Effects of a New School Choice Policy in Florida on Public School Competition

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1 Introduction

1.1 Overview

The effect of school choice policies on schools and students in the United States has been thoroughly researched in economics and education literature. Supporters of these policies believe school choice can be "the tide that lifts all boats" by increasing equity and closing the educational attainment gap (Hoxby 2003). However, the literature produces mixed results as to whether school choice is the great equalizer supporters claim it to be (Hastings 2009, Deming et al. 2014, Figlio and Hart 2014, Figlio et al. 2020, Cullen et al. 2006). In light of the uncertainty around school choice and student outcomes, economists turn to theory to predict how these policies should influence schools and students. In the style of Tiebout's "A Pure Theory of Local Expenditures", many economists argue that school choice creates competition for schools that should induce them to improve their productivity (Tiebout 1956, Hoxby 2000, Figlio and Hart 2014, Hanushek and Rivkin 2003). Issues of competition and productivity can be studied either through school inputs or student outcomes. As much of the literature makes clear, it is very difficult to measure student outcomes and attribute them causally to policies. On the other hand, school inputs such as expenditures can be easily measured, and an understanding of these school-side changes may help researchers make connections between policy and outcomes. Among school choice policies in the United States, open enrollment has unique implications for public school competition. Typically, students either attend their zoned traditional public school (assigned based on their residential address) or an alternative school choice option such as a charter, magnet, or private school. This tie between school assignment and residence materializes in housing prices, which absorb public school quality. Open enrollment complicates the education market because it decouples the relationship between residential and educational choices (Hoxby 2000, Denice and Gross 2016, Hastings 2009, Reback 2008, Özek 2009). These policies expand traditional public school choice options by allowing students to attend any school in their district (or sometimes another district) that is under capacity. Whereas families typically must move for their child to attend a different traditional public school, open enrollment grants school transfers at virtually no cost. In this way, open enrollment policies substantially increase the degree of choice afforded to families while simultaneously reducing the cost of exercising that choice. It is clear that these policies create major shifts in the education market.

In this paper, I investigate whether a new open enrollment policy in Florida induces competitive responses in Florida public schools. Using theory of public goods in the style of Tiebout and Hoxby, I predict schools facing high levels of competition due to open enrollment will decrease their per pupil expenditures. Using a unique panel dataset of school- and district-level variables, I estimate the effect of public school competition on per pupil expenditures. I measure public school competition as a treatment consisting of school density and the number open enrollment student transfers. I then test my hypothesis using a fixed-effects pooled regression analysis and find small to moderate significant effects of competition on per pupil expenditures. I also run this analysis on school quality and find no effect of public school density and small but significant effects of transfer activity.

In the remainder of this section I describe Florida's school choice landscape as well as the policies governing my two outcome variables of interest: per pupil expenditures and school grades. Section 2 contains a review of relevant literature, followed by a presentation of my theoretical framework in Section 3 and my empirical framework in Section 4. I describe the data in Section 5, present my empirical results in Section 6, and conclude with a discussion of implications for further policy analysis in Section 7.

1.2 Florida and School Choice

Florida has a long and complex school choice history. Florida's charter law was enacted in 1996, and today the state has more charter schools than most other US states. As of 2018-19, Florida had 658 charter schools whose enrollments totaled over 313,000 students. Additional choice options include almost 600 magnet schools or programs and over 2,000 private schools. One of Florida's largest school choice programs is the Florida Tax Credit Scholarship Program, which began in 2001 and provides tax credits for corporations in exchange for contributions to student vouchers.

Florida's most recent school choice policy is statewide intra- and inter-district open enrollment. Florida Statute s. 1002.31 was passed in 2016 and mandates that all school districts in Florida adopt controlled open enrollment policies (COE) starting in the 2017-18 school year. Students may attend any school in the state for grades k-12, whether it is a traditional public school, charter school, or magnet school, conditional on the school's admissions guidelines and state capacity and class size limits.

School districts and charter schools must post their capacity determinations online so that parents are aware of their choices prior to the application period. Each spring, parents who wish to transfer their child to another Florida public school complete an online application with their home district. After the application period, students who applied for a COE transfer are allocated seats in schools via lotteries. Once a student secures a spot at a new school via COE, they may remain at that school through the highest grade offered.

