, Bretten, Gregory R. Weiher, Kent Tedin, and Richard Matland. (2000). "Choice, Charter Schools, and Household Preferences." *Social Science Quarterly*, Vol. 81, No. 3, pg. 846-53.

Kolstad, Andrew J., and Owings, Jeffrey A. (1986). "High School Dropouts Who Change Their Minds about School." Office of Educational Research and Improvement (ED), Washington, DC.

Lankford, R.H., E.S. Lee, J.H. Wyckoff. (1995). "An Analysis of Elementary and Secondary School Choice." *Journal of Urban Economics*, Vol. 38, pg. 236-251.

Lazear, Edward P. (1999). "Educational Production." National Bureau of Economic Research, Working Paper 7349, Cambridge, Mass.

Lee, Valerie E., Robert Croninger, and Julia B. Smith. (1996). "Equity and Choice in Detroit." In Fuller, B. and Elmore, R., *Who Chooses? Who Loses? Culture, Institutions, and the Unequal Effects of School Choice* (pg. 70-94). Teacher College Press, New York.

Loveless, Tom and Jasin, Claudia (1998). "Starting From Scratch: Political and Organizational Challenges Facing Charter Schools." *Education Administration Quarterly*, Vol. 34, pg. 24

Machan, Tibor R. (2000). *Education in a Free Society*. Hoover Institution Press, Stanford, Calif.

Maddala, G.S. (1983). *Limited Dependent and Qualitative Variables in Econometrics.* Cambridge University Press, New York.

Maranto, Robert, and Scott Milliman, Frederick Hess, April Gresham. (1999). *School Choice in the Real World.* Westview Press. Boulder, Colorado.

Mayer, Susan E. and Peterson, Paul E. (1999). *Earning and learning: how schools matter.* Brookings Institution Press: New York, N.Y.

Merrifield, John (2001). *The School Choice Wars.* Scarecrow Press, Lanham, Md.

Metcalf, K.K., W.J. Boone, F.K. Stage, T.L. Chilton, P. Muller, and P. Tait (1998). "Evaluation of the Cleveland Scholarship Program." Indiana Center for Evaluation, Bloomington, Indiana.

Millman, Scott, Frederick Hess, and Robert Maranto. (1999). "Does the Public Sector Competition Stimulate Innovation: The Competitive Impacts of Arizona Charter Schools on Traditional Public Schools." Mimeo, James Madison University, Virginia.

Mueller, Dennis C. (1989). *Public Choice II.* Cambridge University Press, United Kingdom.

Nechyba, T. (1997). "Existence of Equilibrium and Stratification in local and hierarchical Tiebout economics with property taxes and voting." *Economic Theory*, Vol. 10, No. 2, pg. 277-304.

Niskanen, W. (1971). *Bureaucracy and Representative Government.* Aldine-Atheron Press, Chicago.

Peterson, Paul, Jay P. Geene, and William Howell. (1999). "An Evaluation of the Cleveland Scholarship Program." Program on Education Policy and Governance, Harvard University.

Plisko, V.W., and Stern, J.D. (1985). "The Condition of Education: 1985 edition." Washington, D.C. U.S. Government Printing Office.

Poirer, Dale J. (1980). "Partial Observability in Bivariate Probit Models." *Journal of Econometrics*, Vol. 12, pg. 209-217.

Rees, Daniel I., and Mocan, H. Naci. (1997). "Labor Market Conditions and the High School Dropout Rate: Evidence from New York State." *Economics of Education Review*, Vol. 16, No. 2, pg. 103-09.

Romer, Thomas and Rosethal, Howard. (1979). "Bureaucrats Versus Voters: On the Political Economy of Resource Allocation by Direct Democracy." *Quarterly Journal of Economics*, Vol. 93, no. 4, pg. 563-87.

Rothstein, Laura F. (1999). "School Choice and Students with Disabilities." In Sugarman, S., and Kemerer, F., *School Choice and Social Controversy*. Brookings Institute Press, Washington, D.C.

Rouse, Cecilia Elena. (1998). "Private School Vouchers and Student Achievement: An Evaluation of the Milwaukee Parental Choice Program." *Quarterly Journal of Economics*, Vol. 113, No.2, pg. 553-602.

Rubinfeld, Daniel L. (1987). "The Economics of the Local Public Sector" in Auerback, A. and Feldstein, M., *Handbook of Public Economics*, Volume 2. Elsevier Science Publishing Company, Inc.: New York.

Rumberger, R.W. (1983). "Dropping Out of High School: The Influence of Race, Sex, and Family Background." *American Educational Research Journal*, Vol. 20, No. 2, pg. 199-220.

Rumberger, R.W. (1987). "High School Dropouts: A Review of Issues and Evidence." *Review of Educational Research*, Vol. 57, No. 2, pg. 101-121.

Schwab, Robert M., and Zampelli, Ernest M. (1987) "Disentangling the Demand Function from the production Function for Local Public Services – The Case of Public Safety." *Journal of Public Economics*, Vol. 33, pg. 245-260.

Schneider, Mark, Paul Teske, Melissa Marschall, and Christina Roch. (1998) "Shopping for Schools: In the Land of the Blind, the One-Eyed Parent May Be Enough." *American Journal of Political Science*, Vol. 42, No. 3, pg. 769-93.

Schneider, Mark, Paul Teske, and Melissa Marschall. (2000) *Choosing Schools: Consumer Choice and the Quality of American Schools*. Princeton University Press: Princeton, N.J.

Smith, Kevin B. and Meier, Kenneth J. (1995). *The Case Against School Choice: Politics, Markets, and Fools*. M.E. Sharpe: Armonk, N.Y.

Sorensen, Elaine. (1993). "Continuous Female Workers: How Different Are They from Other Women?" *Eastern Economic Journal*, Vol. 19, No. 1, pg. 15-32.

Sugarman, Stephen D. (1999). "School Choice and Public Funding." In Sugarman, S. and Kemerer, F., *School Choice and Social Controversy*. Brookings Institute Press, Washington, D.C.

Summers, Anita A. and Wolfe, Barbara L. (1977). "Do Schools Make a Difference?" *American Economic Review*, Vol. 64, No. 4, pg.639-651.

Teske, Paul (1998). "Evaluating the Effects of Public School Choice in District 4." Manhattan Institute, New York.

Teske, Paul, Mark Schneider, Jack Buckley and Sara Clark. (2000). "Does Charter School Competition Improve Traditional Public Schools?" Manhattan Institute, New York.

Texas Department of Education. (2000). "Texas Open-Enrollment Charter Schools, Third Year Evaluation: March and July 2000." Texas.

The Center for Educational Reform. (2000a). "What The Research Reveals about Charter Schools." Washington, D.C.

The Center for Educational Reform. (2000b). "Charter Schools Today: Changing the Face of American Education, 2000." Washington, D.C.

The Center for Educational Reform. (2000c). "Charter School Laws Across the States 2000." Washington, D.C.

The Center for Educational Reform. (1999). "National Charter School Directory, 1998-99." Washington, D.C.

Tiebout, Charles. (1956). "A Pure Theory of Public Goods." *The Journal of Political Economy*, Vol. 64, No. 5, pg. 416-424.

Tunali, Inman. (1986). "A General Structure for Models of Double-Selection and an Application to a Joint Migration/Earnings Process with Remigration." *Research in Labor Economics*, Volume 8, Part B, pg. 235-282.

Vazques, Jorge Martinez, and Seaman, Bruce A. (1985). "Private Schooling and the Tiebout Hypothesis." *Public Finance Quarterly*, Vol. 13, No. 3, pg. 293-318.

