THE COMPETITIVE EFFECTS OF CHARTER SCHOOLS IN UTAH

by

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ABSTRACT

Charter schools have become an important aspect of Utah's unique K-12 education system as they have increased in both popularity and number in recent years. The increase of charter schools has allowed for a higher degree of parental choice regarding their children's education as well as various effects on the traditional public schools. Economic theory suggests that increased competition may influence firms to increase quality and/or decrease price. The question remains if the same holds for the education market in Utah. Nationwide existing evidence in the literature is mixed, where many studies have shown positive competitive effects of charters on public schools while a few others have shown negative or negligible competitive effects. Further analysis for the Utah education market is therefore warranted. This research identifies and analyzes the competitive effects of charter schools on the academic achievement of students in traditional public schools (K-6) in Utah. School-level criterion-referenced test (CRT) scores serve as a measure of academic achievement for the years 2005 through 2010. For completeness, two broadly-accepted measures of competition are utilized. Results suggest positive and significant competitive effects on traditional public school achievement in the subjects of Language Arts and Science, and negative but mostly not significant effects on Mathematics.

For Lindsey, whose encouragement and confidence never wavered

“[W]e allow the market, consumer choice and competition to work in nearly every industry except for the one that may matter most: education.”

- Milton Friedman,

as cited in Moore (2012)

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CHAPTER 1

INTRODUCTION

From a school productivity viewpoint, that is academic achievement per dollar spent, the United States has shown dramatic declines during the past 40 years (Hoxby 2003). The overall productivity decline is not the only issue at hand; academic achievement varies greatly across demographic areas where the quality of schooling is high in wealthy suburbs, reasonable in small towns, and substantially worse in the inner cities. Achievement gaps between high and low income levels also continue to rise.

These harsh realities have prompted many policy leaders, teachers, and parents to explore different education solutions aimed at helping children succeed in school. Charter schools have emerged as an attractive alternative to traditional public schools. They remain publicly funded, albeit normally at a lower rate than traditional public schools, but generally have greater freedom in decisions of personnel, administration style, and curriculum. Over the last 20 years their role has become more and more prominent in offering educational alternatives for parents and students, especially so in Utah.

Similar to other areas, the discipline of economics can lend general theories that prove helpful in studying the impact of these education dynamics.

Specifically, theories of competition, public expenditures, and industrial organization will directly apply to the many questions surrounding the emergence of charter schools. In his seminal theory of local expenditures, Tiebout (1956) argues that local demand for public goods and services represents the true preferences of the consumer-voters, and therefore the revenue-expenditure patterns of the localities are given "approval" by the consumer-voters who choose to live there. If this were not the case, consumer-voters would choose to leave for a better option (following Tiebout's infamous "vote with their feet" mechanism). This theory is directly relevant not only to state education funding but also to consumer-voter preferences of local K-12 education composition. By increasing the market share held by charter schools, parents (consumer-voters) are given a larger set of education options and are therefore more likely to find their preferred preference pattern. As Holmes, DeSimone, and Rupp (2003) point out, this also gives parents a "credible threat" against traditional public schools who continually fail to make improvements.

Paramount to this research is the impact that charter schools have on the existing traditional public schools. Comparative analysis of achievement levels between the traditional public schools and the newly emerging charter schools is outside the scope of this research. Rather, I seek to identify any competitive effects of charter schools on the academic achievement of students in the existing traditional public schools. If Tiebout's theory holds with respect to education, then we would expect there to be gains in achievement of traditional public schools by the mere existence of competing charter schools, ceteris paribus.

This research will not only be of interest to education and public policy, but will also have potential impact on the state and nationwide economies. Within the recent decade, Utah has benefitted from a higher educated work force as numerous firms have expanded facilities and production here locally. In order to encourage continual job growth, the local education system must remain productive. Both state and nationwide, educated labor will continue to be a vital component of economic production. A growing and dynamic economy will demand an educated workforce, one that delivers the tools and skills necessary for participation in the global markets. As suggested by Lenontif (1956), the sources of American economic growth have historically been intensive in human capital, a notion that is even more persuasive today. It is clear that the United States will consequently benefit immensely from a more productive and dynamic education system as we produce more human capital-intensive goods. This research, therefore, is not only interesting to education and public policy, but has potential impacts on the health and competitiveness of the overall macroeconomy.

My research begins by providing a comprehensive review of the existing literature on education markets and competition in Chapter 2, gives a background of charter schools, with special emphasis on Utah's details, and examines education through the lens of an economic market in Chapter 3. I then describe the potential behavioral incentives created by competition and provide a general conceptual model in Chapter 4. Chapter 5 outlines the data sources, individual variable definitions, and presents the economic models through which statistical estimation will be approached. Lastly, the results are presented in

chapter 6, followed by a conclusion in Chapter 7. Ultimately, this research empirically tests many economic theories relating to competition. As charter schools have emerged in Utah, their full impacts on the overall education structure are yet to be known. This research identifies and investigates those impacts.

CHAPTER 2

LITERATURE REVIEW

It's a well-accepted notion that education continues to be an important aspect of policy nationwide, a point historically true since our nation's founding. Moreover, an increasing number of policies are aimed at increasing educational outcomes in order to boost economic competitiveness and growth. Given these realities, and also seeing the dramatic declines in academic achievement per dollar spent over the past 40 years, it is to little wonder why the study of education has seen increased attention in the existing literature, especially so in conjunction with the field of Economics.

Charter school policies and laws, specific by state, all remain relatively young nationwide. Clearly, it certainly follows that the study of competition from newly-emerged charter schools is therefore also relatively new in the field of education economics. In spite of its recent nature, much empirical work has been done in limited areas. Much of this work focuses on states that have enacted education policies allowing for the development and growth of charter schools, and/or the expansion of various school choice policies. These states include (but are not limited to) California, Michigan, Minnesota, Arizona, Florida, Ohio, and North Carolina. Existing literature employs a wide variety of

methodological approaches that produce an equally wide variety of outcomes. Of particular interest to my research is reviewing different methodological approaches of quantifying school competition, specifically those of measuring charter school competition, and using it in the achievement models. A common component found in nearly all of the reviewed articles is utilizing distance as a price of attending competing charter schools, which subsequently serves as a measure of competition. This aspect will certainly be critical to any study on school choice, and is a central element in my own research. Another component, although less common in the literature, is the use of enrollment share to identify competing schools' market share in education. This approach borrows some of the same theoretical foundations found in industrial organization economics and is indeed useful in its application to education markets.

Another important aspect to any empirical work is to review the various statistical approaches taken in the existing literature. As expected, there exist a variety of statistical models utilized in the reviewed literature, but I pay special attention to research done on longitudinal data (also known as panel data) in relation to education markets. Many commonalities can be found between past research and my own models, which ultimately add strength and persuasiveness to my results.

In this chapter, I review the various methodological approaches that address both the measurement of competition as well as the measurement of academic achievement. Also, I address and review the statistical approaches used in analyzing the various empirical data. In doing so, I have separated out the articles that have found positive competitive effects from the articles that

have found negative and/or negligible competitive effects.

Evidence of Positive Competitive Effects

I first begin by reviewing an article by a particularly well-known economist, Caroline Hoxby, who has written extensively on the subject of school choice and whose work is commonly cited in the existing literature. In her article, "School Choice and School Productivity – Could School Choice Be a Tide that Lifts All Boats?" (Hoxby 2003), she views academic achievement in a unique framework. Rather than strictly defining academic achievement as the bare nominal value, Hoxby's work is centered on the idea of school productivity – that is achievement per dollar spent. Utilizing school-level data from Arizona and Michigan, she compares the performance of traditional public schools before and after the introduction of charter competition by employing a difference-in-difference strategy. An important aspect of Hoxby's model is that she addresses an often-overlooked dynamic of historical achievement trends. Considering the reality that charter schools likely emerged as a response to local circumstances, preexisting productivity trends were taken into account in the model by incorporating a de-trended differences-in-differences strategy. This more sophisticated strategy controls for each school's initial conditions. Moreover, in addition to examining the nominal effects of competition, estimates are presented on how schools' productivity trends changes after facing competition. Hoxby defines charter competition as a nonlinear function, that is, a competitive threshold, which is met after 6% of a district's enrollment belongs to charter schools. She finds that charter competition in Arizona and Michigan increases traditional public school

achievement scores in both math and reading. In order to study the impact of competition derived from charter school existence, Hoxby argues that the following requirements must be met: (a) There is a realistic possibility that at least 5% of students enrolled in traditional public schools could go to charter schools; (b) the traditional public schools lose at least some of their funding when a student leaves for a charter, and (c) the policy has been in place for a few years. All three of those conditions are met for Hoxby's research, and certainly are met in the case of Utah's education system. For example, by 1999, approximately 3.5% of all nonprivate elementary students in Michigan were enrolled in charter schools. For Utah, as of 2009, a full 4.0% of all nonprivate elementary students were enrolled in charter schools. This particular article is one of many that Hoxby has written on the subject of school competition, and remains an important comparative piece to my own research.

Another commonly-cited piece in the school choice literature is done by Holmes, DeSimone, and Rupp (2003), where they study the impact of charter school competition in North Carolina. Of the surveyed states that were early adopters of charter school laws, North Carolina has seen some of the greatest growth in charter school use. By starting from a conceptual framework of a school agent's utility (ostensibly a school principal), they explore the effects of competition with a greater foundation of economic underpinnings. As the measure of competition, they utilize five indicator variables that signal if the traditional school is within 5, 10, 15, 20, or 25 kilometers of the nearest charter school. It becomes increasingly important to note that charter school placement may be an endogenous factor, responding to either high achievement level areas

(in order to “skim” the high-performing students) or responding to low achievement level areas (and subsequent dissatisfied parents). Holmes, et al. acknowledge these possibilities and examine the North Carolina county-level factors that may influence the location of charter school placement. They report that Hausman tests of exogeneity are insignificant and therefore imply that these location measures can be treated as exogenous. In addition to traditional cross-section regression models, they utilize both an instrumental variable panel model (borrowing the Arellano-Bond procedure for dynamic panel models), as well as a maximum likelihood model that accounts for initial conditions. All of the models produce evidence of overall gains from charter school competition. The gains approximately equate to a one percent increase in achievement when a traditional public school is faced with competition from a nearby charter school.

Important to any empirical work studying educational outcomes is the inclusion of control variables that aid in isolating a particular effect of interest. In an article examining outcome in Florida, Sass (2006) argues that much of the existing research regarding charter competition lacks “sufficient controls for student characteristics” which opens up the possibility of numerous selection-bias problems. He proposes a value-added specified model that holds school achievement as a function of school inputs, lagged achievement, and a fixed effect on an individual level. Like Holmes, et al. (2003), Sass utilizes the Arellano-Bond procedure for dynamic panel data, which is essentially an instrumental variable approach, in addition to his restricted value-added model. To control for the location endogeneity possibility, a school fixed effect is added to his achievement model, which is very close to the particular approach I use in

estimating the competitive effect of charter schools. As a measure of competition, he first identifies charter, private, and other traditional public schools within 2.5, 5, and 10 miles of each examined traditional public school. As a supplemental measure of competition, he also includes a measure of market share of charter, private and other traditional public schools. His results find that the presence of one or more charter schools within 2.5 miles of a traditional public school is associated with a 3% increase in the average annual math score gain of traditional public schools. As expected, these increases diminish as the distance to the nearest charter school increases, consistent with the economic theories of competition. Using the measure of market share also produces similar results; charter school market share is positively correlated with math scores in traditional public schools. Similar measures of competition are included in my own models.

Due to its extensive geographic size and large levels of population, Texas remains one of the most important states in leading and determining K-12 school policy. Charter school legislation originally passed in Texas in 1995, after which 17 new charter schools opened up. These particular state characteristics make Texas a prime case for further investigation of competitive effects following charter school emergence. The work of Booker, Gilpatric, Gronberg, and Jansen (2008) examines student achievement in the traditional public schools after charter schools have penetrated the education market. By using a panel of test scores that span across 8 years (which is similar to my own, although contains 2 more years), they examine how charter competition has affected the students who have remained in the traditional public schools. Similar to Hoxby (2003) and

others, their method of measuring competition essentially involves measuring the portion of public school students who are enrolled in a charter school, measured at the district level. As a supplement, they also include the number of charter schools within 5 miles and within 6-10 miles of the traditional public school. Using a value-added approach prevalent in the literature, a fixed effect model is employed that includes a fixed effect specific to the individual school, as well as a vector of school inputs. A main benefit of using a fixed effect model is the way it controls for preexisting student ability and other family/parental characteristics that influence achievement in the surrounding population. Moreover, a fixed effect approach properly addresses the potential for endogeneity bias of charter school location, a point of special emphasis in my own research. Ultimately, their results suggest positive effects of charter competition on the academic achievement of students remaining in traditional public schools. The reported gains in achievement are consistent for both math and reading test scores, and consistent across their various measures of competition.

Evidence of Negative Competitive Effects

Of the reviewed literature studying the competitive effects of charter schools, a notable work is effectively presented by Ni (2009). Michigan is another state that has historically influenced K-12 education nationwide, and is also an early adopter of charter school legislation, making it a worthy candidate for further empirical investigation. Ni focuses on the competitive effect of charter schools on the efficiency of the surrounding traditional public schools in Michigan. A school-level longitudinal data set covering the years 1994 to 2004 is

utilized. The initial charter school legislation was passed in 1993, allowing for the emergence of various charters over the years. Ten years after the law passed, Michigan had 226 charter schools enrolling 92,000 students, which accounts for 5% of the state's public school population. Ni also points out the importance of Michigan's school finance system, which attaches charter funding to each student enrolled, thus creating an ideal competitive environment for such a study. A stated objective of Ni's work is to address a substantial limitation of previous research by distinguishing any competitive effects in the short-run from those in the long-run. The measurement of competition comes through both the magnitude and the duration of competition, thus allowing for distinction of time length. Differing from some of the other research, Ni's analysis is done on the district level rather than the individual school level, as data permitted. The measure of charter competition magnitude is similar to Hoxby's (2003), where competition faced by a district is the percentage of students who transferred out of a traditional public school into a charter school. The magnitude of competition, as we've seen, can either be measured as a continuous or dummy variable. Ni follows Hoxby (2003) and Bettinger (2005) by using a dummy variable that takes on the value of 1 if the percentage of charter enrollment reaches 6%, and 0 otherwise. To capture the duration of charter competition, Ni included three other dummy variables that indicate whether the competition was in the short, medium, and long run if the competition lasted less than 3 years, 4 to 5 years, and longer than 5 years, respectively. With these measures of competition, Ni uses a variety of estimation techniques to identify any competitive effects from charter schools. By employing a pooled OLS approach that aggregates the observed

years, there emerges a negative association between charter competition and student achievement, although it is much smaller once a set of control variables are included. A more complete fixed effect approach is ultimately utilized which produces more persuadable results. This approach takes into account the longitudinal nature of the data which is argued to be more accurate while providing a better fit. Overall, this methodology produces evidence of a negative but insignificant competitive effect on student achievement. This effect becomes larger in the medium-run and significant only in the long-run. These negative effects of charter competition are consistent for both math and reading tests in 4th and 7th grades. Ni's work is an important piece in the education literature for two reasons. First, it uniquely distinguishes the duration of charter competition faced by the traditional public schools. Second, and more important, the fixed effect approach used allows for charter school endogeneity and operates under very plausible assumptions. That being said, my own empirical approach includes many of the same characteristics. Ni's work is also distinguished from much of the other literature in that it finds evidence of negative effects of charter school competition on the achievement of students in the traditional public schools.