Prior to the enactment of s. 1002.31, several school districts already offered some form of open enrollment and most allowed transfers for students with exceptional circumstances. There were 23 of 67 districts that had less than 0.5% of their students transfer via an open enrollment program in 2016, the year before s. 1002.31 went into effect. Table 1.2 provides a summary of COE transfers at the district level for the 2016-17, 2017-18, and 2018-19 school years. Proportions are calculated as the number of student transfers in a district out of total students in a district.

Table 1.2 *District-Level Controlled Open Enrollment Transfer Counts*

	Mean	Median	St. Dev.	Min	Max
2016-17					
Total COE transfers	9383.5180	3284	14094.7400	0	73387
Out-of-district transfers	97.9410	2	180.3450	0	573
Proportion of students utilizing COE	.0890	.0410	.1880	0	.9460
Proportion of students utilizing COE who attend school out-of-	.0010	0	.0070	0	.1060

district					
2017-18					
Total COE transfers	9472.0770	4563	13618.5000	0	74482
Out-of-district transfers	137.0880	51	186.3970	0	624
Proportion of students utilizing COE	.0910	.0470	.1790	0	.9470
Proportion of students utilizing COE who attend school out-of-district	.0020	.0010	.0060	0	.0650
2018-19					
Total COE transfers	9970.6980	4738	13862.0700	0	76303
Out-of-district transfers	128.9980	70	158.9130	0	706
Proportion of students utilizing COE	.0940	.0480	.1760	0	.9630
Proportion of students utilizing COE who attend school out-of-district	.0020	.0010	.0060	0	.0710

Notes: Data comes from the Florida DOE Bureau of PK-20 Education Reporting and Accessibility

Total COE transfers throughout the districts increase from 8.9% in 2016 to 9.4% in 2018. Additionally, out-of-district transfers double from 0.01% in 2016 to 0.02% in 2018. Interestingly, the median number of transfers is consistently lower than the average, which is likely because COE transfer activity is concentrated in large, highly populated districts. The average number of out-of-district transfers decreases slightly from the first year of statewide (2017) COE to the second year (2018). At the same time, the median number of out-of-district transfers increases steadily from 2016 to 2018. The simultaneous decrease in average transfers and increase in median transfers is also likely due to COE activity in highly populated districts. Students in densely populated districts with more school options may be more likely to transfer within the district rather than out of the district. Likewise, students in smaller districts with fewer schools may be more inclined to take advantage of out-of-district transfer options.

1.3 Florida Public School Funding and Cost Reporting

My main variable of interest in my analysis is per pupil expenditures. I believe that in the presence of competition, schools have an incentive to decrease costs. While schools are not profit-maximizing firms, an understanding of the relationship between school funding and costs reveals why they may be inclined to cut costs when they can.

Florida public schools receive funding from three main sources: local (mainly property taxes), state, and federal funds. The main funding mechanism for Florida public schools is the FEFP formula, which was created along with the Florida Education Finance Program in 1973. The formula is largely a function of the number of Full-Time Equivalent (FTE) students enrolled in a school. The first step in calculating a school's total funds is to multiply the number of FTE students by a cost factor to determine a weighted sum of FTE students. There are different cost factors for elementary, middle, and high schools, but within each level this factor is constant. This sum is multiplied by a district cost differential and a base student allocation. This amount determines base funding from state and local FEFP funds. Schools can receive supplemental funds for AP and IB programs, certificate programs, juvenile justice education programs, declining enrollment, sparsity (given to small schools that can't maintain low costs given consistently low enrollment), research, materials, transportation, etc. Finally, the sum of the school's base and supplementary funding comprises the school's gross state and local FEFP dollars.