Venti, Steven F., and Wise, David A. (1982). "Test Scores, Educational Opportunities, and Individual Choice." *Journal of Public Economics*, Vol. 18, No.1, pg. 35-63.

Wells, Amy Stuart. (1998). "Beyond the Rhetoric of Charter School Reform: A Study of 10 California School Districts." University of California, Los Angelos.

Willis, R., and S. Rosen (1979). "Education and Self-Selection." *Journal of Political Economy*, Vol. 87, pp.S7-S36.

Witte, J.F., T.D. Stern and C.A. Thorn. (1995). "Fifth-year Report Milwaukee Parental Choice Program." Available online at: www.lafollette.wisc.edu/outreach/pubs/fifthyear/index.htm.

Witte, J.F. (1997). "Achievement Effects of the Milwaukee Voucher Program." American Economics Association Annual Meeting, New Orleans.

U.S. Department of Education, National Commission on Excellence in Education. (1983). "A Nation at Risk: The Imperative for Education Reform." Washington, D.C.

U.S. Department of Education, National Center for Educational Statistics. (1998). "Common Core of Data, School Years 1991-92 through 1995-96." Washington, D.C.

U.S. Department of Education, National Center for Educational Statistics. (2000a). "Common Core of Data, School Years 1993-94 through 1997-98." Washington, D.C.

U.S. Department of Education, Office of Educational Research and Improvement. (2000b). "The State of Charter Schools 2000, Fourth-Year Report." Washington, D.C.

Zimmer, Ron and Toma, Eugenia. (2000). "Peer Effects in Private and Public Schools across Countries." *Journal of Policy Analysis and Management*, Vol. 19, No. 1, pg. 75-92.

APPENDIX

TABLE 1 – District Level Summary Statistics

Variable Name	**Definition**	**Mean (Std. Dev.)**
Charter	0 or 1 choice for a district to adopt a charter school	0.022 (0.146)
Agency Locale Code	Measures degree of urbanization from 1 to 7, 1 being the most urban, 7 most rural	5.198 (1.919)
Percent IEP	[Number of students with an Individualized Instruction Program (Special Education)/Number of Students]*100	0.11 (.048)
Poverty	Percent of children below the poverty line	0.164 (0.116)
At-risk	Percent of children labeled "at-risk"	0.030 (0.044)
Non-white	Percent of non-white children	0.124 (0.174)
Student/Teacher Ratio	Student Teacher Ratio/10	1.709 (0.405)
Per-Pupil Expenditure	Current Per Pupil Expenditure/1,000	5.714 (1.557)
Local Revenue	Percent of total revenue from local sources	0.428 (0.212)
Percent Republican	Percentage voting Republican in most recent Presidential election	0.399 (0.098)
Dropout Rate	Current year dropout rate	0.030 (0.034)
	Number of Observations	16,714

TABLE 2 – Charter vs. Non-Charter Districts, Comparison of Means

	NON-CHARTER DISTRICTS	CHARTER DISTRICTS	
Variable	*Mean*	*Mean*	
Percent Republican	39.856	39.209	
	(9.771)	(9.687)	
Charter	0.000	1.000	-
	(0.00)	(0.00)	
Dropout Rate	2.907	5.646	*
	(3.316)	(5.178)	
Agency Local Code	5.244	3.135	*
	(1.896)	(1.861)	
Percent IEP	11.197	10.744	*
	(4.802)	(3.588)	
Poverty	16.372	19.396	*
	(11.660)	(11.756)	
At-risk	2.909	5.098	*
	(4.315)	(6.349)	
Nonwhite	12.178	25.325	*
	(17.187)	(23.445)	
Student/Teacher Ratio	17.043	19.157	*
	(4.048)	(3.573)	
Per-Pupil Expenditure	5716.270	5603.570	
	(1552.910)	(1743.710)	
Local Revenue	42.759	43.934	
	(21.232)	(19.000)	
Number of cases	16352	362	

Standard deviation in parenthesis below

* = The means are statistically different at the 5% significance level

TABLE 3 – District Sample 1997-98, Comparison of Means

	ALL DISTRICTS	NON-CHARTER DIST.	CHARTER DIST.	
Variable	*Mean*	*Mean*	*Mean*	
Percent Republican	43.127	43.184	41.068	*
	(10.292)	(10.285)	(10.376)	
Charter	0.027	0.000	1.000	
	(0.162)	(0.00)	(0.00)	
Dropout Rate	2.919	2.855	5.253	*
	(3.124)	(3.045)	(4.673)	
Agency Locale Code	5.114	5.169	3.133	*
	(1.938)	(1.911)	(1.836)	
Percent IEP	11.851	11.863	11.407	
	(4.634)	(4.651)	(3.958)	
Poverty	17.143	17.070	19.769	*
	(12.122)	(12.108)	(12.390)	
At-risk	3.123	3.061	5.337	*
	(4.151)	(4.059)	(6.288)	
Nonwhite	12.993	12.610	26.756	*
	(17.643)	(17.266)	(24.368)	
Student/Teacher Ratio	16.109	16.055	18.047	*
	(3.210)	(3.198)	(3.039)	
Per-Pupil Expenditure	5883.556	5880.879	5979.740	*
	(1748.739)	(1737.618)	(2114.810)	
Local Revenue	44.057	44.095	42.691	
	(21.128)	(21.184)	(19.022)	
Number of cases	5280	5137	143	

Standard deviation in parenthesis below

* = The means are statistically different at the 5% significance level

TABLE 4 – State Level Summary Statistics

Variable Name	**Definition**	**Mean (Std. Dev.)**
Population	Total State Population/1,000,000	5.101 (5.644)
Median Income	Median Household Income/10,000	3.598 (0.562)
Educational Attainment	Percent of Householders with a high school diploma	0.815 (0.537)
Poverty	Percentage of households below the poverty line	0.135 (0.041)
Non-White	Percent of population that is non-white	0.158 (0.136)
Student/Teacher Ratio	Student/Teacher Ratio	16.768 (2.188)
Per-Pupil Expenditure	Current Expenditure Per Pupil/1,000	5.518 (1.324)
Percent Private	Number of students in private school divided by the population ages 5-17	0.094 (0.045)
State/Local	Average state percentage of total revenue at the local level	0.445 (0.168)
Republican Legislature	Dummy variable; 1 if state legislature is controlled by Republicans	0.272 (0.445)
Republican Governor	Dummy Variable; 1 if governor in power is a Republican or Independent	0.507 (0.501)
	Number of Observations	357

TABLE 5 – State Analysis; Charter States vs. Non-Charter States, Comparison of Means

	NON-CHARTER STATES	CHARTER STATES	
Variable	*Mean*	*Mean*	
Charter	0.000	1.000	
	(0.00)	(0.00)	
Student/Teacher Ratio	16.645	17.099	
	(2.161)	(2.237)	
Non-white	0.149	0.181	*
	(0.130)	(0.150)	
Percent Private	0.091	0.102	*
	(0.045)	(0.044)	
Population	4.618	6.396	*
	(4.673)	(7.542)	
Educational Attainment	0.809	0.830	*
	(0.055)	(0.047)	
Poverty	0.136	0.131	
	(0.040)	(0.042)	
Median Income	3.529	3.784	*
	(0.546)	(0.564)	
Per-Pupil Expenditure	5.366	5.925	*
	(1.317)	(1.264)	
State/Local	0.455	0.419	
	(0.162)	(0.183)	
Republican Legislature	0.238	0.361	*
	(0.427)	(0.483)	
Republican Governor	0.462	0.629	*
	(0.499)	(0.486)	
Number of cases	260	97	