Evidence of Negligible Competitive Effects

The economic theory that underlies much of the empirical studies examining charter competition can plausibly allow for positive evidence, negative evidence, and even little to no evidence of any competitive effects. Not unlike other areas of empirical investigation, some studies have found little to no effect of charter school competition on traditional public schools. Among them is an

important piece done by Buddin and Zimmer (2005) looking into the effects of increased charter use in California's school system. A unique aspect included in their work is a survey administered to various charter school and similar traditional public school principals. This survey provides deep insight into whether or not principals themselves have made meaningful changes in response to increased charter competition, and fills a void left in the existing literature of supplementing empirical data with qualitative findings. They find, among other things, that 25% of principals in matched traditional public schools have changed instructional practices in response to charter competition. In other areas, such as financial aspects, the majority of principals find little to no effect of charter schools. These survey results pair nicely with an accompanying empirical analysis done of student reading and math scores over a four year time period. The measure of competition comes in numerous forms that include the distance to the nearest charter, the number of charters within 2.5 miles, and the share of public students enrolled in a charter school. Together with various demographic controls, the measures of competition are put into a fixed effect model that is consistent with the literature. Overall, their results show little evidence of charter schools affecting traditional public school achievement in California. Ultimately, they are unable to find consistency with the previous literature's evidence of positive or negative competitive effects from charter school competition.

Further Investigation

After reviewing the existing literature on the subject of charter school competition, it is clear that there is not necessarily a clear and consistent consensus of evidence. That being said, there indeed is a strong majority of research that finds positive effects from charter competition. In spite of a consistent picture of evidence, quantitative methodology, however, is fairly consistent across the research. In particular, the measurement of competition in all of the reviewed articles involves using either distance to the charter schools, enrollment share of charter schools, or both. My research will include various measures of charter competition that include both of these concepts. In addition to the competitive metrics, the statistical approaches are surprisingly related from piece to piece. The use of a fixed effect model for longitudinal education data is prevalent throughout the literature, and is ultimately adopted in my work.

The importance of studying various charter school policies is evidenced by the large amount of empirical research that has gone into calculating its effects. Seeing that the overall existing evidence is mixed, the topic is well suitable for further investigation. Empirical analysis of Utah's policy effects is therefore warranted.

CHAPTER 3

THE MARKET STRUCTURE OF EDUCAITON

This research seeks to examine the competitive effects of charter schools in Utah. By doing so, it is necessary to establish the general framework under which public schools operate, both charter and traditional public. In this chapter, I give an introduction and background of charter schools generally, and the specific characteristics of charter schools in Utah, with special emphasis on the latter. I then discuss the structure of education in terms of a market, where buyers and sellers meet. In doing this, I address the similarities and differences between traditional public schools and charter schools. Finally, I discuss the funding mechanisms for schools and the monopolistic features of public education.

Charter Schools

In order to understand the nuances of the education market, a note on the structure of charter schools is necessary. Charter school characteristics and basic structure, although are quite similar nationwide, still vary from state to state. For my research, I will stay focused on the characteristics and legal

structure unique to Utah's public education system. First, a brief introduction and background of school choice in Utah is worth mentioning.

School choice has become especially important and contentious in the state of Utah over the past decade. In early 2007, the Utah legislature passed the "Parent Choice in Education" Act (H.B. 148), which was essentially a voucher law for education. The law was somewhat contentious, which lead to its placement on the ballot that November and was eventually repealed by popular vote. The law was initially designed to offer scholarships to families who choose to send their children to private schools. The scholarship amounts ranged from $500 to $3,000, depending on the individual family's income level. Since the dollar amount of the individual scholarships remained well below the per-pupil funding in Utah, the voucher program indeed had the potential to save Utah taxpayers a significant and increasing amount of money over the tenure of the program. Moreover, in addition to fiscal savings, the voucher program also was likely to decrease the average class size in the traditional public schools by acting as a relief valve for ever-growing enrollments.

This noteworthy instance of passage and then repeal of an impactful education law portrays the overall desire and contentiousness for educational choice in Utah. In light of these facts, it is to little wonder why Utah has seen so much growth in charter schools over the past decade. Utah first passed its charter school law allowing for the emergence of charter schools in 1998. Since then, their popularity and use has increased tremendously. By 2010, over 40 K-6 nonalternative charter schools emerged in Utah (which is the defined criteria that I use in my analysis), most of which ended up along the so-called "Wasatch

Front," comprising of Davis, Salt Lake, and Utah counties. It is worth mentioning that many charter schools that have emerged are alternative in nature and specialize in unique areas such as Autism and English as a Second Language (ESL). Charter school growth and popularity in Utah remain strong today as more and more parents seek public education options.

It is necessary first to establish the general public structure of charter schools. To begin, charter schools are 100% public schools that are independently operated. Charter schools generally have an increased level of accountability, but enjoy more flexibility in terms of curriculum style. As outlined in Utah Code 53A, charter schools are "considered to be public schools within the state's public education system" and "governed by independent boards and held accountable to a legally binding written contractual agreement." Moreover (and interestingly), a charter school "may be established by creating a new school or converting an existing public school to charter status". The specific requirements for charter schools in Utah (also listed in Utah Code 53A) include 10 important mandates. Among the most important requirements for charter schools are that they be "nonsectarian in its programs", may not "charge tuition or fees, except those fees normally charged by other public schools", and that they must submit "the same annual reports required of other public schools under this title."

In terms of governing bodies and operations, charter schools also differ. Traditional public schools operate under the supervision and direction of local school districts, where the majority of education decisions and policies are made. This is in contrast to the structure of charter schools, where they operate under

the supervision and direction of the State Charter School Board, where each individual charter school essentially exists as its own district. Under Utah Code 53A, the State Charter School Board authorizes “the establishment of charter schools,” annually reviews and evaluates “the performance of charter schools,” and monitors the charter schools.

Like their traditional public school counterparts, charter schools are held to strict state requirements of student and annual progress reports. There are no differences in reporting requirements for charter schools compared to those required of traditional public schools. Moreover, as is the case with traditional public schools, charter schools are required to employ academically accredited teachers certified by the state of Utah. These requirement measures seek to provide, to the taxpayers as well as the parents of school-going children, assurance of rigor and quality of the public education system in Utah.

As seen, many similarities exist between traditional public schools and charter schools, where both entities share numerous characteristics and mechanisms. There are, however, a few notable differences that contrast the two, among them are curriculum and administrative flexibility. While charter schools are held to the same reporting regulations and guidelines as traditional public schools, they do have some additional flexibility regarding curriculum. Much of the curriculum decisions can be made at a school level, with heavy involvement and input directly from parents. Although outside the scope of my research (and excluded in my dataset), many charter schools are specifically founded to specialize in alternative schooling, such as autism, English as a Second Language, etc. As for the “regular” charter schools, parents enjoy

greater opportunities to provide input to the curriculum approaches. One other notable difference comes in the form of staffing and administrative structures. In Utah, charter schools are exempt from any existing negotiated contracts related to the hiring and dismissal of teachers. In other words, charter schools are not legally required to hire unionized teachers, although they retain the option to do so. Charter schools are, however, in all cases required to hire teachers who are certified by the State of Utah. Together, these notable differences generally allow for greater flexibility for charter schools. In their relatively short history in Utah, they have provided public school options to parent who are seeking them for their children.

As a greater number of charter schools emerge, their popularity and use have risen. Given the increasing popularity in Utah, charter school enrollment capacity remains somewhat limited. Increases in enrollment capacity must first be requested by the individual school, and then approved by the State Board of Education. Funding must be then be finalized and appropriated by the state Legislature for charter school enrollment growth.

Charter schools have emerged as a viable option for parents who, for one reason or another, are in need of education alternatives outside of the traditional public schools. Although the similarities between charter schools and traditional public schools are numerous, the few differences among them effectively contrast the two.

The Market Structure of K-12 Education

When analyzing different aspects of K-12 education, it is helpful to view the system as a market, where the buyers of education (students and parents) meet the sellers of education (schools). From this viewpoint, where education is the good exchanged, both agents (buyers and sellers) will operate under particular constraints inherent in any market.

On the demand side, students face particular mobility constraints when participating in the education market. These constraints arise due to the rigid structure of the public K-12 system. America's K-12 education system is comprised of numerous regulations addressing assignment of schools, which are almost entirely a function of the locale in which students live. Utah is no different, where parents are given virtually no choice in public school enrollment. Under Utah Code (Code 53A, Chapter 2, Section 207), schools may open up their particular enrollment for students who do not reside in their district, provided that their current enrollment level is "at or below the open enrollment threshold". (Other exceptions can be made at the discretion of the local school board. Seeing that these cases, however, are indeed rare and cumbersome, it is therefore a reasonable assumption in my framework to assume extremely limited public school choice in these instances). These enrollment constraints quickly become binding year after year due to the fact that individual schools only operate below the open enrollment threshold on very rare cases. This is partly a function of Utah's large family size, as well as limited public funding, especially in relation to neighboring states. These constraints are important to this study specifically because of the various affects they have on student behavior. As we

further understand the relationship between the market structure under which students operate and how that relates to student and parent behavior, we gain critical insights into how the various educational policies affect outcomes. This latter point is specifically of interest to charter school policies in Utah, as they provide general market mechanisms of competition.

The supply side also faces particular constraints when providing students with education. For decades now, everything from academic curriculum programs to time schedules has been regulated and directed from a central authority – a school district, the state office of education, or the federal department of education. This structure places numerous constraints on the part of the teachers and schools and leaves them with limited flexibility.

K-12 Education Policies in Utah

As I will show, Utah's public education framework has many unique aspects that differentiate it from other states. This is, in part, due to differences in demographic and cultural aspects unique to Utah's population. Certainly, demographic differences are notable and important to education policy, especially so in Utah. The differences described herein provide particular challenges and constraints as well as unique opportunities for overall education policy in Utah.

First, it is important to provide context to the demographic differences of Utah compared against characteristics of the nationwide population. For instance, a notable difference of Utah's population occurs in its age distribution. These differences are highlighted in Figure 3.1, where we see a large number

portion of Utah's population gathered near the young end of the scale, which is disproportionately large when compared to the nationwide population. Clearly, public education is responsible for precisely this portion of Utah's population. In light of these age distinctions, it is even more evident that Utah faces particularly important education constraints.

Another difference worth noting is the very large size of Utah's school districts in relation to other states. Empirically, this characteristic is dealt with by using school-level data, which contrasts some of the literature that uses district-level data for its unit of analysis, though many articles use school-level data as well. To start, Utah's counties are disproportionately large in relation to other states, partly due to the high concentration of population along much of the "Wasatch Front" area, comprising of Davis, Salt Lake, and Utah counties. School enrollments, subsequently, are also highly concentrated in these large counties and districts. In fact, as of 2010, more than two thirds (68%) of Utah's entire K–6 (predefined in my data) enrollment was in only three counties – Davis county, Salt Lake county, and Utah county. These large counties generally translate into large school districts for Utah, where the top five districts contain 59% of all enrolled K-12 students (predefined in my data, including charter school enrollment within the districts' geographical boundaries).

These details are important to note because of the analysis on behavior of the individual agents. When studying the impacts of education policies, they ultimately have their affect when they cause a change in behavior. This may take the form of behavior changes by students, by parents, or by school administrators. Ultimately, the main focus of my research involves studying the

impacts caused by the behavior of the school administrators in response to overall student behavior, after facing competition. In Utah's case, competitive pressures are likely to be felt by individual schools, but it is certainly plausible to assume that district administrators will already be made aware of any future competition. In all, these facts will help build a general framework of behavior and economic theory that will support further empirical evidence. As outlined, the educational and demographic realities in Utah make it a case suitable for investigation.

Education Financing Mechanisms

The process by which schools are financed, and the mechanisms behind those dynamics, are important to include in any study on education. This is especially true when discussing their effects on the behavior of the school officials, given the incentives created by the financing structure. Although not entirely comprehensive in nature, the following will provide meaningful context that proves necessary for the theoretical principles underlying competitive effects.

In general, public schools are financed through a combination of local property taxes, state income tax, and federal tax dollars. In Utah, education funding comes from federal, state, and local sources. Although it varies by school district, overall statewide education funding is broken down as such: Federal funds account for about 7% of school district's revenue, state funds account for about 71%, and local funding accounts for about 22% (Utah State Office of Education). Similar to many other states, Utah's education funding is

structured around the basic premise that individual school funding follows the student. Utah calculated a “weighted pupil unit” (WPU) that awards funds differently by grade, etc. As established earlier in this chapter, nearly all public school students attend the school that serves the area in which they live. This structure leads to a funding mechanism that awards an individual public school funds based on little more than the population of students who live in their boundaries and thus attend their school. In short, education funding in Utah for traditional public schools is essentially a function of an individual school’s enrollment. When a student chooses to leave the traditional public school to enroll in a charter school, a portion of the “weighted pupil unit” leaves the traditional public school, depending on the grade and school district. (As mentioned, charter schools act as their own independent district, and therefore do not receive local funds but are almost entirely funded through statewide funds.) Therefore, all else equal, a loss of enrollment would equate to a loss of funding for a traditional public school. It is under this mechanism that the economic theories of competition can operate in Utah’s education market. All else equal, a loss of enrollment equates to a loss of funding. A short note here on some unique incentives is necessary. Since only a portion of funding leaves the traditional public school when a student migrates to a charter school, this might be seen as beneficiary to the traditional public schools that face large class size constraints. However, it remains clear that many traditional public school administrators do not see charter schools in this light, but rather they continue to view them strictly as competitive institutions that compete for limited education funding.

Public Education as a Monopoly

In acknowledging the unique aspects of public education that differentiate it from various other markets, we encounter what is frequently mentioned by critics to be dominant to the main issues in education today, namely that of the monopoly status of traditional public schools. This last subsection of Chapter 3 serves somewhat as a transition into Chapter 4, which addresses behavior under competition. First, the characteristics of the education market must be described and addressed.

As will be shown in Chapter 4, public education inherently has two characteristics that may cause it to be treated as a public good, namely non-excludability and nonrivalry. A specific aspect tying it to the definition of a public good is certainly the fact that it is available to all citizens who seek its services. Along with these features, however, come limited options. When choosing to "consume" the services of public education, individuals are left with virtually no choice in regards to where to enroll their children. Of course, this would be in the absence of enrolling in a private school which would incur significant monetary and time costs far above those of public schools. As I have presented, and under Utah code 53a, individuals are essentially assigned a school that their children must attend, if they are to enroll in public education.

The situation therefore in the public education market appears to resemble a monopoly, where the traditional public schools own all of the market. Clearly, this is not an uncommon feature of public goods, but does create some inefficiencies and problems specifically in the market for education. First, it has already been established that the structure of public education leaves parents

and students with little to no choice regarding the selection of individual schools, if they are to enroll in public schools. Second, given the fact that the market for education is almost entirely owned by traditional public schools, the administrators and policy makers do not feel the risk of losing students (and subsequent funding) to competing schools. In the absence of these risks, significant decreases to school quality arise as a very realistic possibility. The cost of parental dissatisfaction to a local school administrator will not necessarily be financial (or an opportunity cost), but rather will come in a form resembling nothing more than verbal complaints. Though, it must be noted that there likely exists some sort of dissatisfaction threshold at least on a school district level, when passed, causes significant changes to be made. Such a threshold, however, would necessarily be much higher in the absence of competition. Lastly, traditional characteristics of a monopoly often involve barriers to entry. The public school market structure proves no exception, in the sense that there exist significant (indeed virtually impassable) barriers to entry into the education market, at least for the publicly-funded school market. This is in contrast to a competitive market where firms are able to enter a market where profits are attractive with some ease. Outside the newly formed possibilities through charter school laws, when education firms (new schools) wish to enter into the education market, they must to so as a private school, which will not receive public funds allocated for education. This would essentially differentiate their product, making it outside the realm of substitutability. Clearly and understandably, the market for education remains with significant barriers to entry for any new firms.