There are two important aspects of school funding to note. First, although schools receive supplementary funds for various programs and issues they may face, funding is largely dependent on consistent enrollment. Second, while each school annually reports their own per pupil expenditures, their funding is determined by a constant cost factor. Therefore, the FEFP formula does not take these changing individual costs into account. Consequently, it is in a school's best interest to operate such that their total costs do not exceed their FEFP funds. Each year, every public school reports their per pupil expenditures, which are categorized as follows:

- Salaries for employees in permanent positions
- Employee benefits
- Purchased services (professional and technical services (including lawyers, doctors, engineers, architects, consultants, accountants), insurance and bond premiums, travel, maintenance done by contractors, rentals, communications, etc.)
- Energy services
- Materials and supplies (Instructional, custodial, maintenance supplies, textbooks, publications, oil, repair parts, food, etc.)
- Capital outlay (Expenditures for existing land/buildings, new buildings, new equipment, motor vehicles, software, library books, furniture, remodeling, computer software)
- Other expenditures and fund transfers
- School indirect costs (costs that do not belong to a particular program. The FL DOE cites "the custodial staff of a school cleans areas used by all programs of the school" as an example)

Each of these items adds up to total school cost per pupil. This sum is then is added to district indirect costs to create the total program cost per pupil. For the purpose of my analysis, I will focus on total school costs per pupil, as I want to isolate changes made at the school level. I will also analyze sub-components of this total to determine where, if any, schools are making expenditure changes.

Only publicly run schools are included in the data I obtain on per pupil expenditures, which means charter schools are excluded. To account for effects of competition on charter schools, I also run specifications for school quality.

1.4 School Grade Calculation

To test the effect of competition created by statewide COE on school quality, I use an index created by the Florida DOE called "school grade" as an outcome variable.

Every public school in Florida receives a grade each year based on the following criteria: student performance on English language arts, math, science, and social studies exams, graduation rate (for high schools only, additional criteria is included for middle and elementary schools), and acceleration success (awarded for AP, IB, and other certification opportunities made available to students). For English language arts and math exams, schools are graded based on overall student achievement, overall learning gains, and learning gains for the lowest 25% of students. Every category is measured as a percent out of 100. Afterwards, the categories are averaged to compute a raw score which corresponds to a school grade[1].

2 Literature Review

There is myriad evidence that suggests school choice reforms create competition and that this competition influences the behavior of local and state governing boards. I review papers that argue that school choice (created either through legislation or population density) increases the level of competition in the market for public schools, thereby adding market pressure for school and district leaders.

A seminal paper on the economic relationship between constituents and local public goods is Tiebout's "A Pure Theory of Local Expenditures." Tiebout (1956) relates public goods markets to private goods markets, where governments are suppliers and constituents are consumers. In the model, a consumer-voter moving to a new community has many municipalities with different expenditure-bundles from which to choose. With full knowledge of expenditure differences, the consumer-voter chooses the community whose expenditure patterns best matches their own preferences. In addition to this knowledge, consumer-voters have a "willingness to pay" that materializes as their choice of whether to move. Likewise, municipalities can change their allocation of public goods to attract the most constituents. In this way, Tiebout's local governments "compete" with each other for constituents, and these pressures force them to provide the optimal amount of public goods at the lowest cost. In my paper, I exploit similar theories to frame schools as suppliers in the education market.

Much of the literature draws on Tiebout's theory to describe the competitive nature of education markets. Hoxby (2000) employs Tiebout's model to show that geographical areas that have more school districts have greater "Tiebout Choice." Hoxby finds that increased Tiebout Choice[2], leads to increases in student achievement scores and decreases in per pupil spending. These findings have important implications for my paper: because I use school expenditures to measure supply-side responses to competition, Hoxby's finding that increased competition leads to decreased per pupil expenditures is compelling. Further, the finding that schools increase student achievement while *simultaneously* decreasing costs suggests that schools are actively trying to increase productivity in the face of competition.

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[1] A raw score of 62% or higher is an A, 54% to 61% a B, 41% to 53% a C, 32% to 40% a D, and below 31% an F. Schools must test 95% of their student population.

[2] The degree of Tiebout Choice is ingeniously measured by the number of streams in a given geographical area. Hoxby argues school districts drawn in the 19th and early 20th century used streams as boundaries to allow easy passage for children to school. The number of streams works as an instrumental variable because it is exogenous to any residential or public funding/building decisions.