Standard deviation in parenthesis below

* = The means are statistically different at the 5% significance level

TABLE 6 – State Analysis, 1997-98, Comparison of Means

	ALL STATES	NON-CHARTER STATES	CHARTER STATES	
Variable	*Mean*	*Mean*	*Mean*	
Charter	0.588	0.000	1.000	
	(0.497)	(0.000)	(0.000)	
Student/Teacher Ratio	16.482	16.314	16.600	
	(2.026)	(2.389)	(1.763)	
Non-white	0.162	0.112	0.197	*
	(0.137)	(0.088)	(0.155)	
Percent Private	0.096	0.082	0.105	*
	(0.043)	(0.033)	(0.048)	
Population	5.251	3.843	6.236	
	(5.848)	(3.830)	(6.812)	
Educational Attainment	0.831	0.832	0.830	
	(0.043)	(0.042)	(0.044)	
Poverty	0.128	0.125	0.129	
	(0.035)	(0.030)	(0.039)	
Median Income	3.717	3.582	3.812	
	(0.547)	(0.535)	(0.544)	
Per Pupil Expenditure	6.131	5.836	6.337	
	(1.261)	(1.082)	(1.351)	
State/Local	0.439	0.434	0.442	
	(0.166)	(0.130)	(0.190)	
Republican Legislature	0.373	0.381	0.367	
	(0.488)	(0.498)	(0.490)	
Governor Republican	0.627	0.619	0.633	
	(0.488)	(0.498)	(0.490)	
Number of cases	51	21	30	

Standard deviations in parenthesis below

* = The means are statistically different at the 5% significance level

TABLE 7 –State Probit Results, Binomial and Random Effects;
Probit on state choice to pass charter legislation

MLE Binomial Probit			
Variable	*Coeff.*	*t-ratio*	*Marginal Effects*
Constant	-7.435	-3.485	-2.329
Student/Teacher Ratio	0.016	0.295	0.005
Nonwhite	1.089	1.314	0.341
Percent Private	2.498	1.001	0.783
Population	0.030	1.830	0.009
Educational Attainment	5.851	2.363	1.833
Poverty	3.414	0.927	1.070
Median Income	0.082	0.283	0.026
Per Pupil Expenditure	0.143	1.394	0.045
State/Local	-1.497	-2.815	-0.469
Republican Legislature	0.303	1.557	0.099
Governor Republican	0.386	2.408	0.120
Random Effects Probit			
Constant	-40.430	-3.451	-2.556
Student/Teacher Ratio	0.655	2.551	0.041
Nonwhite	-2.892	-0.960	-0.183
Percent Private	2.669	0.333	0.168
Population	0.155	2.272	0.009
Educational Attainment	19.821	2.366	1.253
Poverty	-7.373	-0.606	-0.466
Median Income	-1.838	-1.554	-0.116
Per Pupil Expenditure	3.944	3.243	0.249
State/Local	-12.548	-4.223	-0.793
Republican Legislature	0.773	1.204	0.049
Governor Republican	1.351	3.033	0.085
Rho	0.963	48.792	
Number of Observations	357		

TABLE 8 – State Probit, years 1994, 1995, 1996, 1997

	1994			1995		
Variable	*Coeff.*	*t-ratio*	*Marg. Effects*	*Coeff.*	*t-ratio*	*Marg. Effects*
Constant	-7.986	-1.008	-1.817	-1.173	-0.193	-0.428
Student/Teacher Ratio	-0.268	-1.373	-0.061	-0.034	-0.219	-0.013
Nonwhite	-1.583	-0.428	-0.360	-0.306	-0.099	-0.112
Percent Private	12.506	1.569	2.845	8.535	1.200	3.115
Population	0.106	1.539	0.024	-0.020	-0.406	-0.007
Educational Attainment	15.208	1.506	3.460	-0.096	-0.013	-0.035
Poverty	7.174	0.703	1.632	-1.201	-0.113	-0.438
Median Income	1.160	1.026	0.264	0.994	1.020	0.363
Per Pupil Expenditure	-0.905	-1.888	-0.206	-0.224	-0.703	-0.082
State/Local	-6.223	-2.018	-1.416	-3.856	-1.963	-1.407
Republican Legislature	0.214	0.366	0.050	0.233	0.457	0.086
Governor Republican	0.338	0.637	0.079	0.307	0.596	0.110
Number of Observations	51			51		
	1996			**1997**		
Constant	-3.139	-0.578	-1.247	-6.894	-0.912	-2.632
Student/Teacher Ratio	-0.193	-1.057	-0.077	-0.029	-0.187	-0.011
Nonwhite	0.663	0.259	0.263	3.057	1.107	1.167
Percent Private	1.911	0.253	0.759	4.974	0.612	1.899
Population	0.017	0.376	0.007	0.021	0.462	0.008
Educational Attainment	-3.559	-0.524	-1.414	2.292	0.284	0.875
Poverty	17.853	1.841	7.093	11.195	0.927	4.274
Median Income	2.177	2.521	0.865	0.761	0.970	0.291
Per Pupil Expenditure	-0.111	-0.322	-0.044	0.047	0.166	0.018
State/Local	-1.960	-1.155	-0.779	-0.228	-0.137	-0.087
Republican Legislature	0.805	1.375	0.307	0.423	0.804	0.158
Governor Republican	-0.064	-0.127	-0.025	0.115	0.247	0.044
Number of Observations	51			51		

TABLE 9 - Duration Analysis, Life Table

Time	*Enter*	*Censored*	*At Risk*	*Exited*	*Survival Rate*	*Hazard Rate*
1991	51	0	51	1	1.0000 (.000)	.0198 (.020)
1992	50	0	50	1	.9804 (.019)	.0202 (.020)
1993	49	0	49	6	.9608 (.027)	.1304 (.053)
1994	43	0	43	4	.8431 (.051)	.0976 (.049)
1995	39	0	39	6	.7647 (.059)	.1667 (.068)
1996	33	0	33	8	.6471 (.067)	.2759 (.097)
1997	25	0	25	4	.4902 (.070)	.1739 (.087)
1998	21	0	21	4	.4118 (.069)	.2105 (.105)
1999	17	0	17	3	.3333 (.066)	.1935 (.111)
2000-01	14	13	7	1	.2745 (.062)	.1429 (.142)