Conclusion

In a “normative” rather than “positive” fashion, this chapter has sought to describe the realities and characteristics of the education market, with special emphasis on Utah’s education uniqueness and facets. In doing so, it is intended to impress upon the reader the overall structure of education as a monopolistic one that may be opening itself up to a small degree of competition through the passage of charter school laws. Before any empirical analysis is to be done, the theoretical foundations of individual behavior will be addressed in Chapter 4.

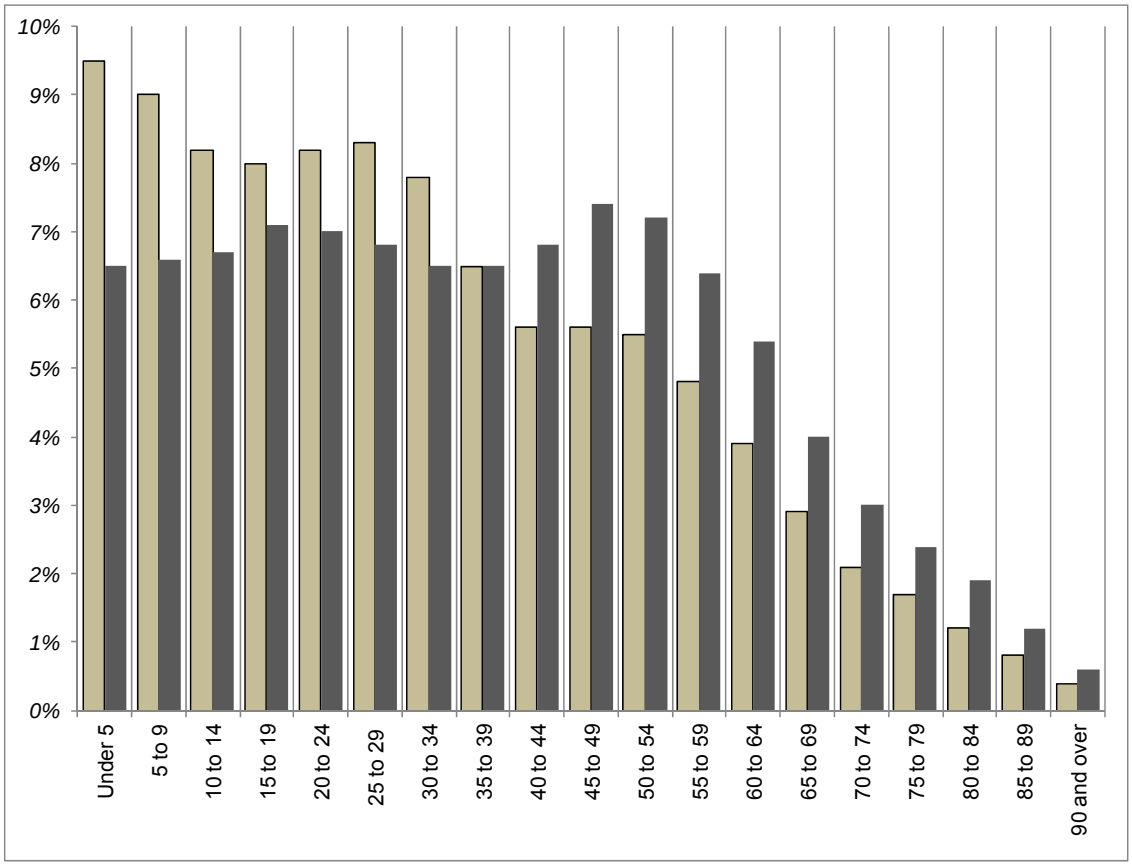

Figure 3.1: Age Distribution - Utah and U.S. Utah U.S.

Source: U.S. Census Bureau, 2010 Census.
Summary File 1, Tables P12, P13, and PCT12.

CHAPTER 4

BEHAVIOR UNDER COMPETITION

The dynamics of school choice and charter competition depend substantially on the notion that human behavior may be altered by various incentives and pressures. This idea is not foreign in discipline of Economics, but may be foreign to some in who have studied K-12 education. In the context of education markets, the forces of competition, or even the threat of competition, may apply pressure on numerous agents to change their behavior. These responses may take many forms and affect various levels of the school structure. For instance, when faced with the threat of losing substantial student enrollment to a nearby charter school, a school administrator may introduce new curriculum changes to entice students to stay. The ultimate outcomes will inevitably depend on the degree to which administrators react to various market forces. This chapter will first establish education as a public good, give an introduction to market forces and consumer behavior under competition, discuss substantially "Tiebout choice" theory in relation to the education market, address education applications viewed in a general equilibrium sense, and develop a general conceptual model for behavior in education when faced with competition.

Market Mechanisms and Education as a Public Good

The economic theories that underlie market behavior must first be generally established in order to examine education as a market. Standard economic theory provides the argument that competition forces firms to increase quality and/or decrease price. This argument clearly is a function of the changes in behavior on the responding firm's side. The two important aspects here that vary are price and quality, both being tools at the firms' disposal to attract potential revenue. Not unlike the market structure of industrial firms, the market for education is also a function of the various characteristics of the buyers and sellers. This includes the number and concentration of schools (sellers) in a given area, which effectively is a measure of market share. Market forces that influence firms to increase quality and/or decrease price are mechanisms inherent in a consumer market, and are essentially driven by demand for their products. Education policy, conversely, is not necessarily driven directly by the demand for its product, but rather by political and public mechanisms that will be outlined in this section.

In applying various market structure principles to education, it is requisite first that I discuss a few notable differences in relation to industrial firms. First, education is understood to be a public good and not directly a purely and individually consumed private good. The benefits of education are not constrained strictly to each individual but can indeed be enjoyed by the broad public. Certainly, the benefits of education cannot be excluded from the non-payers of such good, thus satisfying the non-excludability condition. Additionally, as a greater portion of any population becomes educated, the created benefits

received by others are not diminished, but may even prove to be more beneficial to others due to the increased levels of education. The second condition of a public good, namely nonrivalry in consumption, is thus satisfied. The overarching characteristic of education in this sense is its role as a positive externality for society. This argument is made clear in the simple observation that a highly educated population brings about many benefits to their area, outside of the summed individual gains.

This distinction of education as a public good is important to understanding the behavior within the education market and, most importantly, the justification for its publicly-funded financing structure. When considered a public good, the burdens associated with funding education can be widely distributed across society, which will consequently lead to a more collective sense of ownership and responsibility over education obligations. Nationwide, and in Utah specifically, public education is created in such a way to respond to political pressure as a public good where voters and constituents have collective control over local decisions. This implies that local individuals, including parents of school-going children, do not necessarily have any direct decision-making power in public education, but must express their voice through local political mechanisms. The directly-elected governing bodies include local school boards, state representatives, and state senators who all craft and direct education budgets, curriculum, and policies. It is through these political mechanisms that education policy may be directed, but there also exist market-like mechanisms that influence public and education policy.

Tiebout Choice

Direct voting is not, however, the only mechanism by which citizens can affect educational policy. Constituent influence can also be felt and revealed by behavior – specifically by where individuals choose to live. This theory, formally structured by Tiebout (1956), is commonly known today as "voting with your feet" and is incredibly useful and illustrative in describing the education market.

Ultimately, the education market operating within the public school system is about aligning the supply of education with the demand for it. In a sense, the demand for education can be understood in terms of a pattern of individual preferences, aggregated to each larger unit (i.e., families, neighborhoods, cities, counties, etc.). Given the fact that education is foremost a public good, and that its funding sources are public, we can apply Tiebout's (1956) theory of local expenditures directly to the education market.

First, we must recognize an issue of determining the level of expenditures that exists in the public sector. The main issue that was most famously argued by Musgrave and Samuelson, cited in Tiebout (1956), was the absence of a "market type" solution to determine the level of public good expenditures. The resulting consequence was that a large portion of the national income was allocated in a "nonoptimal" way, at least when compared to the private sector. Tiebout seeks to show that these suboptimal public expenditure issues do not necessarily need to apply to local expenditures. The distinction is an important and consequential one, indeed one that helped popularize Tiebout's theory.

I start with the main problem that is key in the suboptimal expenditure allocations, namely that of aligning the consumers' preferences with the proper allocation of public goods and services. The purpose of the surrounding government, as Tiebout explains, is to essentially determine the level of public goods desired by the consumer and tax them accordingly. The government's revenue-expenditure pattern therefore must adapt to the consumers' preferences. Within this framework, it is easy to see the numerous problems potentially arising in the area of public expenditures and allocation. Specifically, the heterogeneity of consumer preferences is far too vast to be satisfied by any homogenized public expenditure policy. Moreover, the public expenditure problem is further complicated by the fact that true individual consumer preferences are not fully revealed. As Tiebout notes, the solution to these problems is executed through political mechanisms whereby public expenditures are based off of the preference patterns of a "typical voter." This mechanism clearly leads to sub-optimal public expenditure allocation, further exacerbated as consumer preferences become more different (or further) from the mean "typical voter." A complicating layer added to this problem is an "ability-to-pay" principle inherent in the progressive tax structure introduced on the revenue side of the public sector side.

Perhaps Tiebout's most prominent contribution was the clear distinction between centralized (federal or national) expenditure patterns and local ones. The relationship between centralized policies and local ones are a matter of one-to-many, with the number of locales being many in number. While centralized expenditure allocation must be adapted to fit the "typical voter," Tiebout notes

that local expenditure allocation is more stably set. This fact creates the most essential distinction between centralized and local expenditures precisely because it allows the consumers (voters) to choose between locales based off of, to no small degree, the expenditure patterns of the local community. In choosing a community in which to live, citizens undoubtedly seek areas with expenditure patterns that best reflect their own set of preferences. By doing so, the citizens will be able to "vote with their feet," as has the principle been known since Tiebout's infamous work.

The closeness with which a citizen can match his own set of public preferences with that of a community will depend on the number of communities available, as well as the degree of mobility available to him to locate to alternative areas. Therefore, as Tiebout admits, there will likely remain a degree of suboptimal expenditure allocation due to both the scarcity of communities and the large number of citizens. This limitation, however, should not diminish the effectiveness of the argument itself, nor the usefulness of the theory applied to education markets. The ability to match consumer-voters' preferences will therefore be a matter of degree.

Specifically because of its publicly-funded nature, this theory proves very persuasive when applied to the market for education. This is especially true for the Utah case when studying the effects of emerging charter school competition. By allowing the formation of public school alternatives, another layer of public expenditures is added to each community, adding to the variability of expenditure patterns. Alternative communities can now attract more citizens who seek the kind of choices in education that charter schools have to offer. The process by

which consumer-voters can cause policy changes is made possible through 2 main dynamics: choices and threats.

With an increase in the variety of communities available to them, and without relaxing the reasonable constraints of distance and/or mobility, citizens are more likely to find an area that best matches their own set of public preferences. It should be clear to any reader that offerings in education are at or near the top of most all citizens' priority lists when deciding on the community in which to locate. Seeing that potential tax revenue and growth are a function of constituent populations, individual communities have nontrivial incentives to offer appealing education expenditure patterns, and thus attract more tax payers. It is shown through this mechanism that citizens are able to vote not only in the strict legal sense, but also "with their feet" by selecting the community in which to live. This mechanism grants persuasive power to the potential tax-paying citizens, and indeed includes real incentives for community policy makers to offer matching patterns of education demanded by said populations. These effects will quickly be felt by the individual schools and school districts, as they must compete with neighboring communities to satisfy the expenditure patterns demanded.

The second dynamic through which consumer-voters can cause policy changes is simply by threatening to move to a different community. This point has been persuasively argued by Holmes, et al. (2003) in relating the Tiebout theory to school choice. When parents find themselves dissatisfied with various aspects of a local school system, they can threaten to dis-enroll their children, and leave the community, leaving behind a piece of funding proportional to that

single family tax share. Well known are the typical costs associated with moving communities, including nonfinancial social costs, but school offerings and school quality are such a concern to parents that these threats must, in most cases, be considered credible. The occurrence of threatening to dis-enroll from a school is a more common mechanism of bringing about changes in school policy than those of actually selecting alternative communities and following through to the threat by actually moving.

Tiebout's theory of matching public expenditure patterns has been shown to be valuable in exploring the effects of increasing competition in education markets (for specific examples, see Holmes, et al. (2003)), and will be used in the theoretical framework of my own research. The theory is valuable precisely due to the mechanism by which charter school emergence, by definition, increases parental choice for education. This consequentially will lead to greater portions of the Utah population to "vote with their feet".

General Equilibrium

The principles contained within general equilibrium theory can also prove to be effective in studying education markets and student outcomes, precisely due to the numerous mechanisms of student sorting and resource distribution. Hoxby (2003) has noted the importance of including these principles of general equilibrium by arguing the need for solving three simultaneous equilibria: equilibrium in the market for schooling, equilibrium in the market for housing, and equilibrium in the labor market. All three of these areas are critical for any individual community, and are certainly a factor in education policy in Utah.

Clearly, while this research specifically addresses the competitive effects in the market for schooling, it is important to provide context through discussion of the other markets that are inherently related to education.

Viewing education markets within the framework of general equilibrium is also an argument made persuasively by Goldhaber and Eide (2003). In a review of methodological approaches to studying education competition, the authors explicitly separate the two structures of equilibrium analysis, namely general and partial. A substantial amount of school choice research, they point out, has gone into viewing the competitive effects on the entire school system, in a general equilibrium sense, but only measuring those effects in a partial equilibrium sense. In order to fully understand the competitive impacts, they argue that a general equilibrium framework should be used. This essentially requires an analysis of the competitive impacts of new education competition on the entire school system. Ultimately they argue that, for increased choice to have an impact on the education market, it must cause positive changes in the entire public school system.

This argument is persuasive, in no small degree, due to the fact that the overwhelming majority of K-12 students will remain in the traditional public schools. Utah is no exception to this fact, indeed adding a greater need for research to be done on the competitive effects of charter schools on the achievement of the students who remain in the traditional public schools. Overall, charter schools have fulfilled a need for additional public school options, but are clearly not intended to replace traditional public schools in their entirety. The overwhelming majority of K-12 students will indeed remain in the traditional

public schools. By incorporating the general equilibrium principles, the models I use will be more complete in the sense that they look at the impacts on the entire school system. My research therefore answers the more broad questions related to students who remain in the traditional public school system.

Another methodological critique made by Goldhaber and Eide (2003) is the need for research to test across areas with varying degrees of competition when testing the general equilibrium effects of education competition. My research comprehensively covers these differing degrees by utilizing numerous approaches to measure charter competition. Moreover, the statistical models will be applied to various subsets that differ in population and density. The methodological and statistical details are discussed in Chapter 5.

Conceptual Framework

In order to study the competitive impacts of charter schools, it is necessary to develop a conceptual framework through which individuals' behavior will plausibly work. Following the same general approach as Holmes, et al. (2003), I consider a general conceptual model for school behavior following competitive pressures from charter schools. For purposes of simplicity, and considering the fact that my data are school-level, I will approach the conceptual model from the viewpoint that the agent is the school principal. However, it must be noted that the acting agent in Utah's education market might also be a district administrator or superintendent. Consider first, an enrollment function,

$$E(q(e), p) \tag{4.1}$$

where a school's enrollment, E, is a function of school quality, $q(e)$, and the price of attending a competing charter school, p. Further, school quality, $q(e)$, is a function of the effort exerted by the school principal. Since I am working within the context of the public school system, this conceptual framework makes more sense by including the price of the competing good (price of attending a charter school). Next, consider the utility function of the school principal,

$$U(E, e) \tag{4.2}$$

where his/her utility, U, is a function of the school's enrollment, E, and his/her effort exerted, e.