As a follow up to Hoxby, Hanushek and Rivkin (2003) investigate whether public school competition affects teacher quality in Texas. Hanushek and Rivkin use a Herfindahl index in their analysis, which is a measure of student density in schools. The authors also analyze the relationship between competition and overall school quality in different metropolitan statistical areas (MSAs). They find that while competition and quality are not strongly related in many MSAs, that in the five largest MSAs they have a strong, positive relationship. With respect to teachers, they find that between school competition raises the quality of teacher personnel practices.

As the topic of school choice becomes increasingly relevant in the 21st century, many researchers argue the presence of competition created by policy. Figlio and Hart (2014) argue the effect of competition created by Florida Tax Credit Scholarship, which grants private school vouchers to students. They find that the effect of competition on public schools increases with the proximity of private schools. Additionally, they find that schools that are in danger of losing funding by losing low income students to vouchers see the largest effects. This result is important for my research because it shows past evidence that Florida schools react to competition with respect to financial incentives.

In this paper, I focus on Florida's statewide open enrollment policy. While there has not been much research on competition created by open enrollment, many authors have studied the impacts of such policies on student outcomes. Deming et al. (2014) exploit lottery-based school assignment in the Charlotte-Mecklenburg school district and find that students attending their first choice school via open enrollment have better graduation and college attendance rates. They also find that students whose neighborhood schools are low performing see especially large gains from winning the lottery. Therefore, they argue, open enrollment benefits the low income students it's intended to.

This result is not ubiquitous, however. Cullen, Jacob, and Levitt (2006) find that winning the lottery to attend a first choice school in Chicago has no effect on test scores, graduation rates, and other academic measures. However, they do find that lottery winners experience non-academic benefits such as decreased disciplinary and arrest rates. In a study of open enrollment in Michigan, Cowen and Creed (2017) also find no evidence of the policy's effect on student outcomes.

Some researchers hypothesize that open enrollment produces small gains in student achievement because it creates access issues for low income students. Denice and Gross (2016) study causes of stratification in an open enrollment policy in Denver. They compare the "supply" of public schools for families of different backgrounds[3]. They find that white families have better schools near their homes than minority families. Because parents generally choose schools that are close to home, low income families are at a disadvantage because their school supply is of lower quality. In an open enrollment setting, these families choose from a "different set" of schools compared to their white counterparts.

Hastings (2009) studies how stratification affects schools' competitive responses to open enrollment. Despite the fact that open enrollment would seemingly threaten low quality schools

[3] "Supply" being the number of public schools within a two-mile radius of a family's home.

the most, Hastings finds that high quality schools see the largest increases in test scores as a response to demand-side pressure. Again, inherent stratification not only influences the benefits of open enrollment but also changes how schools react to competition.

While most papers on open enrollment focus on its effect on student outcomes, my paper analyzes competition created by this policy and its implications for schools and students. Additionally, I study the new statewide open enrollment policy in Florida, which to my knowledge, has not yet been analyzed empirically. I include specifications for the effect of competition on school quality, but my main focus is the effect of competition on supply-side outcomes, such as per pupil expenditures. I choose this outcome because as s. 1002.31 was passed in 2016, I believe changes in per pupil expenditures will be evident before changes in school quality. Furthermore, because the literature produces mixed results on the effect of open enrollment on student outcomes, I feel that an analysis of supply-side outcomes will produce more conclusive results.

3 Theory

In this section I present the theoretical framework used to investigate whether Florida public schools react to competition induced by statewide COE. I argue how COE changes the education market for both families as consumers and schools as suppliers.

Open enrollment policies significantly change the education market for families by diminishing the relationship between residential and educational choices. This idea is illustrated by Tiebout's theory, which argues that agents have a set of preferences for public goods and choose jurisdictions to live in that best match their preferences (Tiebout 1956). In practice, one can think of Tiebout's jurisdictions as school districts or even neighborhoods. Without open enrollment, an agent choosing a neighborhood to live in would include public school quality in their bundle of preferences. Conversely, an agent moving to a district with open enrollment may weigh public schools less or even remove them entirely from their bundle of preferences. This is because their supply of public schools is not limited to their district or neighborhood. This implication has led many researchers to hypothesize and find evidence for long-run effects of the availability and choice of schools on housing prices (Danielsen, Fairbanks and Zhao 2015, Neilson and Zimmerman 2014, Chung 2015). However, because Florida's COE policy is relatively new, I am unable to observe any potential effects on the housing market.