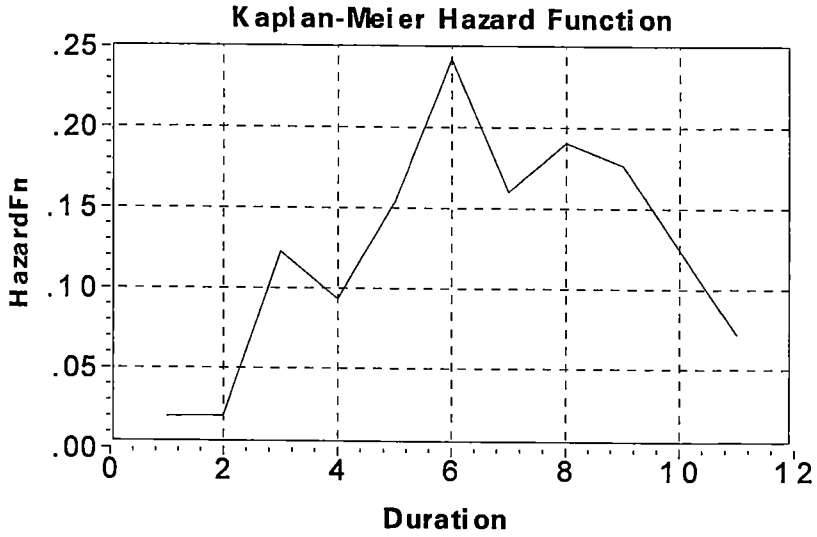

FIGURE 1 – Life Table Hazard Function

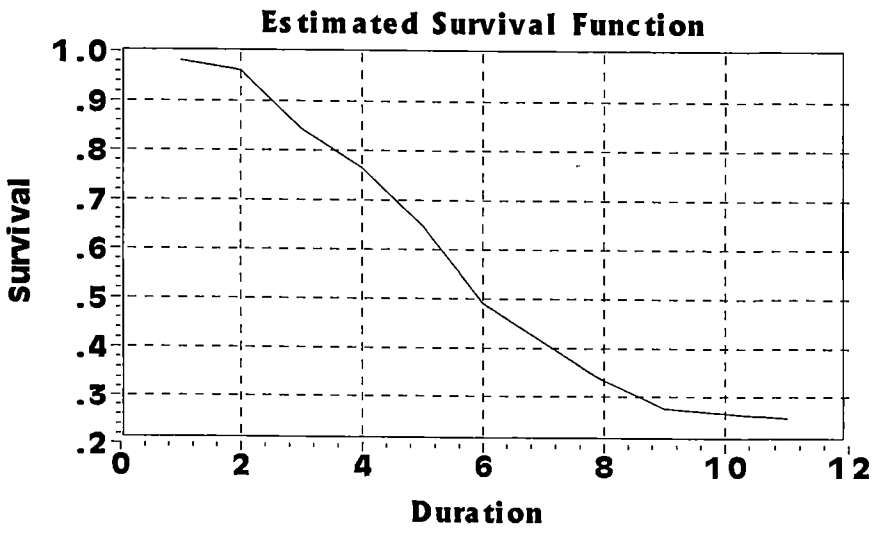

FIGURE 2 – Life Table Survival Function

TABLE 10 – Weibull Loglinear Model

Variable	*Coeff.*	*t-ratio*
Student/Teacher Ratio	-0.012	-0.204
Nonwhite	-0.632	-0.594
Percent Private	-2.139	-0.873
Population	-0.014	-0.768
Educational Attainment	3.061	1.639
Poverty	2.793	0.659
Median Income	-0.161	-0.440
Per Pupil Expenditure	0.048	0.396
State/Local	0.216	0.415
Republican Legislature	-0.099	-0.487
Governor Republican	-0.064	-0.347
Sigma	0.369	5.246
Number of Observations	357	

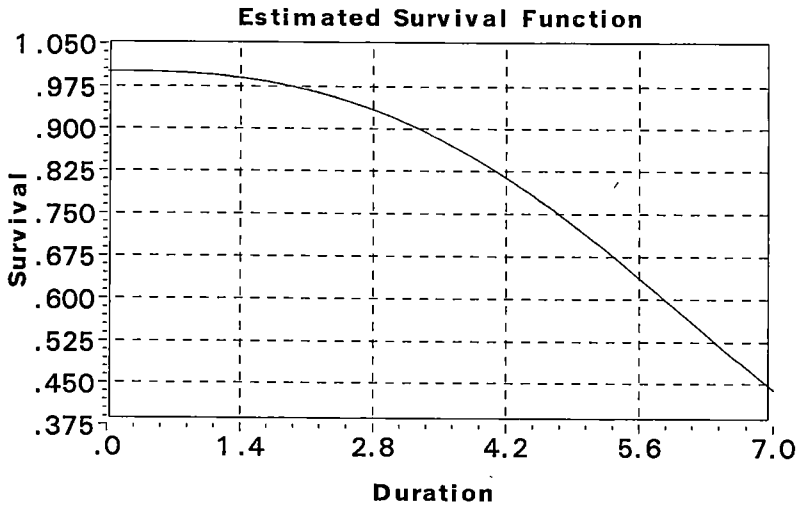

FIGURE 3 – Weibull Survival Function

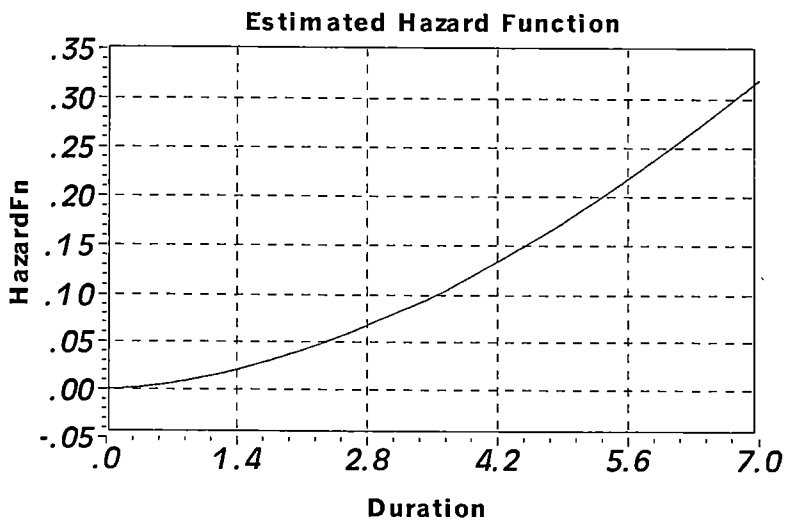

FIGURE 4 – Weibull Hazard Function

TABLE 11 – District Probit; Probit on district charter choice with year and state dummy variables

Variable	*Coeff.*	*t-ratio*	*Marginal Effects*
Constant	-3.641	-9.211	-0.042
Agency Locale Code	-0.224	-12.972	-0.003
Per Pupil Expenditure	0.015	0.674	0.000
Percent IEP	0.681	0.842	0.008
Poverty	1.407	3.616	0.016
Local Revenue	0.452	2.515	0.005
At-risk	-0.499	-0.819	-0.006
Nonwhite	0.462	2.465	0.005
Percent Republican	0.202	0.571	0.002
Student/Teacher Ratio	0.423	3.496	0.005
Number of Observations	16,714		

TABLE 12 – District Probit (Random Effects)

Variable	*Coeff.*	*t-ratio*	*Marginal Effects*
Constant	-12.691	-6.230	-0.039
Agency Locale Code	-0.919	-7.883	-0.003
Per Pupil Expenditure	-0.049	-0.525	0.000
Percent IEP	0.557	0.195	0.002
Poverty	0.621	0.314	0.002
Local Revenue	-0.468	-0.774	-0.001
At-risk	1.244	0.441	0.004
Nonwhite	5.642	5.055	0.017
Percent Republican	2.516	1.928	0.008
Student/Teacher Ratio	1.457	3.164	0.004
YR1992	-6.242	-5.244	-0.019
YR1993	-3.440	-6.556	-0.010
YR1994	-2.240	-6.382	-0.007
YR1996	0.561	1.876	0.002
YR1997	1.661	4.198	0.005
Rho	0.967	141.355	
Number of Observations	16,714		