In this framework, it should be clear that an individual school's enrollment, E, is increasing both in school quality, $q(e)$, and in the price of attending a competing charter school, p. Moreover, the agent's utility, U, is increasing in school enrollment, E, but decreasing in his/her effort exerted, e. As established, Utah's education system is such that an individual school's funding is directly tied to its enrollment levels. Thus, the funding incentives for the agent heavily involve enrollment levels. Therefore, the agent's behavior can be described as maximizing

$$U(e, E(q(e), p)) \tag{4.3}$$

where essentially he or she can only alter enrollment, E, through changes to school quality, $q(e)$, by increased levels of effort, e. Of course, the price of attending a competing charter school, p, is of interest, but treated as exogenous to the agent.

The first order condition is

$$U_e + U_E E_q q_e = 0 \tag{4.4}$$

and rearranging produces

$$-U_e = U_E E_q q_e \tag{4.5}$$

which shows that, at this level of maximization, the effort to increase enrollment equals the marginal disutility from exerting effort. What this conceptual model portrays is that as enrollment in the traditional public school increases, the agent has less incentive to exert effort to affect quality. More abstractly, this notion is consistent with Tiebout choice, in that there is a decreasing amount incentive for schools to improve quality if enrollment (and subsequent funding) is already high or already increasing. These notions are, of course, strictly related to monetary incentives and exclude any nonfinancial motivating factors.

Again, this general conceptual approach was done persuasively by Holmes, et al. (2003), but is helpful in describing any behavior by the school principal (or any higher level school administrator) for my own research of Utah's education. The rationale for including this conceptual model in my research is to clearly frame the potential behavior changes by the agent in response to any competition. As enrollment is partially a function of the price of attending a competing charter school, it only becomes a meaningful factor when p is such that the competition is substitutable. In other words, an agent's behavior is likely only affected by competition when the price of attending the competition is low. For my research, I include various measures of charter school competition, most of which involve distance from the traditional public school to a nearby charter school as a proxy for the price of attending the charter school. Further details and rationale for using distance as a measure of competition are provided in Chapter 5. Suffice to note in this section that competition will only solicit a reaction when the school is a close substitute.

This general conceptual model also reveals the incentives created by charter school competition. As a nearby charter school becomes more and more competitive, the school agent is faced with the possibility of losing enrollment and subsequent funding. Therefore, market-like incentives are created by competition for the agent to increase the quality of the traditional public school. Specifically, in terms of educational changes, this may involve additional staff training, curriculum improvements, or any other instructional improvements, in response to increased competition. To this end, it is the purpose of this research to explore and test these theories with solid empirical data.

Actual competition from a nearby charter school may not be the only mechanism by which agent behavior is changed. It is entirely possible that the mere threat of competition may be substantial enough to elicit policy responses from school administrators. Hoxby (2003) notes that, within the education market, school performance will depend on the availability of alternative schools, and not necessarily whether the parents actually use those alternatives. This notion is fully consistent with the principles of behavioral economics and is also argued by Holmes et al. (2003). This research allows for such behavioral mechanisms as it explores the effects of the availability of alternative schools on the student outcomes.

Concluding Thoughts

The degree to which competition from charter schools is felt is certainly a function of residents' ability to exercise Tiebout choice over their traditional public schools and their school districts. Recalling from Holmes, et al. (2003), the existence of alternative options for public schooling gives parents a credible threat against schools who continually fail to make improvements, or continually fail to offer any response to parents' dissatisfaction. Utah has a unique case of having disproportionately large school districts, which ultimately decrease the number of districts from which to choose. For example, as mentioned in Holmes, et al.(2003), North Carolina has 117 traditional school districts, Michigan has over 500, while Utah has only 40 (as of 2009). Moreover, the top five school districts contain approximately 50% of K-6 public school students in Utah. This low number and large size of Utah's school districts will certainly impact the

market structure of education in the sense that parents will have a diminished degree of school district choice, in relation to other charter states.

On a more abstract level, and as Booker, et al. (2008) note, the mere fact of a charter school law passing may be enough of a motivating factor in a traditional public school's decision to respond to potential competition. In other words, and in a preemptive sense, an individual traditional public school may in fact respond to the threat of competition without (or before) any charter schools even surface nearby. These market-like motivating factors will indeed be a function of the perceived sense of competition that is held by a school administrator. The very premise upon which these notions are formed is entirely consistent with Tiebout's theory of public choice. A critical element in the theory is the mechanism that is operated by a simple threat of leaving the locale and subsequently taking potential future funding. Administrative decisions will certainly be influenced by perceived threats, which are clearly validated by historical reality. As Hoxby (2003) notes, the threats to leave an individual public school by dissatisfied parents must be credible if they are to have any realistic effect.

The reality of the current education system is such that it is quite unlikely that charter schools will ever educate a substantial part of any state's student population, a point even acknowledged by charter advocates. Yet, as noted by Buddin and Zimmer (2005), charter schools' most effective impacts will likely be felt at the structural or systemic level of education. This is accomplished by charters infusing market-like incentives to the traditional public schools that eventually permeate through the entire system. Therefore, charter schools

potentially will have their greatest impact in the long-run not necessarily on the students who choose to enroll in their services, but rather on the majority of students who remain in traditional public schools.

CHAPTER 5

DATA AND METHODOLOGY

An essential characteristic of any meaningful research is its unique contribution to the existing literature. As outlined in my literature review, found in Chapter 2, and considering the tremendous growth of charter schools, further empirical research is certainly warranted in Utah. In order to unique contribute to the existing literature, I present the main characteristics of my research. The first comes in the form of a newly-created and unique longitudinal data set, while the second is analysis of the empirical data through various statistical approaches. Taken together, these characteristics of my research will define its unique contribution to the literature. Justification for using the various statistical approaches is grounded in the literature, and properly cited where necessary.

A common limitation in any study on education outcomes is derived from the fact that the data are non-experimental in nature. To test the impact of various policies on student outcomes, we must utilize the existing empirical data. A short note on the limitations to the data set is worth mentioning here. Not unlike most social science research, economic analysis applied to education cannot create pure experiments. In light of these realities, researchers are forced to explore the existing data within this constrained environment. My

research of the competitive effects of charter schools is no different, where existing empirical data is used, and limitations are dealt with using robust statistical measures. Greater limitations exist on the reliability of the test scores used, and will be addressed in a later section.

New Data Set

In order to uniquely contribute to the existing literature, I have created a new longitudinal data set with numerous parameters to measure the effects of charter competition. I have done this by combining two large authoritative data sets.

First, I have obtained school-level criterion-referenced test (CRT) score data from the Utah State Office of Education for the academic years 2005-2006 through 2010-2011. These tests are given in three subjects: Math, Science, and Language Arts. Two measures for each subject were obtained: First, a school-level average score for the subject, and second, the percentage of total students who are deemed proficient in such subject for each school. Therefore, my dataset contains two measures of 3 subjects for 6 years. These data provide overall indicators on how well each individual school is preparing their students on those 3 subjects and allows for strong comparative models.

Second, I have obtained school-level demographic and enrollment data from the National Center for Education Statistics (NCES). These particular data serve as a supplement to the CRT score data set and, when combined, form a rich data set on which to perform robust empirical analysis. The NCES data also allow for the statistical models to properly control for numerous factors outside

the scope of my research, but are indeed important to include in the models for completeness.

Measures of Competition

In a competitive market, each firm basically has two separate tools at its disposal – price and quality. In an education market, the distance to a charter school represents the price of attending it. This is due to the complete lack of any sort of tuition or other costs associated with enrollment. Justification for using distance as the cost of attending a nearby charter school is strongly supported by the literature. Holmes et al. (2003) cite numerous specific empirical evidence of using distance as a relevant cost, a principle dating back to Hotelling's well-known letter written to the National Park Service in 1947 discussing distance as an instrument of price. Its use has also been shown effective specifically to the education literature, as portrayed in Goldring and Hausman (1999), where they find distance as an important factor for parents when choosing between alternative schools.

As the distance to the nearest charter school decreases, the price of enrolling in said school effectively decreases. When the price of attending the competing school decreases, relative to the traditional public school, its degree of substitutability increases. The degree of competition is therefore increased as the number of competing schools rise and as their distance to the students decrease. Competitive pressure felt on the schools administrators also increases as the probability of students enrolling elsewhere happens to be negatively associated with the distance to the nearest competing school. Since public

schools' price components are essentially fixed, when competition affects the price of education, competing schools are forced to respond by changing the other constraint – quality. Seeing that the price of attending a charter school is effectively a function of its distance to the potential students, and in order to include this in my data set, I have calculated the distance from each traditional public school to each charter school in their county. The distance measure is calculated "as the crow flies," and is in miles.

In the school choice literature, two basic approaches are taken with respect to using distance as a competition measure. First, a linear approach can be taken that measures the number of competing schools within a particular distance from the traditional public school. This method allows for the detection and influence of two effects. First, for the effect of any competition from a nearby charter school (in a dichotomous fashion), and second, for the measure of magnitude of competition to increase as more charter schools exist nearby. This linear approach has been taken by Sass (2006) and Bettinger (2005). Second, a nonlinear approach to measuring competition can be taken where a series of variables indicate after a particular competitive threshold has been reached. The use of a dummy variable to capture the level of competition is argued by Hoxby (2003), where she states that the impact of competition should not necessarily be measured linearly, but will be negligible at low levels and become more pronounced as charter school enrollment reaches a threshold of competition – around 6% of district's enrollment. This method is also utilized by Bettinger (2005) and Ni (2009) in their analysis of charter school competition. Hoxby (2003) argues that competition from charter schools is likely only observable after

6% or more of a district's enrollment belongs to charter schools. This non-linear approach seems to be an appropriate methodological avenue, indeed one that can be grounded in industrial organization theory. The issue in applying this particular measure to school choice in Utah arises due to the different structure of school districts. As previously outlined, school districts in Utah are disproportionately large in relation to other states. This leads to smaller units of analysis on the district level and a much large number of schools included in each district. Still, the single use of this metric will be one part of my overall methodological approach of measuring competition.

For robust results, and consistency, my method of measuring competition involves a variety of approaches and metrics. First, I follow the basic structure utilized by Sass (2006), and others, where he uses a series of variables that indicate how many charter schools are found within 2.5, 5, and 10 miles of the traditional public school. My method measures the number of charter schools within 1, 2, 3, 4, 5, and 10 miles of the traditional public school. This method allows for the effect of any charter schools within a given distance as well as the measure of magnitude of competition to increase as more charter schools exist nearby. Second, I include the distance (in miles) to the nearest charter school. Including this measure appropriately accounts for the underlying theory that as the distance to the competing charter school increases, the degree of competition felt by the traditional public school should is diminished. Appropriately so, we would expect the correlation of such variables to be negative. Third, following the methodology of Hoxby (2003), I include a series of dichotomous variables indicating when 5%, 6%, and 7% of a school district's

enrollment belongs to charter schools. Ultimately, a 5% threshold works best for the data. For completeness here, I also use the continuous measure of a district's enrollment belonging to charter schools. Finally, I use a set of dichotomous variables indicating when there exists three or four charter schools within 5 miles of the traditional public school. This particular measurement of competition is used persuasively by Booker, et al. (2008) and incorporates the notion of dichotomously comparing traditional public schools that have experienced charter competition with those that have not. Essentially, it serves as an indicator of charter competition penetration into the education market. Together, these multiple measures of competition will serve as a check for completeness after controlling for school-level characteristics that influence achievement.

Using distance as a measurement of competition may expose the results to some form of bias. In their excellent review of education competition methodology, Goldhaber and Eide (2003) note that the reliability of results certainly will depend, in some degree, on the appropriateness of the instruments used. I am confident however in the methodology used due to its wide use in the existing literature as well as the theoretical principles underpinning their use. Although unique in a few key aspects, the market for education is similar to any other competitive market, where they must compete with substitutable goods nearby. This fact is certainly clear when schools become open to competition, as is the case when charter schools enter the market. These distinctions and similarities have already been discussed, but indeed are worth mentioning again in relation to the quantitative methodology used.

Test Score Data

Although its effectiveness is still open to debate, grade-specific standardized tests remain the most widely-accepted proxy for student achievement. For my particular study, school-level criterion-referenced test (CRT) score data was obtained from the Utah State Office of Education for the academic years 2005-2006 through 2010-2011. The CRT scores measure three subjects – Language Arts, Mathematics, and Science. The scores also come in two different forms – the individual school average score and the percentage of the school that is considered proficient in each subject. These Criterion Referenced Tests are administered to each individual public school in Utah and have been consistent in both methodology and use for the reported years included in my study, proving to be a reliable and consistent instrument for academic achievement. By having a broad set of academic indicators, the empirical analysis through econometric models will be very robust, ultimately leading to strong and persuasive results.

Given that my research studies a six year time period, the point of interest is the dynamics of these CRT scores. An often overlooked aspect in the empirical literature is that of historical trends. This point is most effectively argued by Hoxby (2003), where she notes the importance of measuring the trends of education scores, and not only the levels. My research will follow the same notion by incorporating a fixed-effect approach that accounts for the historical trends of CRT scores before competitive effects are introduced, as well as direct controls for any year effects that might exist. Moreover, by including different measures of competition, namely the dichotomous variable indicating

when a traditional public school faces strong charter competition, the historical trend preceding that particular year is statistically accounted for.

Statistical Approaches

The central question of interest is essentially how increased competition affects the quality of the competing traditional public schools. The measurement of quality comes in the form of the changes to the trends of school-level CRT scores. As explained, my method of measuring competition involves using an instrument for price of attendance, namely that of distance from the traditional public school to the nearby charter schools. Since my approach measures individual schools over a period of 6 years, it will take on a panel structure, containing two subscripts. In a general sense, academic achievement therefore can be described as:

$$CRT_{it} = \delta X_{it} + \beta Distance_{it} + \varepsilon_{it} \quad (5.1)$$

where CRT_{it} is the average Criterion Referenced Test (CRT) score for school i in time t, X_{it} is a vector of time-specific characteristics of school i that influence achievement, including the percentage of a school's enrollment that is Hispanic, the percentage of enrollment that is Free/Reduced Lunch eligible, a school's student-to-faculty ratio, and the school's district size in terms of total enrollment (in thousands), and $Distance_{it}$ is a variable indicating the number of charter

schools within 1, 2, 3, 4, 5, or 10 miles of school i in time t, or one of the other measures of competition.

After controlling for the various school characteristics, equation (5.1) measures school effectiveness or productivity. Ni (2009) appropriately notes that this measure can be read as achievement per dollar spent, after the school demographic and spending variables are properly accounted and controlled for. Hoxby (2003) also articulates academic achievement trends in these terms of achievement per dollar spent.

The measure of competition found in equation (5.1) takes into account the effect of having any charter school within X miles, while still allowing at the same time different levels of effects for each additional charter school within X miles. I argue that this methodology is more effective, and ultimately more persuasive, due to the underlying theory of marginal competition. Namely, as the number of charter schools within X miles of the traditional public school increases, so does the level and severity of competition. Moreover, this methodology is not only appropriate in terms of economic theory but is also widely used in the school choice literature (see Bettinger 2005 and Sass 2006).

Estimating equation (5.1) through OLS would prove to be problematic due to the panel nature of the data. A simple OLS approach does not properly take into account the lagged achievement effects (namely, CRT_{it} will partially be a function of CRT_{it-1}). Moreover, a pooled OLS approach assumes that all the other variables not accounted for in the model are uncorrelated with competition. This is an improper and improbable assumption given the fact that charter school

location will likely be, at least in part, a function of such traditional public school characteristics (see the following section). These limitations and complications are addressed in the context of charter competition and location by Ni (2009) and addressed in a technical sense by Baltagi (2001).

