Charter School Competition & Saturation Point Forecasting

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EXECUTIVE SUMMARY

We provide empirical evidence via a statistical model that charter schools introduce an element of competition into the traditional public school market. However, attempts at predicting a specific point of saturation in the charter market prove untenable given the subjectivity of defining saturation. Given these findings, we suggest that a charter school analyst position be created to monitor developments and trends in the charter market over time for each local education agency. An exploratory statistical methodology which the analyst can follow is offered. Further, we recommend that the State Board of Education and Legislature consider how to accommodate and fund education in context of long-term trends in urban population growth.

INTRODUCTION

It is commonly assumed that charter schools introduce an element of competition into the market for public education. While research has focused on evaluating the effects of charter competition on public school academic outcomes, little is known about how charters have changed the financial and competitive environment of public education. Further, there is little research on whether charters are saturating the market for public education. The North Carolina Charter School Advisory Board (CSAB) refers to this concern in a 2014 report: "In the future, districts and existing charter schools will face a saturation point as more new schools are projected to open" (p. 8). Determining whether this point of saturation exists and if competition is shifting the dynamics of the charter school market in relation to the lifting of the charter school cap are two key concerns for practitioners and policymakers.

To study the effects of competition and saturation, we run two probability models of charter school closure. The models provide evidence of competition and saturation in the public education market, acting as a force to reach market equilibrium in relation to the lifting of the cap. We also find differential effects across structural characteristics of local education agencies (LEAs), particularly across urban and regional areas. Finally, we consider the effects of population dynamics on demand for public education. While this is not found to be a significant predictor in our models, it is probable this will become more relevant for planning purposes for capacity and expenditures. This can be attributed to projected increases in population growth through 2030.

The regression models are supplemented with a descriptive and graphical analysis of what competition, saturation, and population growth look like for three major LEAs: Charlotte-Mecklenburg, Durham, and Wake County. There is general evidence in favor of this exploratory approach relative to rigorous statistical modeling, given the unique structural features which drive the public education market for each respective LEA. Further, we recommend additions to the charter school application to reflect market demand.

DATA & VARIABLES

We employ a range of variables to study the effects of charter competition and saturation on the public education market. All data are from the National Center for Education Statistics (NCES) Institute of Education Sciences (IES) Elementary and Secondary Information System (ELSI), the North Carolina Department of Instruction, and the NC Office of State Budget and Management. We collect an aggregate of data on each LEA per year spanning 2002-2013.

We operationalize (measure) charter school closure as the dependent variable of interest, labeled *yi*. This is conceptualized in Equation 1, which shows the choice between a charter closing, denoted as a "1" in the model, and a charter not closing, denoted at "0" in the model. Selection of this dependent variable of interest aligns with existing literature (Paino et al., 2014; Schwenkenberg and Vanderhoff, 2015) and captures changing market effects.

$$yi = \left\{ \begin{array}{ll} 1 & \textit{if a charter closes} \\ 0 & \textit{if a charter does not close} \end{array} \right\}$$

Our independent variables capture charter school competition, saturation, demographics, socio-economic status, and school finances on charter school closure. Charter school competition is measured at the LEA level via the ratio of charter school enrollment divided by total LEA enrollment. Charter school saturation is measured via the number of charter schools out of the total number of charter and traditional schools in an LEA.

Demographic variables include ratios of the number of limited English proficiency (LEP), students with an individualized education plan (IEP), free and reduced lunch (FRL), Asian, African American, and Hispanic students out of total enrollment. FRL is also considered a proxy for socio-economic status. School finances include local, state, and federal revenue in addition to total expenditures. Total debt incurred during each year is also included as a control.

RESEARCH MODEL

To study the effects of charter schools on the public school education market, we conduct a probability panel model which includes each of the 115 LEAs. The model assesses the effects of competition, saturation, demographic and socio-economic, and financial variables on the probability of charter school closure rates. We denote the following variables: γ for the two competition variables, δ for demographic and socio-economic factors, and ϑ for financial variables.