Besides its potential long-run effect on housing prices, open enrollment has short-run effects on the education market. Specifically, these policies have significant effects on "switching costs" that are typically associated with school choices. For example, without open enrollment, a family may only send their child to a different traditional public school if they move homes. The cost of switching schools is high because changing residency is the only way to access different schools. On the other hand, open enrollment policies drastically lower the cost of switching by allowing families to send their child to any school regardless of where they live. Now, the only costs associated with switching are transportation and any indirect costs involved with transferring schools.

Not only do open enrollment policies change the education market for families, but it is easy to see how they affect the suppliers of this market as well. Without open enrollment, a family's only option in the education market for a traditional public school is their zoned school. On the other hand, open enrollment expands choice among traditional public schools beyond zoned schools. Therefore, these schools are no longer unique in the education market: they now have competitors that offer the same type of education at almost an identical price. The competition created by open enrollment threatens schools by offering families more education options of the same type. Public schools are not profit-maximizing entities, but as outlined in Section 1.3, Florida public schools largely depend on enrollment for funding. Additionally, individual school costs are not directly incorporated in the funding calculation. Therefore, a school's costs per pupil and funding can fluctuate independently of each other.

As a result of this policy, Florida public schools have an incentive to increase their enrollment while decreasing certain per pupil expenditures to make up for enrollment lost to competition. With this logic, I hypothesize that Florida public schools make supply-side changes in response to competition induced by statewide COE.

4 Empirical Framework

In this section I describe how I measure each school's competitive landscape and supply-side changes. Then, I explain my specifications for measuring the effect of COE-induced competition on per pupil expenditures and school grades.

4.1 Measuring Competition

In my analysis, my variable of interest is the degree of competition each school faces as a result of statewide COE. Although s. 1002.31 is applied identically to every district and school, the degree to which the policy is influential and used by families depends on many factors. For example, a high school in a highly populated area with many other high schools nearby will likely see COE more actively than the only high school in a small, rural town. For this reason, I use several variables to construct a continuous treatment that measures the degree of competition each school faces. This measurement of each school's competitive landscape contains 1) the proximity of alternative school choices and 2) the number of students enrolling in school via COE per district per year.

The first component of my treatment is the proximity of alternative school choices for each school. I hypothesize that families in high density areas can more easily practice COE because of the proximity of alternative school choices and decreased travel costs. The proximity of other school choices can also predict how each school may be affected by s. 1002.31 in the future. I derive the availability of alternative school choices for each school by invoking the concept of "Tiebout Choice" (Tiebout 1956, Hoxby, 2000). Using school-level data and GPS coordinates from the Florida DOE, I construct school density variables. For each $School_{kj}$, a $School_{ij}$ is added to the density count if it lies within five miles of $School_{kj}$ and operates at the same $Level_j$ (where j is equal to elementary, middle, or high). I measure the density in four categories: public schools within $School_{kj}$'s district, public schools outside of $School_{kj}$'s district, the total number of public school alternatives (sum of within district and out-of-district density counts), and private schools. To illustrate,

$$Density_{kj} = -School_{kj} + \sum_{i=1,j=j}^{i=n,j=j} (School_{ij} * \delta)$$

**Where δ = 1 if $School_{ij}$ lies within 5 miles of $School_{kj}$, and 0 otherwise. I subtract $School_{kj}$ from the density index because a school does not count as its own competitor.

I analyze schools both within the district and outside of the district to account for pre-existing choice prior to s. 1002.31. For example, schools within the district were already viable choices before statewide COE in districts that already had open enrollment policies. I include a density variable for private schools as they were a viable choice before and after s. 1002.31 was enacted.