A more complete statistical methodology should include a fixed-effect approach, which decomposes the error term ε_{it} into an unobservable school-specific effect, μ_i and an idiosyncratic error that changes over time, υ_{it}. This idiosyncratic error is considered to be the "usual" residual and therefore is assumed to be uncorrelated with itself, uncorrelated with X, homoscedastic, and have a mean equal to zero (see Baltagi, 2001). The school-specific and time-invariant effect, μ_i, accounts for any fixed underlying differences in school quality and effectiveness and differs between units but, for any particular unit, is constant. It also may include historical aspects that influence, among other things, charter school location. On the other hand, υ_{it} differs between units as well as between time observations. Finally, I also add a year-specific effect, θ_t, to the error component, that will account for any error effects that come from a specific year in the observed range. Given the empirical nature of this data, it is important to properly account for these year-specific effects that might influence achievement, a point of special emphasis in the education literature. Similar to Buddin and Zimmer (2005), the overall error component becomes $\varepsilon_{it} = \mu_i + \upsilon_{it} + \theta_t$.

When working with longitudinal data, a random-effects model approach is often taken. However, in this particular instance, estimation through a random-effects model would assume that the location of the charter school is necessarily random, an implausible and unlikely assumption. On the other hand, a fixed-effect approach is more appropriately used in this research due to the school-specific and time-invariant effect, μ_i, which is allowed to be correlated with $Distance_{it}$. Effectively, this approach allows the location of the charter school to be related to the unobserved differences among traditional public schools, which is an important component of the estimation due to the fact that charter schools often locate in areas where traditional public school student achievement is low and parental dissatisfaction is high. Alternatively, a random-effects model assumes that μ_i is a random variable that is uncorrelated with the explanatory variables, which is certainly a false assumption for the charter school situation in Utah. This particular fixed-effects approach applied to longitudinal education data not only operates under reasonable assumptions, but is also commonly used in the literature (see Booker *et al.* (2003), Bifulco and Ladd (2006), Buddin and Zimmer (2005), and Ni (2009)).

With the error term decomposed, the equation then becomes:

$$CRT_{it} = \delta X_{it} + \beta Distance_{it} + \mu_i + \upsilon_{it} + \theta_t \qquad (5.2)$$

which is identical to equation (5.1), except for the decomposed error term, $\varepsilon_{it} = \mu_i + \upsilon_{it} + \theta_t$. By separating the different error effects, we can

distinguish the unobserved school heterogeneity that affects student achievement, namely μ_i. Estimation of the year-specific error effect is done directly through the inclusion of dichotomous year variables (similar to Buddin and Zimmer (2005)).

Following Holmes (2003) and Sass (2006), my model takes the form where the current school achievement is a function of lagged achievement, various measures of charter school competition (distance), and a vector of time-specific school characteristics that influence achievement. As stated, estimation of the model is performed primarily through a fixed-effect linear regression for panel data that allows for time-variant competitive effects as well as time-invariant demographics (fixed-effects). This particular fixed-effects approach applied to longitudinal education data is commonly used in the literature (see Booker et al. 2008, Bifulco and Ladd 2004, Sass 2006, and Ni 2009), and serves as a strong statistical vehicle for my empirical data.

Charter School Location and Endogeneity

Charter school location could prove to be problematic for statistical estimation, essentially due to its endogenous nature. Since the passing of charter school laws in Utah, charter schools are allowed to locate at the founding members' discretion. Of course, the choice of location will be a function of local demand for charter schools. The governing bodies deciding charter school location will undoubtedly find areas in which demand for alternative schools will be sufficient to populate a new charter school. In theory, charter schools are likely to emerge in areas that exhibit an overall high level of dissatisfaction for the

traditional public schools. This dissatisfaction could clearly be due to many different factors, but it is not unreasonable to assume that most involve dissatisfaction with the level of educational quality perceived by parents. Herein lays the potential problem of endogeneity. If areas with failing schools (or at least a lower level of achievement relative to other areas) attract more and more charter schools, then certainly those traditional public schools would be on a declining achievement trend anyway. This scenario has the potential of exhibiting some feedback effects with respect to charter competition and academic achievement. However, considering these potential issues derived from charter school location, the statistical estimation approaches used should indeed deal explicitly with the inherent possibility of any endogeneity effects (see Holmes 2003 and Sass 2006).

Related to this discussion of charter school location is an excellent piece by Glomm, et al. (2005), where they examine the emergence of charter schools in Michigan and California. Since the dependent variable used (the number of charter schools within a district) is a non-negative integer value, they estimate their model using a Poisson regression. Their results suggest that charter schools tend to locate in areas where populations are racially and educationally diverse. Moreover, they report that the overall quality of surrounding traditional public schools appears to have a large effect on charter school location.

For completeness regarding these possibilities, I followed the approach of Glomm, et al. by constructing a Poisson regression to estimate the potential factors leading to charter school location in Utah, where the number of charter schools within a given distance acts as the independent variable. My results

initially show evidence that charter schools are more likely to emerge in areas where achievement is already high in Language Arts and Science, but low in Math. These results, however, diminish substantially once I directly control for any year effects (by explicitly including dichotomous year variables). Charter school location, although important to briefly address in my overall methodology, still remains outside the scope of my research. Further investigation into charter school location, similar to Glomm, et al. (2005), would continue to profit the education literature.

Finally, the possibility of endogeneity is not only of importance to the statistical approaches, but also to the theoretical structure regarding charter school location, where student self-selection may also be an issue. After locating near a traditional public school, it is entirely possible, and may even be highly probable in some areas, that the newly-emerged charter school attracts relatively higher (or lower) achieving students. These effects, if true, would have the potential to bias the coefficient estimates of my results. A full review and analysis of this nature of student self-selection is dealt with thoroughly in Chapter 6.

Conclusion

The data used in my research, although carrying the same accepted limitations of any empirical analysis, is derived from reliable and rich sources. The empirical models and statistical approaches are used commonly in the economics literature, the education literature, and all operate under reasonable assumptions. Perhaps more importantly, they are grounded and supported by

the underlying economic theories. Together with this newly-created dataset, these empirical estimations should prove interesting and meaningful results. Ultimately, they will uniquely contribute to the existing literature, and provide substance and evidence to any education policy discussions in Utah.

CHAPTER 6

RESULTS AND DISCUSSION

As outlined in the previous chapter, the unique dataset that I have constructed includes a large number of variables measuring competition and controlling for demographic and school-specific differences. In all, I have executed over 200 separate fixed-effect regression models, which have produced a wide variety of estimates and results. In this chapter, I discuss the empirical results, interpret some of the coefficient estimates, address the potential issues of endogeneity and student self-selection, and discuss some of the limitations associated with the statistical approaches. Broad conclusions and policy discussions will be reserved for Chapter 7.

Empirical Results

In Chapters 3 and 4, I have established that Utah's education structure inherently differs from other states in terms of district size, number of schools, and charter school growth. The demographics of Utah are an important factor in these discussions, as they are in any research in education, and will serve as context for my empirical results. In presenting my empirical results, I will cover four different model subsets. In doing so, I explore the various nuances of the

different subsets, as well as the overarching patterns and trends across the subsets exploited by the separate empirical models.

Empirical Results

Statewide

I begin first by running the empirical models over all predefined K-6 schools in Utah. The benefits of this statewide approach are twofold. First, it increases the sample size, thus improving the potential accuracy of the estimates, and suppressing any potential outlier influence. Second, and more importantly, by running the models for all schools across the state, both schools that have experienced charter competition and those that have not are included, thus creating a perfect control group for the estimations. This latter point is important for the theoretical structure of my research as well as the statistical soundness thereof.

As outlined in Chapter 5, each of the three test subjects contains two measures - the average test score for each school, and the percent of each school's enrollment that is deemed proficient in each subject. These measures have remained consistent across the specified time period. Also, recall that I use 11 measures of competition for each of these test score indicators. In all, this produces 11 model results presented on each of the six tables. Each table contains coefficient estimates for the 11 measures of competition, school-specific demographic controls (percent of enrollment that are Free/Reduced Lunch eligible and the percent of enrollment that are Hispanic), the constant, and the overall R squared for the model. Direct year dummy variables are included in

each model but not explicitly reported. Moreover, the district size and student-to-faculty ratio variable coefficients were consistently negligible and not statistically significant, and thus not reported (but included in each model for proper control). Lastly, a note on the school districts is necessary. During the specified time period in the data, 2005 – 2010, the Jordan school district split into two separate districts. The Utah State Office of Education did not yet have test scores for the newly created district (Canyons). As a result, I have excluded the 28 traditional public schools belonging in that district for the entire time period. For consistency, I also excluded the three charter schools that operate within the district's geographic boundaries.

Tables 6.1 through 6.6 present the fixed-effects model results ran on all predefined K-6 schools statewide. Starting with the percent proficient dependent variables, we see positive gains from charter competition for Language Arts scores (Table 6.1). The coefficients are all positive (except for the variable measuring the distance to the nearest charter school, which is negative, suggesting positive gains to increased competition) and most strongly shown with the strong charter competition dummy indicator that indicates when there exist at least three charter schools within 5 miles of the traditional public school. This particular measure of competition was argued by Booker, et al. (2008) and compares the traditional public schools that have experienced strong charter competition to those who have not. This measure essentially indicates charter penetration into each traditional public school's market. Ultimately, and according to the models, having at least three charter schools within 5 miles equates to a 1.5% increase in the portion of students who are proficient in

Language Arts, *ceteris paribus*. An increase of 1.5% is indeed no trivial gain, for it is more than one third of one standard deviation for Language Arts proficiency gains during the specified time period. For further context, consider that during the 2005-2010 time period, the average Language Arts proficiency gain was only 0.07 percentage points. Looking at the distance indicator variables, we see the strongest competitive effects occurring around 2 to 3 miles from the traditional public school. According to the model, every additional charter school within 2 miles of a traditional public school is equated with a gain of about 1% in the portion of students who are proficient in Language Arts. Again, a 1% increase equates to approximately one quarter of one standard deviation for Language Arts proficiency gains during the specified time period. Lastly, the nonlinear dichotomous measure of a competitive threshold shows positive gains in Language Arts. The school-specific demographic controls all have expected signs, and are statistically significant for almost all models. It is worth noting that the percent of a school's enrollment that is Hispanic was more consistent and statistically significant than the percent of a school's enrollment that is Free/Reduced Lunch eligible. Again, these demographic variables act as proper controls for the various models, and are indeed important for accurate estimates. Finally, the overall R squared figures for Language arts models range from 0.52 to 0.64.

Moving to Math results, found in Table 6.2, we see somewhat negative effects from charter competition on the portion proficient in Math. First, it is worth noting the differences in Math trends in relation to Language Arts. The average gains in the portion proficient in Math are not gains at all but rather are declines

statewide. Accordingly, the coefficient estimates will be treated somewhat differently. From the model results, we see an overall negative effect of charter school competition on the portion proficient in Math for traditional public schools. The negative effect is statistically significant for most, but not all, measures of competition. Again we see strongest results from the dichotomous variable indicating when three or more charters exist within 5 miles of the traditional public school. According to the model, having at least three charter schools within 5 miles of a traditional public school is associated with a decrease in the portion of enrolled students proficient in Math by 1.2%, *ceteris paribus*, which equates to less than one quarter of one standard deviation. This is significant at the 5% confidence level but not at the 1%. Interestingly, the estimates for the nonlinear dichotomous threshold variable carries a statistically significant positive coefficient, suggesting gains of about 1% to Math proficiency for traditional public schools who belong in districts where charter school enrollment exceeds 5% of public school district enrollment. This peculiarity may exist due to the fact that these models were executed across all schools statewide. By doing so, numerous districts were included in the models, some that passed this threshold and some that did not. It is entirely possible that a number of overall districts saw a benefit from charter competition on Math scores, while individual traditional public schools experienced negative effects from charter schools competing in close proximity to them. Lastly, we again note that the demographic controls all contained the expected signs, consistent with the Language Arts models, while the Math models had slightly lower R squared figures, ranging from 0.38 to 0.53.

Lastly, I address the model estimates of charter competition on Science proficiency, found in Table 6.3. The estimates from the fixed-effect models for Science paint a less clear picture, having negative coefficient signs but very little statistical significance. There were only two measures of competition that provided statistically significant results, the number of charter schools within 3 miles and the number within 5 miles of the traditional public school. Both were negative, suggesting somewhat negative effects of competition on Science proficiency when ran on schools across Utah. The model suggests, *ceteris paribus*, that each additional charter school within 3 miles of a traditional public school is associated with a decline in the portion proficient in Science by 1.4%, which is less than one quarter of one standard deviation. The lack of significance and consistency in the other measures of competition gives some hesitation in looking too deep into these particular results. Measuring the effect of competition on Science proficiency will continue to be more difficult in relation to other subjects. The demographic controls appeared to be consistent with the other models, and mostly statistically significant. The overall R squared measures for Science proficiency ranged from 0.43 to 0.54.

Next, I discuss the model results for average scores, in contrast to the portion of enrollment that is proficient in each subject. First, a note on the differences is necessary. It is intentional that the tables and discussion are presented with the proficiency measures first. This is somewhat due to the fact that a portion proficiency measure can arguably give a better understanding of a school's overall academic achievement rather than using an average score. The distinction between the portion of a school's enrollment that is deemed proficient

in a subject and a school's average score in that subject is small but important. An average score, as a mean, may easily be influenced by outliers. On the other hand, a measure of proficiency, I argue, will give a better sense of overall school success and school quality. These distinctions remain important in the education literature, and are indeed worth briefly addressing in my research. Although my statewide model results include both measures, I argue that the proficiency measure is perhaps more persuasive due to these facts.

The results using the average scores for each subject are found in Tables 6.4 through 6.6. First, it is clear that the average test score estimates are consistent with the proficiency estimates for each subject. This consistency across models should provide reliability in their estimates and indeed accuracy in all of the results. A second observation comes in the fact that the coefficient estimates for the average test scores remain somewhat smaller in size than what would perhaps be expected. According to these results, it becomes more difficult for competitive effects to influence the average score for a traditional public school than it is to influence the portion of enrollment that is proficient. In other words, the competitive effects from charter schools appear to have greater impact on the portion of students that are proficient than the average test score for each school.

In looking at the statewide model results, we see mixed evidence overall of charter competition. While the strongest results come in gains for Language Arts proficiency, there also exist some negative effects for Math proficiency. These results are entirely consistent with much of the literature, in that they find significant positive gains from competition for some subjects and negative and/or

negligible competitive effects for other subjects. Next, I will look at the results for model execution across smaller subsets of Utah's schools.

Empirical Results

Davis, Salt Lake, and Utah Counties Subset

More than many other states, Utah's population is relatively concentrated in a single area. Partly due to the geographic features of the bordering rocky mountains, much of Utah's population is concentrated among three counties (Davis, Salt Lake, and Utah), which make up most of the so-called "Wasatch Front." Not surprisingly, the majority number of schools is also concentrated in this area. In terms of K-6 public schools (as defined by the parameters set forth in my dataset) across Utah, we see a majority (58.2%) number of schools among those three counties. In terms of K-6 public school enrollment, 68.4% of students are enrolled among those three counties. Moreover, as of 2010, 74% of K-6 predefined charter schools operate in one of those three counties. Having a high concentration of schools and student enrollment among one specific area is certainly grounds for separate investigations.

Considering these realities, it is necessary and interesting to run my empirical models for separate subgroups. In this section, I constrain the models to Davis, Salt Lake, and Utah counties to explore the possibility for different results. For the sake of brevity, I only present proficiency measures for each of the separate subsets. As we saw in the statewide results, the average score estimates were entirely consistent with the proficiency measures. Moreover, I argue that the proficiency measures offer a better representation of student

success and school quality. As a note, I also limit the number of models ran for the subsets to 7 rather than 11 in order to reduce redundancy.