Following the literature on determinant factors of charter school closure (Paino et al., 2014; Schwenkenberg and Vanderhoff, 2015) we estimate a probability model, specifically called a probit regression. As a technical side note, we use clustering on the LEA level and robust standard errors of the probability of charter school closure as a function of four vectors including competition, demographics, socio-economics, and financial measures of each LEA. The probability of charter school failure is outlined in the equation below:

$$pi = \Pr[yi = 1 \mid xi] = \varnothing(\alpha + \gamma xi + \delta xi + \vartheta xi + \pi xi)$$

FINDINGS

As shown in Appendix I tables, estimating the above equation reveals that charter school competition and concentration are markedly different for urban and rural schools prior to and following the lifting of the cap. In urban schools, competition was not found to be significant from 2008-2010, a probable function of a maturing charter school market reaching maximum competition with the cap. However, this trend is reversed with the lifting of the cap in 2011. The probability of an urban school facing competition becomes a significant factor in predicting the closure of a charter school after 2011, indicating that urban markets were more open to a competitive landscape. This can be attributed to the urban target market, in which information and choice regarding charter schools may be more open and transportation easier relative to a rural setting.

However, competition was quite different for schools in rural markets. While it was a significant factor prior to the lifting of the cap, indicating that charter and traditional public schools were still competing for students even with a ceiling on the number of charter schools, this trend quickly reversed with the lifting of the cap. Competition was no longer a significant factor in determining charter school closure in rural areas following the lifting of the cap, which may be indicative of a mature market which has little opportunity or demand for charter expansion.

Saturation is measured as the number of charter schools out of total schools in an LEA. It is a significant factor in all of the regressions, and decreased closure rates of charter schools for both rural and urban schools following the lifting of the cap. This may be indicative of charter schools responding to the regulatory environment to which they must adhere. In

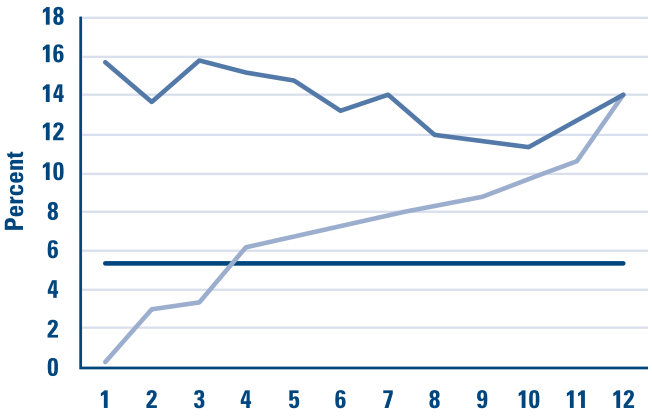
particular, it may imply that the process of charter approval is maturing and becoming more effective at rooting out charters which may prove problematic. Further, it may indicate that market forces are steering away unneeded expansion, in that existing charter schools are expanding enrollment populations and grade levels as they become more mature over time.

Conducting descriptive and graphical analysis of each LEA corroborates the findings of these regressions, and also provides evidence against the attempt to abstract regression or forecasting models on the state level to LEA level policy. In particular, graphical analysis of the three key variables of interest, competition, saturation, and a normalized population (converted to logarithmic scale) count, yields differential trends in the education market per LEA over time.

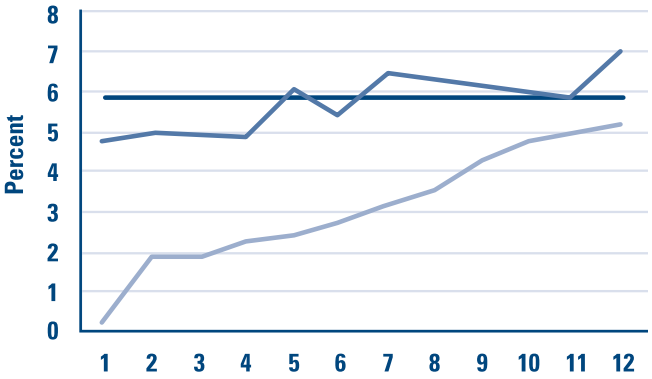
For example, in Durham, the slow increase in population is met with an extensive growth in the competition ratio. Charter school saturation is also relatively high, albeit volatile, with a spike after the lifting of the cap. This is indicative of a volatile market in Durham, which will likely be subject to expansion of charter schools. However, it must be emphasized that there is no exact point of saturation to be predicted or forecasted. Unless an arbitrary point of saturation is stated per LEA, there is little reason to seek this value out; rather, an analyst should conduct this type of analysis each year to determine if growth in a given LEA will continue, and if so, whether additional monetary resources should be allocated to this area.