TABLE 13 - Uncorrected OLS Regression with Fixed and Random Effects

	OLS		Fixed Effects		Random Effects	
Variable	*Coeff.*	*t-ratio*	*Coeff.*	*t-ratio*	*Coeff.*	*t-ratio*
ONE	0.020	7.316	-	-	0.025	5.352
Charter	0.009	5.876	0.009	6.082	0.009	6.083
Agency Locale Code	-0.002	-14.299	-0.002	-14.856	-0.002	-14.859
Per Pupil Expenditure	-0.001	-5.731	-0.001	-3.935	-0.001	-3.945
Percent IEP	0.056	9.751	0.046	8.051	0.046	8.065
Poverty	0.048	17.251	0.049	17.668	0.049	17.663
Local Revenue	-0.001	-1.149	-0.003	-2.784	-0.003	-2.781
At-risk	0.102	15.696	0.098	15.120	0.098	15.118
Nonwhite	0.022	13.245	0.019	11.053	0.019	11.078
Student/Teacher Ratio	0.006	6.199	0.005	5.094	0.005	5.104
Number of Observations	16,714		16,714		16,714	
Adjusted R-squared	0.386		0.398		0.387	
Log-likelihood value	36935.389		37111.109		-	

TABLE 14 –MLE Procedure

Reestimated probit		
Variable	*Coeff.*	*t-ratio*
Constant	-3.656	-7.450
Agency Locale Code	-0.225	-12.593
Per Pupil Expenditure	0.015	0.498
Percent IEP	0.717	0.565
Poverty	1.459	2.623
Local Revenue	0.450	2.052
At-risk	-0.519	-0.668
Nonwhite	0.469	2.045
Percent Republican	0.190	0.464
Student/Teacher Ratio	0.423	2.922
Corrected Regression		
Constant	0.020	7.619
Charter	0.010	2.367
Agency Locale Code	-0.002	-13.492
Per Pupil Expenditure	-0.001	-6.736
Percent IEP	0.056	10.102
Poverty	0.048	19.272
Local Revenue	-0.001	-1.069
At-risk	0.102	22.277
Nonwhite	0.022	17.528
Student/Teacher Ratio	0.006	6.521
Sigma	0.027	681.539
Rho	-0.030	-0.360
Number of Observations	16,714	

TABLE 15 –1995, 1996, 1997 MLE

	1995		1996		1997	
Reestimated Probit						
Variable	*Coeff.*	*t-ratio*	*Coeff.*	*t-ratio*	*Coeff.*	*t-ratio*
Constant	-1.619	-1.233	-3.386	-4.114	-2.870	-4.219
Agency Locale Code	-0.258	-6.160	-0.223	-7.938	-0.221	-8.819
Per Pupil Expenditure	-0.092	-0.705	0.060	1.375	0.045	1.706
Percent IEP	-2.240	-0.729	-0.032	-0.017	3.000	2.125
Poverty	2.487	1.928	1.112	1.243	-0.102	-0.134
Local Revenue	1.205	2.215	0.317	1.015	-0.282	-1.035
At-risk	-1.181	-0.724	-1.108	-0.775	-0.019	-0.015
Nonwhite	0.201	0.341	0.158	0.390	0.861	2.622
Percent Republican	0.552	0.495	0.516	0.781	0.306	0.647
Student/Teacher Ratio	0.255	0.730	0.822	3.114	0.616	2.602
DAZ	0.411	1.465	1.196	6.268	1.296	7.071
DCA	-0.198	-0.866	-0.072	-0.396	-0.034	-0.205
DMI	-0.410	-1.020	-0.227	-0.946	0.144	0.751
Corrected Regression						
Constant	0.018	2.350	-0.036	-6.356	-0.013	-2.466
Charter	0.007	0.609	0.007	0.690	0.012	1.781
Agency Locale Code	-0.002	-5.912	-0.001	-2.278	-0.001	-4.280
Per Pupil Expenditure	-0.002	-2.520	0.001	2.264	0.000	-1.061
Percent IEP	0.070	5.753	0.027	1.962	0.021	1.773
Poverty	0.074	12.856	0.027	5.358	0.016	3.347
Local Revenue	0.000	-0.043	-0.006	-1.825	-0.004	-1.541
At-risk	0.109	11.097	0.105	8.380	0.147	16.187
Nonwhite	0.022	6.397	0.024	7.897	0.019	7.772
Student/Teacher Ratio	0.003	1.360	0.033	15.252	0.023	11.805
DAZ	0.055	25.743	0.062	25.010	0.057	27.192
DCA	-0.015	-5.921	-0.032	-11.989	-0.025	-11.170
DMI	0.022	10.658	0.012	5.661	0.015	8.721
Sigma	0.025	113.916	0.029	402.749	0.026	427.837
Rho	-0.010	-0.045	0.018	0.103	-0.129	-1.025
Number of Observations	2243		4323		5280	

DAZ, DCA, and DMI are dummy variables for Arizona, California and Michigan.

TABLE 16 –MLE State-by-State Analysis

	ARIZONA			CALIFORNIA			COLORADO	
Reestimated Probit								
Variable	*Coeff.*	*t-ratio*		*Coeff.*	*t-ratio*		*Coeff.*	*t-ratio*
Constant	-4.283	-2.798		-0.963	-0.981		-3.612	-1.322
Agency Locale Code	-0.128	-2.159		-0.319	-7.093		-0.116	-1.554
Per Pupil Expenditure	-0.030	-0.551		-0.085	-1.060		0.266	0.999
Percent IEP	3.702	0.908		2.972	1.410		-22.525	-3.295
Poverty	-0.416	-0.367		1.942	1.501		-4.171	-1.453
Local Revenue	-0.675	-0.921		0.283	0.522		1.147	1.156
At-risk	1.274	1.083		-0.894	-0.512		12.388	0.914
Nonwhite	0.372	0.550		-0.577	-1.263		1.976	0.881
Percent Republican	5.902	2.798		-0.400	-0.440		2.607	1.966
Student/Teacher Ratio	0.708	2.558		0.014	0.050		1.257	1.415
YR1995	0.253	1.011	YR199	0.083	0.353	YR1994	0.046	0.158
YR1996	0.294	1.440	YR199	0.280	1.733	YR1995	0.545	1.896
			YR199	0.536	3.175	YR1997	0.831	2.573
			YR199	0.535	3.123			
Corrected Regression								
Constant	0.014	0.401		0.006	0.874		-0.013	-0.685
Charter	-0.011	-0.291		0.010	0.868		-0.019	-3.426
Agency Locale Code	-0.004	-1.896		-0.001	-3.474		-0.001	-0.985
Per Pupil Expenditure	-0.002	-0.858		0.001	1.365		0.001	0.755
Percent IEP	0.219	3.464		0.029	2.559		-0.053	-0.819
Poverty	0.154	4.811		0.026	5.152		-0.007	-0.367
Local Revenue	0.017	0.886		-0.006	-1.889		0.001	0.186
At-risk	0.164	4.194		0.041	5.493		0.266	2.598
Nonwhite	0.021	1.366		0.010	4.313		0.089	5.088
Student/Teacher Ratio	0.017	1.417		0.003	1.455		0.020	3.241
YR1995	-0.003	-0.441	YR199	0.015	8.036	YR1994	0.002	0.772
YR1996	0.003	0.395	YR199	0.010	6.942	YR1995	0.000	0.155
Sigma	0.052	36.449	YR199	0.003	1.505	YR1997	0.006	1.895
Rho	0.051	0.118	YR199	0.002	0.891	Sigma	0.016	15.863
			Sigma	0.022	115.530	Rho	0.657	4.236
			Rho	0.121	0.460			
Number of Observations	391			2546				276