Again, we begin with the model estimates on Language Arts proficiency, found in Table 6.7. Again, we see evidence of positive competitive effects from charter competition on the portion of students in traditional public schools that are proficient in Language Arts. Consistent with the prior models, the strongest measure of competition appears to be the dichotomous measure indicating when at least three charter schools exist within 5 miles of a traditional public school. When indicated, this measure suggests a 1.2% increase in Language Arts proficiency, *ceteris paribus*. Consistent with the statewide models, this estimate is approximately three times the size of the average gain seen in Language Arts proficiency for the subset over the time period. The demographic controls all have the expected signs, consistent across prior models. The overall model fit seems to be slightly better, given this more homogenous group, and the R squared figures range from 0.70 to 0.71.

With regards to the Math proficiency models for this subset found in Table 6.8, we also see consistent estimates with the statewide results. The models suggest somewhat negative effects from charter competition on Math proficiency for the three selected counties. The strongest measure of competition remains the dichotomous measure indicating when at least three charter schools exist within 5 miles of the traditional public school, giving a -1.6% coefficient. Consistent with the statewide results, we also notice the positive estimate of the nonlinear competitive threshold dichotomous variable, suggesting perhaps district-level gains from competition, but individual school-level losses from more

direct competition. The demographic controls are also consistent and R squared figures range from 0.52 to 0.58.

Lastly, we turn to the Science proficiency results for this smaller subset found in Table 6.9. These estimates suggest somewhat negligible effects of charter competition on Science proficiency for this smaller subset. The only statistically significant measure is the count of charter schools within 3 miles of the traditional public school, which carries a negative estimate of about 1.2%. This is smaller than the statewide estimate for the same measure, but important nonetheless. The demographic controls remain entirely consistent and R squared figures range from 0.56 to 0.59.

Seeing consistent results from this particular subset is perhaps not entirely interesting, but the exercise is indeed important. The consistency, in fact, comes as no surprise given the high levels of population and school concentration, already outlined. The separate subset for Davis, Salt Lake, and Utah counties has provided a further check of completeness for all of the results.

Empirical Results

Salt Lake County Subset

Lastly, I explore an even smaller subset for the empirical models, namely that solely of Salt Lake County. There are principally two main characteristics that motivate this separate analysis for Salt Lake County. First, as previously mentioned, a large concentration of population and students exist in Salt Lake County. Secondly, being a more urban area, it contains a much more diverse population, in terms of race, income, age, etc. Previous studies, such as Ni

(2009), have found differences in empirical results for urban and rural areas. Moreover, the literature has shown that charter schools tend to attract students in large cities and urban areas, often due to lower school quality in those areas. For instance, Glomm, et al. (2005) have found that charter schools tend to locate in areas where populations are racially and educationally diverse. All of these reasons provide rationale for my fixed-effect models to be run on schools solely in Salt Lake County.

Rather than go through each subject, I will discuss some of the similarities and differences exhibited in Salt Lake County in relation to the other model sections. All of the Salt Lake County results are found in Tables 6.10 to 6.12. First, we again see positive competitive effects on Language Arts proficiency in Salt Lake County. These coefficient estimates for the dichotomous variable indicating when at least three charter schools exist within 5 miles are almost identical to the statewide estimates. Looking at the continuous count of charter schools within 3 miles, however, the Salt Lake County model produces much larger results (1.3 compared to 0.8), suggesting greater competitive gains from charters nearby for traditional public schools. With regards to Math proficiency, we see mainly negligible and entirely not statistically significant results. This would suggest that any negative effect from charter competition on Math proficiency is mostly outside of Salt Lake County. The same can be repeated for Science proficiency, where we see negligible/no effects of competition for Salt Lake County.

Constraining the models to Salt Lake County has produced somewhat interesting results in relation to the overall statewide estimates. Salt Lake County

is indeed diverse in many aspects, and this data suggests that charter competition has provided substantial gains in achievement for traditional public schools, at least in the subject of Language Arts, and somewhat negligible effects on achievement in Math and Science. This should ultimately provide key insights into future education policy. Specifically, it highlights the need for separate and distinct approaches for different counties and geographical areas in Utah.

Student Self-Selection, Skimming, and Endogeneity

The potential impacts of student self-selection and charter school location endogeneity must be addressed along with my empirical estimates. As mentioned in Chapter 5, there is a potential for endogeneity with respect to charter school location. Since the location of charter schools in Utah is a function of local demand for school options, it is likely that charters will locate in areas that exhibit low academic quality, high parental dissatisfaction, or both. Essentially, charter school location may indeed be a function, at least partially, of existing trends in academic achievement. This fact opens the opportunity for various feedback mechanisms to influence the empirical estimates. I will first mention the statistical avenues that deal with endogeneity and then discuss the potential student self-selection impacts for biased estimates.

The location of charter schools is not only an issue for state and local education policy, but certainly must be addressed in any statistical approaches. As outlined in Chapter 5, my estimation is done through a fixed-effect model that contains a three-way error component, $\varepsilon_{it} = \mu_i + \upsilon_{it} + \theta_i$. While υ_{it} and θ_i

control for any "usual" idiosyncratic error and time error, respectively, it is μ_i that is of interest for potential endogeneity. The error component μ_i accounts for any fixed underlying differences in school quality and also accounts for historical aspects that influence charter school location. Moreover, potential endogeneity is dealt with further by the fact that the fixed-effect linear regression allows for correlation between μ_i and $Distance_{it}$. This notion is noted and similar methodology used by Booker, et al. (2008), Bifulco and Ladd (2004), Sass (2006), and Ni (2009). Essentially, this particular approach allows the location of the charter school to be related to the unobserved differences among traditional public schools, which is an important component of the estimation due to the previously mentioned reasons that influence charter school location, namely the historic trends and achievement.

Next, I address the potential issues arising from student self-selection. As often addressed in the school choice literature, student self-selection might be a possible explanation driving at least some of the achievement results, at least for some districts. When a charter school opens up in a neighborhood, it may attract students who are already performing at a relatively higher level than their cohorts who remain in the traditional public schools. Theoretically, the parents who choose to explore educational opportunities for their children are already more likely to be heavily involved in their child's education. Consequentially, and theoretically, the children who enroll in charter schools are, all else equal, likely to be inherently different than the children who remain in traditional public schools. Therefore, this specific type of self-selection would cause the empirical

results to be biased downward (and leave the traditional public schools worse off from charter competition) since the students who remain in the traditional public schools will perform relatively less than those who move to a charter school. (This idea is known as “cream skimming” and is substantially addressed by Holmes, et al. (2003) and Hoxby (2003)). Alternatively, if, after a new charter school opens in an area, migrating students to the charter school are relatively lower performers, than the opposite would be true. We would expect the traditional public schools to be better off (perform better) after being exposed to charter competition. Since many (but not all) of my results suggest positive effects from charter competition, let us examine the possibility that the positive estimates are due to student self-selection where the migrating students are performing at a lower level. Although these inquiries remain somewhat outside the scope of my research, they are indeed worth addressing, if nothing less, as a theoretical explanation to the achievement results.

Since all of my data is school-level rather than individual-level, I cannot directly compare the achievement levels of migrating students and students who remain in the traditional public schools. With my data, however, I can compare the different levels of achievement of traditional public schools compared to charter schools in order to see if there are any differences in achievement. Looking at Table 6.13, we see some slight differences in achievement levels, where charter schools appear to have higher levels of achievement for each subject and each measure in all years, except for a few cases. When restricted to Davis, Salt Lake, and Utah counties (Table 6.14), the differences become larger. Finally, when restricted to only Salt Lake county (Table 6.15), the

differences in achievement are even more stark. Given these measures, it is apparent that some evidence exists that the students who migrate to charter schools are performing at higher levels, or at least are not performing below their traditional public school counterparts. This being based off of school-level data, it must be noted that the achievement differences might indeed be a function more of teaching at the different schools, rather than the preexisting ability levels of the students. That being said, these descriptive statistics certainly give us reason to believe that, if anything, charter schools are attracting higher achieving students. These facts suggest that my empirical estimates, again if anything, may be biased downward (since the students remaining in the traditional public schools are at least even or lower achievers to begin with). These facts will certainly add persuasiveness to my results, as they now represent a lower-bound estimate of the true effects of charter competition. It is worth noting that this same self-selection analysis was done by Holmes, et al. (2003), where they found similar results and inferences.

Limitations

Lastly, I will address some of the limitations to the overall models and results. Perhaps the most important limitation to the empirical results is the use of standardized tests. For my data, I have used the Criterion Referenced Tests (CRT) administered to all Utah public schools. The test parameters and standards have remained consistent throughout the time period specified in my data. In spite of the tests' consistency, their validation as an instrument of academic achievement may be limited. I was unable to obtain any validation

tests for the Criterion Referenced Tests used in Utah, and it indeed remains unclear whether any sort of validation tests have even been administered to these tests. A validation test on the CRT instrument could involve administering the test to a sample cohort and then longitudinally following that cohort and re-administering the test at a later time to validate consistency and accuracy. As imperfect as the CRT might be, its scores remain the most widely used and reported outcomes in Utah. Similar standardized test instruments are used in the overwhelming majority of the existing literature. A complimentary study on the impact of charter competition on a high school level could include different measures of academic achievement, namely those of drop-out rates, the portion of enrolled students who continue to a higher education institution, or even some labor market outcomes. Further study on high school level institutions would prove to be beneficial for education policy.

Timing is another limitation worth noting, that will be addressed more substantially in Chapter 7. Although the six year period used in my data is statistically sufficient for examining the competitive effects, Utah is still quite early in their charter growth phase. Allowing more years to pass will arguably add strength to the empirical estimates. However, the fact that some significant results already exist is encouraging to the overall Utah education discussion.

Conclusion

The statistical estimations have provided some interesting results, some of which are expected, and some come as a surprise. The interpretation of these results should clearly be done with some caution. Viewing these results through

a more abstract lens, we see a tale of two effects. The results suggest that competitive effects are being felt on two levels: a district level and an individual school level. While Language Arts achievement is increased from competition on both levels, Math achievement only appears to be increased on a district level. Science, on the other hand is less clear overall. These notions are clearly shown by the different coefficient estimates for each of the different measures of competition. As noted for Math achievement, the estimates for the district measure of competition show positive effects from strong charter competition on a district level, but some negative effects from charter competition on an individual school level. The plausible avenues of explanation for these phenomena will be addressed in the proceeding chapter.

Table 6.1

Fixed Effects Models (Language Arts Proficiency – Statewide)

Dependent variable: Percent of enrollment proficient in Language Arts											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Number of charter schools within 1 mile	0.317										
	(0.631)										
Number of charter schools within 2 miles		0.970*									
		(0.399)									
Number of charter schools within 3 miles			0.810**								
			(0.307)								
Number of charter schools within 4 miles				0.591*							
				(0.253)							
Number of charter schools within 5 miles					0.447*						
					(0.202)						
Number of charter schools within 10 miles						0.175					
						(0.096)					
Distance to Nearest Charter (miles)							-0.115				
							(0.087)				
Charter enrollment exceeds 5% of district enrollment								1.002**			
								(0.285)			
Percent of district enrollment belonging to charters									0.088		
									(0.049)		
3 charters within 5 miles of TPS										1.554**	
										(0.492)	
4 charters wihtin 5 miles of TPS											1.168*
											(0.571)
Percent of enrollment Free/Reduced Lunch eligible	-0.235	-0.023	-0.231	-0.023	-0.023	-0.024*	-0.038**	-0.021	-0.025*	-0.023	-0.023
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.010)	(0.012)	(0.012)	(0.012)	(0.012)
Percent of enrollment Hispanic	-0.240**	-0.246**	-0.250**	-0.252**	-0.255**	-0.254**	-0.263**	-0.242**	-0.244**	-0.256**	-0.244**
	(0.051)	(0.050)	(0.050)	(0.050)	(0.050)	(0.051)	(0.049)	(0.050)	(0.051)	(0.051)	(0.050)
Constant	81.1**	81.0**	80.9**	81.0**	81.0**	81.1**	82.8**	81.5**	81.1**	81.1**	81.1**
	(1.102)	(1.105)	(1.112)	(1.116)	(1.107)	(1.103)	(1.154)	(1.078)	(1.092)	(1.108)	(1.092)
R squared (overall)	0.516	0.517	0.516	0.521	0.520	0.515	0.639	0.537	0.526	0.515	0.519

Robust standard errors in parentheses.
* Significant at 5%, ** Significant at 1%.
Total observation N = 2,645 for all regressions.
Group N = 473 for all regressions.
Year dummies coefficients not reported.
District Size and Student to Faculty Ratio coefficients are negligible in size, not statistically significant, and not reported.

Table 6.2

Fixed Effects Models (Mathematics Proficiency – Statewide)

Dependent variable: Percent of enrollment proficient in Math											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Number of charter schools within 1 mile	-1.319										
	(0.678)										
Number of charter schools within 2 miles		-0.651									
		(0.475)									
Number of charter schools within 3 miles			-0.611								
			(0.328)								
Number of charter schools within 4 miles				-0.679**							
				(0.259)							
Number of charter schools within 5 miles					-0.671**						
					(0.222)						
Number of charter schools within 10 miles						-0.330**					
						(0.111)					
Distance to Nearest Charter (miles)							0.279**				
							(0.090)				
Charter enrollment exceeds 5% of district enrollment								0.926**			
								(0.358)			
Percent of district enrollment belonging to charters									0.130*		
									(0.057)		
3 charters within 5 miles of TPS										-1.176*	
										(0.569)	
4 charters wihtin 5 miles of TPS											-1.032
											(0.726)
Percent of enrollment Free/Reduced Lunch eligible	-0.006	-0.006	-0.006	-0.006	-0.006	-0.005	-0.022	-0.003	-0.007	-0.005	-0.006
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.012)	(0.016)	(0.015)	(0.015)	(0.015)
Percent of enrollment Hispanic	-0.349**	-0.348**	-0.345**	-0.338**	-0.330**	-0.325**	-0.318**	-0.355**	-0.359**	-0.340**	-0.348**
	(0.062)	(0.062)	(0.061)	(0.061)	(0.062)	(0.062)	(0.057)	(0.062)	(0.062)	(0.062)	(0.062)
Constant	81.1**	81.1**	81.1**	81.1**	81.1**	81.0**	80.2**	81.4**	81.1**	81.0**	81.0**
	(1.411)	(1.410)	(1.408)	(1.402)	(1.399)	(1.391)	(1.550)	(1.389)	(1.391)	(1.394)	(1.405)
R squared (overall)	0.405	0.404	0.399	0.389	0.380	0.385	0.527	0.422	0.427	0.401	0.406

Robust standard errors in parentheses.
* Significant at 5%, ** Significant at 1%.
Total observation N = 2,645 for all regressions.
Group N = 473 for all regressions.
Year dummies coefficients not reported.
District Size and Student to Faculty Ratio coefficients are negligible in size, not statistically significant, and not reported.

Table 6.3

Fixed Effects Models (Science Proficiency – Statewide)

Dependent variable: Percent of enrollment proficient in Science											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Number of charter schools within 1 mile	-1.605										
	(0.894)										
Number of charter schools within 2 miles		-1.348									
		(0.695)									
Number of charter schools within 3 miles			-1.409**								
			(0.503)								
Number of charter schools within 4 miles				-0.754							
				(0.502)							
Number of charter schools within 5 miles					-0.496						
					(0.438)						
Number of charter schools within 10 miles						-0.371*					
						(0.176)					
Distance to Nearest Charter (miles)							0.037				
							(0.178)				
Charter enrollment exceeds 5% of district enrollment								-0.158			
								(0.474)			
Percent of district enrollment belonging to charters									-0.079		
									(0.080)		
3 charters within 5 miles of TPS										-0.531	
										(0.999)	
4 charters wihtin 5 miles of TPS											-0.517
											(1.120)
Percent of enrollment Free/Reduced Lunch eligible	-0.026	-0.026	-0.026	-0.025	-0.025	-0.025	-0.025	-0.025	-0.024	-0.025	-0.025
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Percent of enrollment Hispanic	-0.330**	-0.326**	-0.317**	-0.319**	-0.317**	-0.304**	-0.240**	-0.334**	-0.330**	-0.328**	-0.332**
	(0.077)	(0.077)	(0.077)	(0.078)	(0.080)	(0.079)	(0.084)	(0.077)	(0.077)	(0.080)	(0.077)
Constant	68.4**	68.5**	68.6**	68.5**	68.4**	68.4**	66.3**	68.3**	68.3**	68.3**	68.3**
	(1.617)	(1.601)	(1.589)	(1.593)	(1.596)	(1.587)	(2.232)	(1.606)	(1.598)	(1.610)	(1.613)
R squared (overall)	0.460	0.447	0.430	0.445	0.450	0.438	0.539	0.466	0.457	0.465	0.466

Robust standard errors in parentheses.
* Significant at 5%, ** Significant at 1%.
Total observation N = 2,583 for all regressions.
Group N = 463 for all regressions.
Year dummies coefficients not reported.
District Size and Student to Faculty Ratio coefficients are negligible in size, not statistically significant, and not reported.