The second component in measuring competition is the level of COE activity in each district. Because many school districts had some form of COE prior to s. 1002.31, I include COE transfer counts for school years before and after s. 1002.31 in my analysis to control for competition prior to the policy. One limitation of my data is that I was not able obtain school-level data on COE transfers (the reason for which will be explained in Section 4). To mitigate this issue, I use district-level transfer data to account for overall trends in the policy's effect and use. In my analysis, I measure COE transfers as a proportion of total students in a district to account for differences in district sizes.

4.2 Dependent Variables

To measure each Florida public school's response to competition created by statewide COE, I analyze supply-side outcomes. According to the Florida DOE's Office of Funding and Financial Reporting, funding received through local, state, or federal governments is classified as revenue. Per pupil costs reported by schools each year are classified as expenditures. Without taking non-liquid assets, liabilities, and other internal funds into account, a $School_i$'s net funds in $Year_t$ can be simply expressed as follows:

$$Net\ Funds_{it} = (Federal\ Funding_{it} + State\ Funding_{it} + Local\ Funding_{it}) - (Total\ Program\ Cost\ Per\ Pupil_{it} * FTE_{it})$$

** Where FTE_{it} represents the number of students enrolled full-time for $School_i$ in $Year_t$. See section 1.3 for breakdowns of funding and cost calculations

It is clear from this simplified calculation that a school can increase their net funds either by increasing the funding (revenue) they receive or decreasing their per pupil costs. In my analysis, I run different specifications to test whether schools change their costs and revenue in response to competition induced by statewide COE.

My main specifications test the effect of COE-induced competition on three different measures of per pupil costs: total school costs, salaries, and purchased services (which include professional services, insurance and bond premiums, travel, maintenance done by contractors, rentals, and communications). I predict salaries and purchased services would be most affected by decreasing enrollment due to COE. For salaries, it seems likely that increased school competition affects labor demand. For purchased services, I predict that failing schools that suddenly face more competition may choose to invest in more services to improve quality. On the other hand, high-performing schools may need fewer of these services and cut these costs in the presence of competition.

Florida public school funding is largely a function of enrollment. Therefore, to test for changes in revenue, I use data that indicates a school's effort to increase enrollment. In an alternative specification, I test the effect of competition on school quality using the state's school grade system. School grades are indices of several achievement and quality measures, providing a holistic picture of school quality. I believe that school grade is a good indication of a school's effort to increase enrollment because it measures outcomes that can be changed year to year. Additionally, school grades are released each year to the public. Parents who wish to transfer their child to a better school will look to data such as this for information. I use the probability of a school receiving a grade of A or B or a grade of D or F as my outcome variables.

Analyzing two different school outcomes gives my analysis a more thorough picture of the effect of competition on schools due to a limitation in my data. The Florida DOE only has per pupil expenditure data on public non-charter schools. However, data on school grade is available for charter schools, so my school quality specifications will include the effect of competition on all public schools.

4.3 Model Specifications

In this section, I first review the controls I use in each of my specifications. I then explain my baseline cost specifications, tests for heterogeneity across race, and school quality specifications.

4.3.1 Description and Justification of Control Variables

I include a variety of school- and district-level controls that are both common in empirical papers about education policy and unique to the requirements for assessing the effects of competition induced by COE.

School-Level Controls:
Enrollment
I include enrollment as a control because school funding is a function of enrollment. Schools may adjust their costs according to projected enrollment. Enrollment may also affect how students perform on standardized tests, which can therefore affect school grade. Furthermore, schools with large enrollments may also be in cities with certain socio-economic demographics that predict student outcomes.

Magnet/Charter Status
To control for school type, I include dummy variables for magnet and charter status. Charter and magnet schools face different types of competition compared to traditional public schools because they often offer specialized education programs. Also, charter schools may have different funding structures from traditional public schools. Magnet schools may also be more likely to receive higher school grades because they often offer specialized programs and certifications.

Level
I include dummy variables for middle schools and high schools. Elementary schools have both dummies equal to zero. Many empirical papers on school choice and parental valuation of schools have found that parents place the highest emphasis on high school quality (Caetano 2019, Özek 2009). Additionally, parents are more likely to transfer their child to a new school before a "transition grade," or the lowest grade at the next level of school (Özek 2009). Therefore, it is appropriate to control for school level when analyzing the effect of COE.