To highlight the strength of this analysis in providing granular output relative to regression analysis, two additional examples are included. Charlotte-Mecklenburg charter competition also experiences continuously increasing growth albeit at a lesser rate than Durham. This is steady growth of population over time. However, charter saturation increases after the lifting of the cap, indicating a growing influence of charters on this LEA. A final case is found in Wake County, which exhibits gradual charter competition after a boom from 2002 through 2004. This trend proves the need to conduct ratio analysis over time in context of continuing discussion of whether Wake is saturated, a concern which appears more relevant to Charlotte-Mecklenburg or Durham from this analysis.

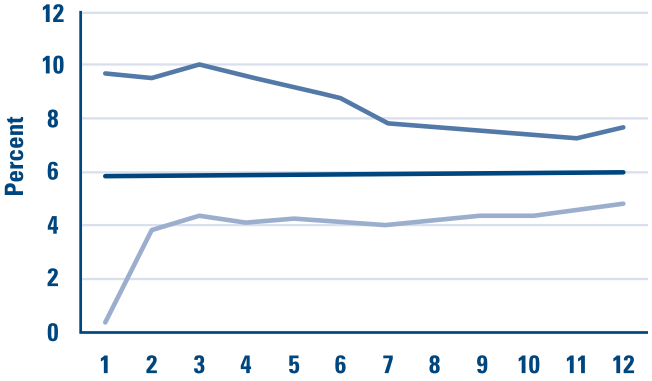
Durham (2002-2013)

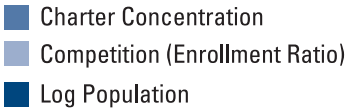


Charlotte-Mecklenburg (2002-2013)



Wake (2002-2013)





POLICY RECOMMENDATIONS

The significance of competition and saturation on charter school closure and differential ratio trends over time can be translated into a few key policy recommendations. First, it must be emphasized that the regression model results are state wide averages over time, and should not be used for forecasting particular point or interval saturation statistics. In particular, analysts should not seek a regression model which can predict when or how saturation will occur, unless very strict parameters of saturation are identified and strong controls for the structural and economic features of each LEA are included. Given the difficulty of creating such a model, likely evidenced by the very limited empirical analysis of charter school saturation in both academic and practitioner research, application of an alternative mode of analysis is advised, namely exploratory data analysis (EDA). EDA offers alternatives to pure regression analysis via descriptive, tabular, and graphical analysis of data. Much of the discussion of the descriptive trends in charter school data takes impetus from EDA. Therefore, it is first recommended that a charter school analyst conduct a form of EDA on each LEA at least once per year. Focus should be placed on each LEA with at least one charter, although markets without any charters or charter applicants should still be reviewed. This process will be described below:

(1) Determine whether the charter school is rural or urban. Compile key socio-economic and demographic statistics over time to differentiate between structural features of each charter school and the respective LEA.

(2) Conduct graphical analysis of competition, saturation, and population changes over time. Provide discussion of whether annual results point to gradual, volatile, or discontinuous change in any of these statistics.

(3) Contact a charter school regional representative, local traditional public school administrators, or charter schools to gain further detail on anticipated market dynamics in the LEA. In particular, is a charter expansion anticipated? The Office of Charter Schools and State Board of Education should also be contacted in the event of a charter school application to discuss the feasibility of the application.

(4) Provide a discussion of whether competition and saturation will increase or decrease for the next year as opposed to a purely statistical model of both concepts. This will ensure that trends in each LEA are discussed, ensuring relevance to charter application approval or policy decisions to each respective market.

Outside of analysis of competition and saturation, charter school applications should also reflect the influence of these market demand variables. Applications currently emphasize fulfillment of standards and academic criteria as opposed to whether the charters are meeting market demand. While charters operate in a public education market without a cap, they are still approved by the State Board of Education. However, this aspect of market competition is not fully reflected in the current application. Charter schools only justify meeting local demand through vague and unscientific methods of projected enrollments. What is necessary is a proper scientific survey, whether from a survey consulting firm or through a standardized survey instrument provided by the State Board to show that charters act as a competing force to traditional public schools in an education market. This will ensure that charter schools are not only opening due to interest of operators but also due to actual, measured, and verified demand in the LEA.