Table 6.4

Fixed Effects Models (Language Arts Average – Statewide)

	Dependent variable: Language Arts CRT Average Score										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Number of charter schools within 1 mile	0.111										
	(0.227)										
Number of charter schools within 2 miles		0.362**									
		(0.129)									
Number of charter schools within 3 miles			0.322**								
			(0.095)								
Number of charter schools within 4 miles				0.272**							
				(0.076)							
Number of charter schools within 5 miles					0.222**						
					(0.061)						
Number of charter schools within 10 miles						0.094**					
						(0.029)					
Distance to Nearest Charter (miles)							-0.042				
							(0.029)				
Charter enrollment exceeds 5% of district enrollment								0.371**			
								(0.086)			
Percent of district enrollment belonging to charters									0.022		
									(0.015)		
3 charters within 5 miles of TPS										0.670**	
										(0.157)	
4 charters wihtin 5 miles of TPS											0.520**
											(0.177)
Percent of enrollment Free/Reduced Lunch eligible	-0.008**	-0.008*	-0.008*	-0.008*	-0.008*	-0.008**	-0.013**	-0.007*	-0.008**	-0.008*	-0.008*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Percent of enrollment Hispanic	-0.063**	-0.065**	-0.067**	-0.069**	-0.070**	-0.071**	-0.067**	-0.064**	-0.064**	-0.070**	-0.065**
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.014)	(0.017)	(0.017)	(0.017)	(0.017)
Constant	167.8**	167.8**	167.8**	167.8**	167.8**	167.8**	168.4**	168.0**	167.8**	167.8**	167.8**
	(0.324)	(0.323)	(0.326)	(0.327)	(0.324)	(0.325)	(0.349)	(0.318)	(0.321)	(0.327)	(0.321)
R squared (overall)	0.451	0.446	0.440	0.441	0.441	0.435	0.558	0.493	0.462	0.437	0.451

Robust standard errors in parentheses.
* Significant at 5%, ** Significant at 1%.
Total observation N = 2,583 for all regressions.
Group N = 463 for all regressions.
Year dummies coefficients not reported.
District Size and Student to Faculty Ratio coefficients are negligible in size, not statistically significant, and not reported.

Table 6.5

Fixed Effects Models (Mathematics Average – Statewide)

	Dependent variable: Math CRT Average Score										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Number of charter schools within 1 mile	-0.412										
	(0.240)										
Number of charter schools within 2 miles		-0.115									
		(0.156)									
Number of charter schools within 3 miles			-0.129								
			(0.104)								
Number of charter schools within 4 miles				-0.137							
				(0.081)							
Number of charter schools within 5 miles					-0.154*						
					(0.070)						
Number of charter schools within 10 miles						-0.056					
						(0.036)					
Distance to Nearest Charter (miles)							0.126**				
							(0.029)				
Charter enrollment exceeds 5% of district enrollment								0.460**			
								(0.115)			
Percent of district enrollment belonging to charters									0.053**		
									(0.020)		
3 charters within 5 miles of TPS										-0.154	
										(0.188)	
4 charters wihtin 5 miles of TPS											-0.049
											(0.236)
Percent of enrollment Free/Reduced Lunch eligible	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.011**	-0.004	-0.005	-0.005	-0.005
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Percent of enrollment Hispanic	-0.078**	-0.078**	-0.077**	-0.076**	-0.073**	-0.074**	-0.088**	-0.080**	-0.081**	-0.077**	-0.078**
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)
Constant	168.8**	168.8**	168.8**	168.8**	168.8**	168.8**	168.8**	169.0**	168.8**	168.8**	168.8**
	(0.423)	(0.424)	(0.424)	(0.423)	(0.421)	(0.419)	(0.488)	(0.416)	(0.414)	(0.420)	(0.421)
R squared (overall)	0.361	0.367	0.363	0.358	0.350	0.361	0.454	0.400	0.392	0.368	0.371

Robust standard errors in parentheses.
* Significant at 5%, ** Significant at 1%.
Total observation N = 2,583 for all regressions.
Group N = 463 for all regressions.
Year dummies coefficients not reported.
District Size and Student to Faculty Ratio coefficients are negligible in size, not statistically significant, and not reported.

Table 6.6

Fixed Effects Models (Science Average – Statewide)

	Dependent variable: Science CRT Average Score										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Number of charter schools within 1 mile	-0.324										
	(0.256)										
Number of charter schools within 2 miles		-0.118									
		(0.208)									
Number of charter schools within 3 miles			-0.174								
			(0.139)								
Number of charter schools within 4 miles				-0.010							
				(0.159)							
Number of charter schools within 5 miles					0.024						
					(0.154)						
Number of charter schools within 10 miles						-0.049					
						(0.052)					
Distance to Nearest Charter (miles)							-0.034				
							(0.065)				
Charter enrollment exceeds 5% of district enrollment								0.039			
								(0.122)			
Percent of district enrollment belonging to charters									-0.020		
									(0.021)		
3 charters within 5 miles of TPS										0.120	
										(0.311)	
4 charters wihtin 5 miles of TPS											0.233
											(0.384)
Percent of enrollment Free/Reduced Lunch eligible	-0.008*	-0.008	-0.008	-0.008	-0.008	-0.008	-0.010*	-0.008	-0.008	-0.008	-0.008
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.052)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Percent of enrollment Hispanic	-0.059**	-0.059**	-0.058**	-0.060**	-0.061**	-0.056**	-0.056*	-0.060**	-0.059**	-0.061**	-0.061**
	(0.019)	(0.019)	(0.019)	(0.020)	(0.021)	(0.020)	(0.022)	(0.019)	(0.019)	(0.020)	(0.061)
Constant	163.1**	163.1**	163.1**	163.1**	163.1**	163.1**	163.2**	163.1**	163.1**	163.1**	163.1**
	(0.413)	(0.407)	(0.407)	(0.409)	(0.408)	(0.407)	(0.638)	(0.406)	(0.407)	(0.412)	(0.410)
R squared (overall)	0.398	0.390	0.393	0.402	0.403	0.397	0.433	0.407	0.389	0.402	0.403

Robust standard errors in parentheses.
* Significant at 5%, ** Significant at 1%.
Total observation N = 2,583 for all regressions.
Group N = 463 for all regressions.
Year dummies coefficients not reported.
District Size and Student to Faculty Ratio coefficients are negligible in size, not statistically significant, and not reported.

Table 6.7

Fixed Effects Models (Language Arts Proficiency – Davis, Salt Lake, and Utah Counties)

Dependent variable: Percent of enrollment proficient in Language Arts							
	1	**2**	**3**	**4**	**5**	**6**	**7**
Number of charter schools within 3 miles	0.849**						
	(0.309)						
Number of charter schools within 5 miles		0.436*					
		(0.214)					
Number of charter schools within 10 miles			0.172				
			(0.096)				
Distance to Nearest Charter (miles)				-0.107			
				(0.093)			
Charter enrollment exceeds 5% of district enrollment					0.501		
					(0.285)		
Percent of district enrollment belonging to charters						-0.020	
						(0.050)	
3 charters within 5 miles of TPS							1.233**
							(0.474)
Percent of enrollment Free/Reduced Lunch eligible	-0.031**	-0.031**	-0.032**	-0.032**	-0.032**	-0.033**	-0.032**
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Percent of enrollment Hispanic	-0.292**	-0.298**	-0.300**	-0.284**	-0.286**	-0.289**	-0.300**
	(0.057)	(0.056)	(0.057)	(0.057)	(0.057)	(0.057)	(0.058)
Constant	82.6**	82.7**	82.9**	83.8**	83.7**	83.7**	83.1**
	(1.397)	(1.423)	(1.389)	(1.392)	(1.368)	(1.385)	(1.364)
R squared (overall)	0.695	0.705	0.697	0.701	0.705	0.702	0.706

Robust standard errors in parentheses.

* Significant at 5%, ** Significant at 1%.

Total observation N = 728 for all regressions.

Group N = 126 for all regressions.

Year dummies coefficients not reported.

District Size and Student to Faculty Ratio coefficients are negligible in size and not statistically significant, and not reported.

Table 6.8

Fixed Effects Models (Mathematics Proficiency – Davis, Salt Lake, and Utah Counties)

Dependent variable: Percent of enrollment proficient in Math							
	1	**2**	**3**	**4**	**5**	**6**	**7**
Number of charter schools within 3 miles	-0.787*						
	(0.351)						
Number of charter schools within 5 miles		-0.937**					
		(0.249)					
Number of charter schools within 10 miles			-0.497**				
			(0.129)				
Distance to Nearest Charter (miles)				0.300**			
				(0.097)			
Charter enrollment exceeds 5% of district enrollment					0.369		
					(0.386)		
Percent of district enrollment belonging to charters						0.118	
						(0.066)	
3 charters within 5 miles of TPS							-1.632**
							(0.602)
Percent of enrollment Free/Reduced Lunch eligible	-0.005	-0.007	-0.006	-0.006	-0.002	-0.004	-0.004
	(0.013)	(0.0128)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Percent of enrollment Hispanic	-0.291**	-0.275**	-0.262**	-0.301**	-0.292**	-0.295**	-0.279**
	(0.069)	(0.068)	(0.068)	(0.068)	(0.070)	(0.069)	(0.067)
Constant	81.9**	82.9**	83.0**	80.5**	81.1**	80.5**	81.7**
	(1.956)	(1.918)	(1.940)	(1.944)	(1.954)	(1.967)	(1.908)
R squared (overall)	0.550	0.517	0.533	0.571	0.574	0.575	0.545

Robust standard errors in parentheses.

* Significant at 5%, ** Significant at 1%.

Total observation N = 728 for all regressions.

Group N = 126 for all regressions.

Year dummies coefficients not reported.

District Size and Student to Faculty Ratio coefficients are negligible in size and not statistically significant, and not reported.

Table 6.9

Fixed Effects Models (Science Proficiency – Davis, Salt Lake, and Utah Counties)

Dependent variable: Percent of enrollment proficient in Science							
	1	**2**	**3**	**4**	**5**	**6**	**7**
Number of charter schools within 3 miles	-1.180*						
	(0.543)						
Number of charter schools within 5 miles		-0.182					
		(0.509)					
Number of charter schools within 10 miles			-0.228				
			(0.203)				
Distance to Nearest Charter (miles)				0.019			
				(0.190)			
Charter enrollment exceeds 5% of district enrollment					-0.556		
					(0.490)		
Percent of district enrollment belonging to charters						-0.123	
						(0.111)	
3 charters within 5 miles of TPS							-0.352
							(1.036)
Percent of enrollment Free/Reduced Lunch eligible	-0.015	-0.012	-0.013	-0.012	-0.014	-0.011	-0.012
	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Percent of enrollment Hispanic	-0.244*	-0.245*	-0.234*	-0.249*	-0.252*	-0.247*	-0.246*
	(0.102)	(0.107)	(0.106)	(0.102)	(0.103)	(0.103)	(0.107)
Constant	67.4**	66.4**	67.0**	66.0**	66.0**	66.6**	66.2**
	(2.410)	(2.470)	(2.481)	(2.760)	(2.613)	(2.733)	(2.457)
R squared (overall)	0.562	0.585	0.584	0.586	0.576	0.580	0.585

Robust standard errors in parentheses.

* Significant at 5%, ** Significant at 1%.

Total observation N = 727 for all regressions.

Group N = 125 for all regressions.

Year dummies coefficients not reported.

District Size and Student to Faculty Ratio coefficients are negligible in size and not statistically significant, and not reported.

Table 6.10

Fixed Effects Models (Language Arts Proficiency – Salt Lake County)

Dependent variable: Percent of enrollment proficient in Language Arts							
	1	**2**	**3**	**4**	**5**	**6**	**7**
Number of charter schools within 3 miles	1.259**						
	(0.418)						
Number of charter schools within 5 miles		0.838*					
		(0.337)					
Number of charter schools within 10 miles			0.571**				
			(0.211)				
Distance to Nearest Charter (miles)				-0.180			
				(0.104)			
Charter enrollment exceeds 5% of district enrollment					1.280**		
					(0.460)		
Percent of district enrollment belonging to charters						0.215	
						(0.118)	
3 charters within 5 miles of TPS							1.532**
							(0.557)
Percent of enrollment Free/Reduced Lunch eligible	-0.034**	-0.033**	-0.036**	-0.034**	-0.031**	-0.038**	-0.035**
	(0.012)	(0.013)	(0.012)	(0.012)	(0.013)	(0.013)	(0.012)
Percent of enrollment Hispanic	-0.313**	-0.320**	-0.328**	-0.310**	-0.323**	-0.341**	-0.331**
	(0.069)	(0.066)	(0.068)	(0.070)	(0.067)	(0.069)	(0.070)
Constant	79.8**	79.9**	79.8**	81.3**	81.6**	80.2**	80.8**
	(2.200)	(2.118)	(2.113)	(2.074)	(2.160)	(2.071)	(2.133)
R squared (overall)	0.710	0.727	0.698	0.725	0.738	0.709	0.730

Robust standard errors in parentheses.

* Significant at 5%, ** Significant at 1%.

Total observation N = 728 for all regressions.

Group N = 126 for all regressions.

Year dummies coefficients not reported.

District Size and Student to Faculty Ratio coefficients are negligible in size and not statistically significant, and not reported.

Table 6.11

Fixed Effects Models (Mathematics Proficiency – Salt Lake County)

Dependent variable: Percent of enrollment proficient in Math							
	1	**2**	**3**	**4**	**5**	**6**	**7**
Number of charter schools within 3 miles	-0.518						
	(0.439)						
Number of charter schools within 5 miles		-0.609					
		(0.369)					
Number of charter schools within 10 miles			-0.097				
			(0.309)				
Distance to Nearest Charter (miles)				0.114			
				(0.102)			
Charter enrollment exceeds 5% of district enrollment					1.231		
					(0.729)		
Percent of district enrollment belonging to charters						-0.039	
						(0.206)	
3 charters within 5 miles of TPS							-0.344
							(0.763)
Percent of enrollment Free/Reduced Lunch eligible	-0.008	-0.010	-0.008	-0.009	-0.005	-0.007	-0.008
	(0.015)	(0.015)	(0.015)	(0.015)	(0.016)	(0.016)	(0.015)
Percent of enrollment Hispanic	-0.323**	-0.321**	-0.317**	-0.327**	-0.316**	-0.315**	-0.316**
	(0.081)	(0.081)	(0.083)	(0.083)	(0.083)	(0.086)	(0.082)
Constant	84.4**	84.6**	84.1**	83.6**	84.8**	84.1**	84.0**
	(2.830)	(2.807)	(2.844)	(2.862)	(2.953)	(2.900)	(2.829)
R squared (overall)	0.595	0.584	0.593	0.594	0.575	0.584	0.589

Robust standard errors in parentheses.

* Significant at 5%, ** Significant at 1%.