TABLE 16 continued - MLE State Analysis

	CONNECTICUT			FLORIDA			GEORGIA	
Reestimated Probit								
Variable	*Coeff.*	*t-ratio*		*Coeff.*	*t-ratio*		*Coeff.*	*t-ratio*
Constant	3.202	0.165		-1.296	-0.242		973.301	0.000
Agency Locale Code	-0.075	-0.165		M	-0.231		-342.395	0.000
Per Pupil Expenditure	0.122	0:632		-0.156	-1.310		-16.910	0.000
Percent IEP	-18.612	-0.924		-10.980	-0.811		63.072	0.000
Poverty	1.492	0.065		-4.483	0.896		1796.000	0.000
Local Revenue	-1.405	-0.239		1.874	0.074		135.954	0.000
At-risk	-6.937	-0.296		1.536	1.468		-11419.300	0.000
Nonwhite	3.813	0.433		4.851	1.193		163.460	0.000
Percent Republican	9.120	0.487		3.113	0.177		63.881	0.000
Student/Teacher Ratio	-4.566	-0.420		0.335	-2.451		-2.025	0.000
			YR199	-0.870	-0.535	R199	15.379	0.000
Corrected Regression								
ONE	-0.006	-0.292		-0.020	-0.161		0.044	0.001
Charter	-0.018	-1.139		-0.004	-0.517		-0.013	0.000
Agency Locale Code	-0.001	-0.663		M	0.440		-0.003	-1.679
Per Pupil Expenditure	0.000	-0.406		-0.003	0.808		-0.003	-1.177
Percent IEP	0.176	3.395		0.034	0.597		0.233	1.687
Poverty	0.176	3.259		0.043	0.585		0.117	1.599
Local Revenue	-0.031	-3.613		0.011	1.871		0.004	0.104
At-risk	0.006	0.048		0.065	1.998		0.089	0.541
Nonwhite	0.023	1.036		0.038	1.144		-0.016	-0.604
Student/Teacher Ratio	0.017	1.855		0.027	9.604		0.008	0.287
Sigma	0.016	19.717	R199	0.006	0.103	R199	-0.006	-1.140
Rho	0.602	1.508	Sigma	0.017	9.604	Sigma	0.025	12.505
			Rho	0.084	0.103	Rho	0.900	0.000
Number of Observations	227			131			123	

TABLE 16 continued – MLE State Analysis

	MASSACHUSETTS			MICHIGAN			MINNESOTA	
Reestimated Probit								
Variable	*Coeff.*	*t-ratio*		*Coeff.*	*t-ratio*		*Coeff.*	*t-ratio*
Constant	-3.146	-0.548		-3.560	-1.511		-1.677	-0.423
Agency Locale Code	0.011	0.079		-0.192	-1.974		-0.308	-3.067
Per Pupil Expenditure	0.071	0.206		-0.010	-0.076		0.100	0.375
Percent IEP	0.361	0.037		-9.673	-1.306		0.820	0.077
Poverty	0.893	0.057		3.411	1.014		2.877	0.714
Local Revenue	-0.937	-0.390		0.343	0.241		-0.143	-0.075
At-risk	-15.192	-0.455		-8.191	-0.855		17.656	0.787
Nonwhite	6.470	1.306		1.796	1.792		-5.531	-2.003
Percent Republican	0.361	0.057		3.336	1.668		0.017	0.004
Student/Teacher Ratio	0.170	0.089		0.339	0.504		0.569	0.338
YR1995	0.122	0.346	R199	-0.134	-0.483	YR199	-0.086	-0.237
YR1996	0.419	1.456	R199	0.015	0.067	YR199	-0.245	-0.518
Corrected Regression								
Constant	0.039	3.637		0.036	3.796		-0.011	-0.266
Charter	-0.005	-0.435		0.027	1.323		0.101	18.391
Agency Locale Code	0.000	-1.139		-0.002	-4.433		0.001	0.574
Per Pupil Expenditure	-0.002	-3.565		0.000	-0.117		0.002	0.502
Percent IEP	0.028	1.746		0.069	2.760		-0.019	-0.215
Poverty	0.131	7.098		0.069	5.447		-0.061	-1.506
Local Revenue	-0.019	-4.866		-0.009	-2.360		-0.004	-0.200
At-risk	0.118	2.348		0.338	9.918		0.471	2.688
Nonwhite	0.004	0.332		0.012	1.324		0.228	6.801
Student/Teacher Ratio	-0.001	-0.186		0.002	0.590		0.010	0.706
YR1995	-0.002	-1.293	R199	-0.002	-0.798	YR199	0.002	0.302
YR1996	0.000	0.027	R199	0.001	0.491	YR199	0.006	0.912
Sigma	0.016	103.409	Sigma	0.035	130.649	Sigma	0.038	96.826
Rho	0.053	0.160	Rho	-0.011	-0.040	Rho	-0.965	-20.887
Number of Observation	1076			2467			839	

TABLE 16 continued – MLE State Analysis

	TEXAS			WISCONSIN	
Reestimated Probit					
Variable	*Coeff.*	*t-ratio*		*Coeff.*	*t-ratio*
Constant	-3.301	-0.568		-2.300	-0.564
Agency Locale Code	-0.951	-1.307		-0.282	-2.646
Per Pupil Expenditure	-1.075	-0.995		0.140	0.559
Percent IEP	18.801	1.089		-1.124	-0.103
Poverty	4.909	0.410		0.152	0.039
Local Revenue	3.635	1.365		-0.467	-0.444
At-risk	1.055	0.037		-0.629	-0.034
Nonwhite	1.811	0.745		1.508	0.404
Percent Republican	-1.127	-0.152		-2.954	-0.913
Student/Teacher Ratio	2.164	0.979		1.134	0.668
YR1996	0.064	0.114	YR1995	0.144	0.526
			YR1996	0.175	0.704
Corrected Regression					
Constant	0.013	3.484		0.007	1.182
Charter	0.016	6.438		0.020	2.271
Agency Locale Code	0.000	-1.196		-0.001	-5.942
Per Pupil Expenditure	-0.001	-2.591		-0.001	-2.688
Percent IEP	-0.008	-1.441		0.021	2.093
Poverty	0.010	4.613		0.018	3.487
Local Revenue	-0.003	-1.857		0.005	2.523
At-risk	0.027	3.963		0.174	11.395
Nonwhite	0.007	3.989		0.030	6.997
Student/Teacher Ratio	0.000	-0.080		0.006	2.290
YR1996	0.000	0.333	YR1995	-0.001	-0.745
Sigma	0.010	110.328	YR1996	-0.001	-0.826
Rho	-0.912	-10.933	Sigma	0.011	82.763
			Rho	-0.274	-0.797
Number of Observations	1977			1865	

TABLE 17 – Year-by-Year OLS procedure on the Dropout Rate

	1992		**1993**		**1994**	
Variable	*Coeff.*	*t-ratio*	*Coeff.*	*t-ratio*	*Coeff.*	*t-ratio*
Constant	-0.010	-1.099	-0.024	-2.542	0.050	5.421
Charter	0.047	3.176	0.029	3.048	0.005	0.910
Agency Locale Code	0.000	-0.693	-0.002	-4.533	-0.003	-7.989
Per Pupil Expenditure	0.002	2.250	0.002	2.421	-0.003	-3.513
Percent IEP	0.051	2.732	0.021	0.821	0.059	3.258
Poverty	-0.005	-0.599	0.121	9.371	0.093	9.800
Local Revenue	0.004	0.866	0.010	2.067	-0.014	-3.860
At-risk	0.065	4.274	0.154	3.673	0.138	7.020
Nonwhite	0.023	4.703	0.004	0.491	0.023	4.051
Student/Teacher Ratio	0.003	1.166	0.016	6.326	-0.003	-1.177
Number of Observations	948		1672		2248	
	1995		**1996**		**1997**	
Constant	0.065	7.496	-0.007	-1.102	0.005	1.043
Charter	0.012	3.234	0.018	5.552	0.013	5.265
Agency Locale Code	-0.003	-7.174	0.000	-1.379	-0.001	-2.913
Per Pupil Expenditure	-0.002	-3.475	0.000	0.480	0.000	-1.027
Percent IEP	-0.073	-5.384	-0.041	-3.555	-0.046	-4.808
Poverty	0.088	10.008	0.032	5.172	0.022	4.347
Local Revenue	-0.003	-0.953	-0.005	-1.710	-0.005	-2.378
At-risk	0.120	6.566	0.115	7.111	0.156	11.274
Nonwhite	0.019	3.697	0.019	4.982	0.014	4.528
Student/Teacher Ratio	-0.009	-3.786	0.020	10.360	0.016	9.838
Number of Observations	2243		4323		5280	