Changing charter applications to reflect market demand will hedge against charter school closure due to poor enrollment projections. This will limit negative effects on students who are affected by charter school closure, including academic loss from interrupted or changed instructional time and setting. Further, it will create stability for funding levels by avoiding unnecessary and unanticipated charter school closures due to invalid charter school enrollment projections.

The findings of this report also indicate the need for discussion and further research regarding growing population in urban areas. How the State Board of Education and Legislature intend to respond to increasing urbanization and population growth, and the resultant need for additional funding for students, is a concern that has received little attention. While there is no equation to predict the exact amount of increase in funding which may be required to accommodate growing populations, practitioners and policymakers should consider whether to focus on funding traditional public schools, charter schools, or a mix of both forms of public schools. While this involves a value judgment, it is a question that should be considered over time as opposed to waiting for projected booms in population in Raleigh and Charlotte through 2030.

APPENDIX 1

Table 1. Logistic Regression Analysis for Variables Predicting Charter School Closure, Cap

	Urban (n=164)			Rural (n=180)		
Predictor	**B**	**SE B**	**AME**	**B**	**SE B**	**AME**
Concentration & Competition						
TCS Ratio	36.17	6.70	7.6***	36.55	10.28	2.4***
CS% Ratio	-2.83	1.64	1.31	6.41	3.17	.42*
Demographics & SES						
Population	-2.86	1.64	-.60	2.29	3.76	.15
Enrollment	4.76	1.48	1.0***	8.56	6.69	.567
Hispanic	4.40	3.84	.93	-7.88	16.23	-.52
Asian	4.64	4.22	.98	-71.66	38.01	-4.75*
Black	-1.56	.91	-.33	.340	1.55	.022
Student Characteristics						
LEP	-11.89	3.30	1.79	-53.38	109.37	-3.53
IEP	-6.07	3.73	-2.5***	-72.42	45.94	-4.79
FRL	.06	.69	.01	-1.78	1.24	-.12
Financials						
Local Revenue	-18.72	3.98	-3.9***	-28.92	5.50	-1.9***
State Revenue	-24.21	4.32	-5.09***	-44.78	10.45	-2.9***
Total Expenditures	7.5e09	2.93e09	1.6e09***	1.51e08	4.95e08	1e09
Constant	12.56			-6.78		
Pseudo R Squared	.4571			.7044		
p>chi2	.000			.000		

*p < .05 **p < .01 ***p < .001

Table 2. Logistic Regression Analysis for Variables Predicting Charter School Closure, No Cap

	Urban (n=167)			Rural (n=177)		
Predictor	**B**	**SE B**	**AME**	**B**	**SE B**	**AME**
Concentration & Competition						
TCS Ratio	49.81	10.15	6.5***	39.05	8.03	2.1***
CS% Ratio	15.71	6.74	2.04**	2.99	2.97	.157
Demographics & SES						
Population	3.79	2.50	.49	6.6	3.87	.347
Enrollment	.686	2.36	.09	11.0	6.0	.58*
Hispanic	.621	4.5	.08	15.27	9.37	.80*
Asian	29.63	8.75	3.8***	-47.63	47.28	-2.51
Black	1.45	1.20	.19	-1.98	1.89	-.104
Student Characteristics						
LEP	-11.89	3.30	-1.70***	-202.94	129.19	-10.68*
IEP	-6.07	3.73	.365	-129.05	58.89	-6.79**
FRL	.06	.69	-.107	6.54	5.06	.34
Financials						
Local Revenue	-18.72	3.98	1.64***	11.27	7.93	.59
State Revenue	-24.21	4.32	4.903***	33.40	9.03	1.8***
Total Expenditures	7.5e09	2.93e09	-1.33e10	2.82e09	6.16e10	1.5e10
Constant	-50.96			-6.78		
Pseudo R Squared	.6608			.7740		
p>chi2	.000			.000		

*p < .05 **p < .01 ***p < .001

References

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The Financial and Business Services Area is in its ninth year of the Research Intern Program. The Program is designed to help build a quality research program within NCDPI to supplement and supply data for discussions related to procedural, process, and policy changes. This year's program included students from Duke University's Master of Public Policy program, North Carolina State University's Master of Public Administration program, and The University of North Carolina at Chapel Hill's Master of Public Administration and Doctorate in Education programs. The intern program is managed by Eric Moore (919-807-3731) and Kayla Siler (919-807-3824) | intern_research@dpi.nc.gov

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