Total observation N = 728 for all regressions.

Group N = 126 for all regressions.

Year dummies coefficients not reported.

District Size and Student to Faculty Ratio coefficients are negligible in size and not statistically significant, and not reported.

Table 6.12

Fixed Effects Models (Science Proficiency – Salt Lake County)

Dependent variable: Percent of enrollment proficient in Science							
	1	**2**	**3**	**4**	**5**	**6**	**7**
Number of charter schools within 3 miles	-0.969						
	(0.726)						
Number of charter schools within 5 miles		0.494					
		(0.743)					
Number of charter schools within 10 miles			0.029				
			(0.458)				
Distance to Nearest Charter (miles)				-0.205			
				(0.216)			
Charter enrollment exceeds 5% of district enrollment					0.038		
					(0.959)		
Percent of district enrollment belonging to charters						-0.449	
						(0.247)	
3 charters within 5 miles of TPS							0.456
							(1.256)
Percent of enrollment Free/Reduced Lunch eligible	-0.022	-0.020	-0.021	-0.020	-0.022	-0.016	-0.022
	(0.020)	(0.019)	(0.019)	(0.019)	(0.019)	(0.020)	(0.019)
Percent of enrollment Hispanic	-0.271*	-0.259	-0.262	-0.245	-0.262	-0.229	-0.263
	(0.137)	(0.139)	(0.141)	(0.136)	(0.141)	(0.144)	(0.144)
Constant	64.9**	63.7**	64.1**	64.8**	64.2**	65.4**	64.2**
	(3.933)	(3.985)	(4.185)	(4.308)	(4.140)	(4.052)	(4.076)
R squared (overall)	0.685	0.677	0.684	0.666	0.685	0.649	0.684

Robust standard errors in parentheses.

* Significant at 5%, ** Significant at 1%.

Total observation N = 727 for all regressions.

Group N = 125 for all regressions.

Year dummies coefficients not reported.

District Size and Student to Faculty Ratio coefficients are negligible in size and not statistically significant, and not reported.

Table 6.13

TPS and Charter Achievement Comparisons

	Language Arts				Mathematics				Science			
	Average Score		*% Proficient*		*Average Score*		*% Proficient*		*Average Score*		*% Proficient*	
	TPS	Charter	TPS	Charter	TPS	Charter	TPS	Charter	TPS	Charter	TPS	Charter
2005	166.72	167.40	76.53	78.27	167.38	167.45	74.52	75.92	162.01	161.44	62.10	60.52
2006	167.46	167.89	78.61	80.38	167.30	167.09	76.23	76.69	163.15	162.48	65.72	63.09
2007	166.64	167.92	77.37	81.65	166.26	167.22	73.50	78.09	163.02	162.80	65.56	66.56
2008	166.33	167.47	76.87	80.05	166.58	167.39	74.13	76.23	162.96	162.82	65.67	65.91
2009	166.59	167.89	77.98	81.92	164.87	165.11	71.82	72.17	163.13	163.42	65.70	67.44
2010	166.48	167.98	77.09	81.03	166.00	165.65	73.85	72.70	163.63	164.43	67.88	70.68

All figures reflect only K-6 schools that are "regular" under federal classification

Table 6.14

TPS and Charter Achievement Comparisons (Davis, Salt Lake, and Utah Counties)

	Language Arts				Mathematics				Science			
	Average Score		*% Proficient*		*Average Score*		*% Proficient*		*Average Score*		*% Proficient*	
	TPS	Charter	TPS	Charter	TPS	Charter	TPS	Charter	TPS	Charter	TPS	Charter
2005	166.29	169.54	75.17	84.54	166.90	169.64	73.25	84.17	161.92	162.66	61.80	66.16
2006	166.98	168.94	76.91	84.52	166.79	168.29	74.73	80.75	162.69	163.29	64.19	65.98
2007	166.31	168.30	75.88	82.92	165.76	167.59	71.81	79.24	162.61	162.85	64.01	66.58
2008	166.13	167.60	75.98	81.04	166.30	167.44	72.75	76.64	162.74	162.95	64.52	66.32
2009	166.55	168.10	77.49	82.73	164.81	165.34	71.16	73.31	163.05	163.79	65.25	69.00
2010	166.50	168.36	76.74	82.33	166.05	166.00	73.58	74.02	163.58	164.70	67.46	72.10

All figures reflect only K-6 schools that are "regular" under federal classification

Table 6.15

TPS and Charter Achievement Comparisons (Salt Lake County)

	Language Arts				**Mathematics**				**Science**			
	Average Score		*% Proficient*		*Average Score*		*% Proficient*		*Average Score*		*% Proficient*	
	TPS	Charter	TPS	Charter	TPS	Charter	TPS	Charter	TPS	Charter	TPS	Charter
2005	164.56	170.14	69.50	86.59	165.61	170.33	69.27	85.42	160.08	162.78	55.20	68.63
2006	165.50	170.16	71.68	87.96	165.34	169.08	70.13	83.36	160.93	164.32	57.49	72.44
2007	164.88	168.72	70.94	84.72	164.23	167.54	66.77	79.65	160.92	162.98	57.57	66.12
2008	164.67	167.08	70.54	79.90	164.55	166.05	67.33	73.06	160.90	162.78	57.51	65.73
2009	165.17	167.40	72.48	80.98	163.19	163.75	65.47	67.90	161.13	163.25	57.50	66.98
2010	165.24	167.76	72.15	80.35	164.63	164.76	68.87	70.64	161.65	164.15	60.14	69.96

All figures reflect only K-6 schools that are "regular" under federal classification

CHAPTER 7

SUMMARY AND CONCLUSION

Clearly, charter schools remain a popular option in Utah for parents seeking alternatives to traditional public school. My data has covered the years 2005 to 2010, since which, many additional charter schools have been opened and/or approved. In nearly all cases, charter school demand exceeds capacity, indicating a sustained and increased call for more charter schools. In light of this growth, my research will help address the previously unknown competitive effects of charter schools on the achievement of traditional public schools. Ultimately, my research can help guide the ongoing policy discussions surrounding the growth of charter schools in Utah. In this last chapter, I summarize the empirical findings, compare them with the existing literature, comment on future research, and discuss the potential impacts on education policy.

Summary of the Findings

The results of my empirical investigation suggest somewhat mixed effects from charter school competition on students remaining in traditional public schools in Utah. The strongest evidence of competitive effects is seen in their

impact on traditional public school achievement in Language Arts, where we see tremendous gains from competition. On a statewide level, the models suggest a 1.5% increase in the portion of students who are proficient in Language Arts when the traditional public school is faced with charter competition. This gain is indeed substantial, considering that it represents the marginal effect of charter competition in the short-run (the competition measurement specific to that year only and not lagged). The impact on Language Arts proficiency is shown to be even stronger for schools in Salt Lake County. The competitive effects on Math scores, however, are less clear but mostly negative on an individual school level, but mostly positive on a district level. During the 2005-2010 time period, overall Math achievement trends were declining for traditional public schools in Utah. According to my empirical models, charter competition had a negative effect on Math proficiency statewide, but a nonsignificant effect on schools in Salt Lake County. Considering the overall decline in Math scores during this time, we may be observing some differences in demand for charter schools by subject. Although my data are constrained only to “regular” K-6 schools, there are charter schools that have emerged to provide better and more specialized instruction for Math. These newly-emerged charter schools then, might indeed be locating in areas with historically poor achievement in Math. However, it must be noted that schools specializing in a particular academic area mostly exist on a high-school level, and would therefore be somewhat outside this particular research. Further investigations into charter school location could prove insightful for these particular phenomena. Lastly, charter competition appears to have negligible and nonsignificant effects on Science scores statewide, and for schools in Salt Lake

County. Some of the same dynamics affecting Math scores might also be present for Science achievement, where it is relatively more difficult to explain the variance in achievement levels.

Finally, another insight from my research surfaces in the context of student populations. While the main objective of my research has been to study the marginal effects of increased charter competition, it's hard not to notice the tremendous impact of student demographics on student achievement. Much of the variance in student achievement for all three subjects can be explained by the percent of enrollment that is free/reduced lunch eligible, and the percent of enrollment that is Hispanic. While my models primarily treat these demographics as control variables, it is important to note their substantial impact on achievement. Moreover, in terms of race, Utah's minority population of young students continues to grow, especially with Hispanic students. This growth will continue to present many challenges and opportunities for the public school system to adapt and further the goals of increased student achievement across all populations. Indeed, a worthy objective and outcome of increased charter competition may well be represented by tremendous increases in minority and poor populations.

Overall, my results are somewhat consistent with the existing literature. My measures of competition are many in number and have been used throughout the literature. My statistical approaches are similar to the many pieces in the literature, but most closely follow the framework outlined by Ni (2009). The evidence suggesting positive competitive effects on Language Arts achievement is entirely consistent with Hoxby (2003), Holmes, et al. (2003), and

Sass (2006), but conflicts with Ni (2009). These discrepancies will inevitably be due, partially, to the different locations used for the various analyses, as different states inherently have different education populations and policies. When examining the competitive effects on Math and Science achievement, my results are somewhat consistent with Buddin and Zimmer (2005). Said literature examined the effects of increased charter use in California's education market, ultimately finding no impact of increased charter competition.

One unique finding in my results is worth noting in this section, namely, a difference found in one of the many measures of competition. With regards to the Math results (Tables 6.2, 6.5, 6.8, and 6.11) that show some negative effects of charter competition, we notice that the measure indicating when charter enrollment exceeds 5% of district enrollment carries a positive estimate for all subsets. This occurs even when the other measures of competition show negative effects of competition. This unique aspect may provide evidence indicating that increased charter competition may have some negative effects on some individual schools facing close competition in proximity, but overall gains for the entire districts that face higher general levels of competition, at least for Math achievement. The different levels of public school administration may help explain these differences, where perhaps the ability to react to competition for some individual school principals is inherently different than that of the higher-level district administrators. These results are consistent with Hoxby's (2003) argument for including a nonlinear threshold measure of charter competition. It appears that, for Utah, once charter school competition passes a threshold, gains

in Math achievement are seen at the district level, but not necessarily at the school level for some select schools.

Another plausible avenue of explanation for the different competitive effects by academic subject may be that some traditional public schools are not responding to competition in instructional areas of Math as they are in other subject areas. This disproportionate effect on Language Arts may be due to a different degree of difficulty in teaching Math and Science areas in K-6 education, or even attracting and retaining qualified teachers for those subjects. The models suggest that, generally, traditional public schools are more able to respond and quicker to respond to competitive pressures by raising achievement in Language Arts than they are in Math or Science. It is not difficult to imagine that a change in curriculum and instruction in areas of Math and Science might involve more time and resources than it would for the area of Language Arts. Indeed, the results suggest just that.

Another key finding that is somewhat outside the main scope of my research is the lack of significance found for class size measures. As a control, I have included the student-to-faculty ratio for all my models. However, in almost every model, such measure was not found to be statistically significant. This perhaps comes as a surprise to the assumption and notion that reducing class sizes will have a positive impact on student achievement. It is possible that class size reductions will in fact have an impact on many educational outcomes, but according to my empirical data, it has no effect on student achievement.

Lastly, after exploring the results of my empirical analysis, we see that charter competition is indeed having an effect on achievement (both positive and

negative), but the magnitude of such effects is somewhat small in most, but not all, cases. Timing of the data might be a plausible reason behind why we are seeing this. As noted, the period of 2005-2010 saw much charter growth for Utah, but that specific time frame only allows for a limited number of years for observing achievement levels following penetration of charter school competition. Certainly, some adjustments in response to competitive pressures can be made rather quickly, while others will inevitably carry a longer time frame. This limitation is not a unique one in empirical research, but is worth addressing for overall context. Allowing as few as 5 additional years to pass could prove worthwhile to this discussion, as is usually the case with empirical data. Nonetheless, these results represent a first step in assessing the various impacts of charter school growth in Utah on the students who remain in traditional public school.

Future Research

The beginning premise of my research has been to empirically examine the competitive effects of charter school competition on traditional public school achievement. By focusing on a particular subset of Utah education (K-6 regular schools), I have created a homogenous group for statistical estimation. At the same time, however, this process opens up the opportunity for research in other related areas.

First, further research that examines charter competition on a high-school level is certainly warranted. Many of the charter schools that have emerged in Utah over the past decade have been on a high-school level, and many of them

specialize in particular subject areas (Math, Science, etc.). Certainly, their impact on traditional public high school achievement would be an interesting addition to this research. Moreover, investigating high-school level institutions provides additional measures of achievement. On a K-6 level, I have used standardized test proficiency metrics and scores for outcome measures. In addition to these same test metrics, a high-school level analysis could provide additional measures such as drop-out rates, college-going rates, and even some labor market outcomes. These additional measures of achievement would perhaps give a more complete view of the impacts of charter school competition, while at the same time offering further insight into education markets and behavior.

Next, increased competition in the education market not only provides incentives for student achievement, but also may change the overall labor market for teachers. Given the notion that increased charter competition provides pressure to increase school quality to attract and retain students, it's plausible to think that increased competition also provides incentives for schools and districts to attract and retain teachers. Although it has remained outside the narrow scope of my research, this topic has been discussed by Hoxby (2002), where she found evidence suggesting that increased school competition makes schools place more value on teachers' effort and the overall quality of teachers. Further evidence on Utah's labor market in education would certainly prove beneficial, where funding constraints are heavily felt.

Lastly, with school-level achievement data, the opportunity may exist to apply different weights to charter competition according to the level of existing

achievement for each charter school. By doing so, the price of attending a competing charter school can be adjusted for quality. It would be expected that there exist stronger competitive effects from charter schools with high achievement levels. Conversely, charter schools with relatively lower achievement levels might not necessarily induce the same competitive pressures. Accepted economic theory would lend related quality-adjusted principles in this arena and would prove beneficial to the overall impacts of increased school competition.

Policy Impacts

An attractive characteristic of empirical research is the real possibility of the results influencing policy discussions. This is especially the case in education research where policy consequences remain particularly high. The results of my research represent statistical estimates of empirical data that are ultimately built on a foundation of economic theory. I have shown that economic theory argues that increased competition in the education market provides incentives for traditional public schools to make meaningful changes that will raise the academic achievement of their students and ultimately attract and retain more students. The statistical models constructed provide results that are mostly, but not entirely, consistent with these economic theories.

To provide evidence and substance to Utah's education policies, the unique aspects of the state have been addressed in Chapter 3. Clearly, given the increase in charter school demand and popularity, Utah's population continues to seek alternatives and choices within the public school system.

Given the slightly different roles that charter and traditional public schools play in the state of Utah, it would clearly be desired that this increased competition brings about a greater degree of cooperation. An ongoing issue in Utah happens to be the constraints and limits of funding provided to public education, given the state's relatively larger family sizes and rapidly growing population. These constraints often translate into larger class sizes and heavier workloads for teachers. Charter schools have provided a pressure relief valve of sorts for the constrained traditional public school system, as they offer to educate children, and generally do so at a lower per-pupil cost.

The empirical results of my research suggest that this increase in charter school use also carries external "spill-over" benefits to the students who remain in the traditional public schools, although not in all areas. According to the models, the districts that have seen a greater degree of charter competition tend to see increases in traditional public school achievement precisely due to the increased competition from charter schools, even and especially after controlling for demographic and year effects. For Utah's education policy, this means that greater charter school use can primarily act as a relief valve for many constrained schools while simultaneously provide meaningful incentives for traditional public schools to increase achievement. It is the argument of the author, therefore, that Utah's education policy-makers should continue to approve charter schools for areas that demand them, as they provide meaningful school options for families that cannot afford private schools, while offering mostly positive externalities for student achievement. Borrowing terminology

from Hoxby (2003), it is evident that a greater degree of school choice in Utah can indeed be a rising tide that lifts all boats.

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