TABLE 18 – State by State Dropout Analysis

	ARIZONA			CALIFORNIA			COLORADO	
Variable	*Coeff.*	*t-ratio*		*Coeff.*	*t-ratio*		*Coeff.*	*t-ratio*
ONE	0.014	0.480		0.005	0.909		-0.011	-0.778
Charter	-0.007	-0.864		0.015	6.515		-0.001	-0.481
Agency Locale Code	-0.004	-2.613		-0.001	-4.437		0.000	-0.538
Per Pupil Expenditure	-0.002	-1.020		0.001	1.719		0.000	-0.294
Percent IEP	0.218	2.920		0.029	2.959		0.024	0.502
Poverty	0.154	5.096		0.026	5.326		0.006	0.305
Local Revenue	0.017	1.026		-0.006	-2.162		-0.001	-0.218
At-risk	0.163	4.915		0.041	5.151		0.219	2.297
Nonwhite	0.021	1.543		0.011	4.030		0.087	6.036
Student/Teacher Ratio	0.016	1.720		0.003	1.644		0.015	3.074
YR1995	-0.003	-0.497	YR199	0.015	7.931	R199	0.003	1.106
YR1996	0.003	0.440	YR199	0.010	7.477	R199	-0.001	-0.475
			YR199	0.002	1.750	R199	0.002	0.648
			YR199	0.001	1.004			
Number of Observations	391			2546			276	
	CONNECTICUT			**FLORIDA**			**GEORGIA**	
Constant	-0.008	-0.384		-0.021	-0.548		0.044	1.080
Charter	0.001	0.118		-0.001	-0.298		-0.013	-1.124
Agency Locale Code	-0.001	-0.739		M	M		-0.003	-2.060
Per Pupil Expenditure	0.000	-0.668		-0.003	-0.552		-0.003	-1.781
Percent IEP	0.187	4.306		0.039	0.591		0.233	2.129
Poverty	0.161	3.091		0.045	1.056		0.117	1.789
Local Revenue	-0.030	-4.038		0.010	0.748		0.004	0.146
At-risk	0.027	0.242		0.065	0.581		0.089	0.639
Nonwhite	0.019	1.345		0.037	1.919		-0.016	-0.656
Student/Teacher Ratio	0.019	1.823		0.027	2.090		0.008	0.382
			YR199	0.007	2.072	R199	-0.006	-1.129
Number of Observations	227			131			123	

TABLE 18 continued – State by State Analysis

	MASSACHUSETTS			MICHIGAN			MINNESOTA	
Variable	*Coeff.*	*t-ratio*		*Coeff.*	*t-ratio*		*Coeff.*	*t-ratio*
Constant	0.039	4.574		0.036	4.290		0.000	-0.014
Charter	-0.003	-0.695		0.026	3.561		0.029	3.164
Agency Locale Code	0.000	-1.398		-0.002	-5.129		-0.001	-0.874
Per Pupil Expenditure	-0.002	-4.967		0.000	-0.118		0.002	1.085
Percent IEP	0.028	1.693		0.069	3.072		-0.020	-0.372
Poverty	0.131	8.243		0.069	5.251		-0.057	-2.407
Local Revenue	-0.019	-5.294		-0.009	-2.488		-0.007	-0.663
At-risk	0.119	2.847		0.338	7.038		0.564	3.517
Nonwhite	0.003	0.329		0.012	1.322		0.233	8.548
Student/Teacher Ratio	-0.001	-0.245		0.002	0.700		0.009	1.163
YR1995	-0.002	-1.451	YR1995	-0.002	-0.907	YR1994	0.001	0.421
YR1996	0.000	0.006	YR1996	0.001	0.564	YR1996	0.005	1.604
Number of Observations	1076			2467			839	

	TEXAS			WISCONSIN	
Constant	0.013	3.841		0.008	1.405
Charter	0.005	1.625		0.013	5.757
Agency Locale Code	0.000	-1.858		-0.001	-7.456
Per Pupil Expenditure	-0.001	-3.199		-0.001	-3.405
Percent IEP	-0.008	-1.376		0.021	2.161
Poverty	0.010	4.266		0.018	3.751
Local Revenue	-0.002	-2.063		0.005	2.531
At-risk	0.028	3.337		0.174	9.426
Nonwhite	0.007	3.912		0.031	6.924
Student/Teacher Ratio	0.000	0.034		0.006	2.534
YR1996	0.000	0.355	YR1995	0.000	-0.755
			YR1996	-0.001	-0.829
Number of Observations	1977			1865	

TABLE 19 – Comparison between conforming and nonconforming data with regards to NCES standards

Nonconforming States: California, Florida, Michigan, North Carolina, South Carolina and Texas			**Conforming States: Remaining 21 States**		
Variable	*Coeff.*	*t-ratio*		*Coeff.*	*t-ratio*
Constant	0.011	1.843		-0.003	-2.386
Charter	0.015	6.243		0.013	6.941
Agency Locale Code	-0.001	-3.309		-0.002	-12.773
Per Pupil Expenditure	0.001	1.548		0.000	-0.650
Percent IEP	0.021	2.139		-0.037	-6.720
Poverty	0.025	5.171		0.029	8.554
Local Revenue	-0.008	-2.718		-0.005	-4.049
At-risk	0.039	4.917		0.219	22.089
Nonwhite	0.010	3.972		0.029	12.703
Student/Teacher Ratio	0.003	1.771		0.025	40.742
YR1992	-0.008	-5.469	YR1993	-0.001	-1.396
YR1993	0.010	4.647	YR1994	0.001	0.677
YR1994	0.004	2.784	YR1996	-0.005	-5.488
YR1996	-0.003	-1.591	YR1997	-0.006	-7.346
YR1997	-0.004	-2.119			
Number of Observations	2547			14,167	

TABLE 20 – Heckman OLS, with fixed and random effects

	OLS		Fixed Effects		Random Effects	
Variable	*Coeff.*	*t-ratio*	*Coeff.*	*t-ratio*	*Coeff.*	*t-ratio*
Charter	0.021	3.577	0.019	3.237	0.019	3.238
Agency Locale Code	-0.001	-9.495	-0.002	-11.776	-0.002	-11.768
Per Pupil Expenditure	0.000	-0.912	0.000	-1.522	0.000	-1.525
Percent IEP	-0.035	-6.206	-0.024	-4.312	-0.024	-4.317
Poverty	0.044	14.286	0.047	15.384	0.047	15.384
Local Revenue	-0.004	-3.295	-0.001	-0.799	-0.001	-0.801
At-risk	0.120	16.161	0.106	14.423	0.106	14.432
Nonwhite	0.017	8.864	0.025	13.121	0.025	13.108
Student/Teacher Ratio	0.011	12.194	0.015	16.591	0.015	16.572
Inverse Mills Ratio	-0.001	-1.139	-0.001	-1.145	-0.001	-1.145
Constant	0.015	5.022			0.001	0.160
Number of Observations	16,714		16,714		16,714	
Adjusted R-squared	0.386		0.399		-	

TABLE 21 – Test Score Summary Statistics

Wisconsin District Test Score Data		
Variable	*Mean*	*Std.Dev.*
Reading score (National Percentile Rank)	0.694	0.076
Math Score (National Percentile Rank)	0.741	0.081
Average Grand Composite Score (raw number)	157.544	9.107
Number of Observations	1,866	
Florida District Test Score Data		
High School Competency (Percent Passing)	0.682	0.073
Number of Observations	132	

TABLE 22 – Florida HSCT, 1996-97, 1997-98;
OLS Regression and MLE Procedure

OLS Regression			**MLE Procedure Corrected Regression**		
Variable	*Coeff.*	*t-ratio*	*Variable*	*Coeff.*	*t-ratio*
Constant	1.041	9.607	Constant	1.064	7.121
Charter	0.015	1.140	Charter	-0.051	-1.838
Per Pupil Expediture	-0.022	-1.558	Per Pupil Expediture	-0.022	-1.268
Percent IEP	0.260	1.400	Percent IEP	0.140	0.563
Poverty	-0.430	-3.558	Poverty	-0.477	-3.021
Local Revenue	0.036	0.934	Local Revenue	0.052	0.985
At-risk	0.282	0.888	At-risk	0.282	0.789
Nonwhite	-0.296	-5.463	Nonwhite	-0.255	-4.085
Student/Teacher Ratio	-0.086	-2.327	Student/Teacher Ratio	-0.080	-1.588
DUM96	-0.001	-0.141	DUM96	-0.012	-1.079
			Sigma	0.053	8.953
			Rho	0.729	2.974
Number of Observations	132		132		
Adjusted R-squared	0.537		-		
			Reestimated Probit		
			Constant	0.456	0.099
			Per Pupil Expediture	-0.408	-0.642
			Percent IEP	-10.247	-1.596
			Poverty	-2.791	-0.568
			Local Revenue	2.509	1.479
			At-risk	3.144	0.157
			Nonwhite	4.431	1.475
			Percent Republican	1.765	0.657
			Student/Teacher Ratio	0.032	0.018
			DUM96	-0.842	-2.403

TABLE 23 – Wisconsin AGCS, 1993-94, 1994-95, 1995-96;
OLS Regression and MLE Procedure

OLS Regression			**MLE Procedure** **Corrected Regression**		
Variable	*Coeff.*	*t-ratio*	*Variable*	*Coeff.*	*t-ratio*
Constant	158.545	27.023	Constant	157.988	25.606
Charter	2.474	0.933	Charter	11.370	1.541
Agency Locale Code	-0.780	-4.374	Agency Locale Code	-0.727	-3.417
Per Pupil Expediture	0.743	1.788	Per Pupil Expediture	0.750	1.745
Percent IEP	-48.363	-5.698	Percent IEP	-47.455	-7.050
Poverty	-14.077	-3.269	Poverty	-14.386	-3.852
Local Revenue	7.829	4.577	Local Revenue	7.717	4.366
At-risk	-85.707	-5.285	At-risk	-85.457	-6.665
Nonwhite	-15.984	-4.016	Nonwhite	-17.044	-4.130
Student/Teacher Ratio	0.284	0.132	Student/Teacher Ratio	0.428	0.189
DUM94	4.281	7.821	DUM94	4.239	7.469
DUM95	7.450	12.905	DUM95	7.309	12.483
			Sigma	7.340	44.505
			Rho	-0.555	-1.087
Number of Observations	1135		1135		
Adjusted R-squared	0.350		-		
			Reestimated Probit		
			Constant	-6.764	0.000
			Agency Locale Code	-0.218	-0.803
			Per Pupil Expediture	-0.055	-0.068
			Percent IEP	-1.357	-0.042
			Poverty	2.085	0.240
			Local Revenue	1.619	0.408
			At-risk	-20.098	-0.669
			Nonwhite	3.734	0.675
			Percent Republican	-5.354	-0.547
			Student/Teacher Ratio	0.466	0.125
			DUM94	5.877	0.000
			DUM95	6.359	0.000

TABLE 24 – Wisconsin Reading and Math Scores, 1996-97 and 1997-98, OLS Regression

	Reading NPR		**Math NPR**	
Variable	*Coeff.*	*t-ratio*	*Coeff.*	*t-ratio*
Constant	84.320	16.574	84.197	16.133
Charter	1.276	0.703	2.597	1.394
Agency Locale Code	-0.297	-1.548	-0.217	-1.104
Per Pupil Expenditure	-0.437	-1.961	-0.389	-1.704
Percent IEP	-51.469	-5.453	-43.896	-4.534
Poverty	-11.462	-2.318	-17.279	-3.407
Local Revenue	6.644	3.596	5.081	2.681
At-risk	-35.518	-1.933	-68.829	-3.652
Nonwhite	-15.601	-3.553	-19.458	-4.319
Student/Teacher Ratio	-2.716	-1.250	0.595	0.267
Number of Observations	731		731	
Adjusted R-squared	0.213		0.276	

TABLE 25 - Wisconsin Reading and Math Scores, 1996-97 and 1997-98; MLE Procedure

	Reading NPR		Math NPR	
Reestimated Probit				
Variable	*Coeff.*	*t-ratio*	*Coeff.*	*t-ratio*
Constant	-4.774	-0.700	-5.955	-1.066
Agency Locale Code	-0.184	-1.296	-0.215	-2.022
Per Pupil Expenditure	0.047	0.130	0.113	0.423
Percent IEP	3.425	0.232	4.196	0.326
Poverty	-1.694	-0.232	-2.251	-0.382
Local Revenue	-0.845	-0.440	-1.661	-1.002
At-risk	5.384	0.446	7.992	0.693
Nonwhite	1.261	0.375	0.894	0.297
Percent Republican	-1.276	-0.377	-2.085	-0.573
Student/Teacher Ratio	2.529	0.931	3.495	1.621
Corrected Regression				
Constant	0.852	14.114	0.852	14.467
Charter	-0.105	-3.258	-0.103	-5.549
Agency Locale Code	-0.005	-2.039	-0.004	-1.822
Per Pupil Expenditure	-0.004	-1.381	-0.004	-1.256
Percent IEP	-0.529	-6.134	-0.455	-5.093
Poverty	-0.109	-2.279	-0.167	-3.607
Local Revenue	0.065	3.206	0.049	2.539
At-risk	-0.342	-1.447	-0.674	-3.196
Nonwhite	-0.123	-3.022	-0.158	-3.178
Student/Teacher Ratio	-0.025	-1.046	0.008	0.363
SIGMA	0.069	35.397	0.071	38.750
RHO	0.812	6.564	0.876	10.402
Number of Observations	731		731	

VITA

Matt Metzgar was born in Wheeling, West Virgina, and graduated from Wheeling Park High School in 1990. That fall, he entered West Virginia University, and received his Bachelor's Degree in Secondary Education in May of 1994. In the fall of 1995, he entered the MBA program at Wheeling Jesuit University, and served as a graduate assistant in the Financial Aid department. In August 1997, he graduated from Wheeling Jesuit University and immediately entered the doctoral program in economics at the University of Tennessee, Knoxville. In August 2001, he received a Doctor of Philosophy degree in Economics from the University of Tennessee, Knoxville.

He is presently employed as a Visiting Assistant Professor at Kent State University, in Kent, Ohio.