School Grade
I predict that schools with consistently higher grades will likely face different levels of competition, and therefore have different cost changes.

School Demographics
In addition to the other school-level controls, I include data on the racial and socioeconomic composition of each school. To proxy for the socioeconomic makeup of each school, I also include the proportion students that receive free or reduced-price lunch. These demographic characteristics are essential controls because racial and socioeconomic characteristics are likely correlated with the quality of the school and the local funding (especially that which comes from taxes) available.

District-Level Controls:
Economic Characteristics
At the district level, I include data on labor force participation, unemployment, and log median income. Economic characteristics are correlated with the local and state funding available for each of these districts, as well as the likelihood of families using COE.

District Demographics
In addition to racial characteristics of each school, I include the racial composition of each district. Again, because racial characteristics are strongly correlated with other socioeconomic characteristics, they are important controls for analyzing different districts' funding and performance.

Parent's Education
I include information on educational attainment for adults with school-aged children. This information is correlated with unobserved family information, such as how much a parent cares about school quality, how informed a parent is about school choice, etc.

4.3.2 Baseline Specification

My baseline specification uses pooled OLS to test the effect of the competition created by statewide COE on per pupil expenditures. I include year effects and six school dummy variables to estimate school fixed effects. I use fixed effects because I believe there are unobserved characteristics within each school that impact its expenditures and performance. For instance, I do not have data on district funds, budget changes, or income taxes, all factors that influence school funding. Therefore, I use fixed effects to isolate each school's individual relationship to competition, costs per pupil, and performance.

To confirm that this model is appropriate, I run a Hausman test and find that fixed effects best fits my model. However, because my density variables are time-invariant, I cannot run a traditional fixed effects model. Instead, I run a pooled OLS and estimate school fixed effects by including unique dummies for schools of different densities and levels.

To choose school dummies, I determine the 25th and 75th percentiles for total public school density. Each of these percentiles represents high or low density. I also find the 50th percentile for school demographics such as proportion of students receiving free/reduced priced lunch, school grade, etc. Each of these percentiles is calculated for elementary, middle, and high schools. Then, I find an arbitrary school that fits these characteristics for each school level. In total, I have two categories: high density and low density, and one elementary, middle, and high school within each category. For example, I include a dummy variable for River Ridge High School as a high density high school because it is in the 75th percentile for density and has demographic characteristics that fall around the 50th percentile. In total, I have six arbitrary school dummies.

To summarize, my base specification estimates average effects of competition on per pupil expenditures, and supplements this with quasi-fixed effects for six arbitrary schools.
My baseline specification school costs per pupil is expressed by,

$$\ln(y_{it}) = \alpha + \beta_1 x_{1it} + \beta_2 x_{2it} + \beta_3 x_{3it} + \beta_4 x_{4it} + \beta_5 x_{5it} + \beta_6 x_{6jt} + \beta_7 Year_{it} + \beta_8 School_i + \epsilon_{it}$$

Where:

- y_{it} = costs per pupil (either total school costs, salaries, or purchased services)
- x_{1it} = total public school density for school *i* in year *t*
- x_{2it} = out-of-district density for school *i* in year *t*
- x_{3it} = private school density for school *i* in year *t*
- x_{4ijt} = proportion of total students transferring via COE in school *i*'s corresponding district *j* in year *t*
- x_{5it} = school-level controls
- x_{6jt} = district-level controls for school *i*'s corresponding district *j*
- $Year_{it}$ = time effects for school *i*. These are represented by two dummies for the years 2017-18 and 2018-19. 2016-17 is omitted.
- $School_i$ = school fixed effects for six arbitrary schools. The effects are divided into two categories: high density and low density. There is one elementary, middle, and high school for each category.

4.3.3 Tests for Heterogeneity

I also run specifications to test whether the effect of competition on total costs per pupil differs depending on racial demographics. Because race is associated with many socioeconomic factors, it also likely related to school density. Additionally, I predict the racial composition of a school can proxy for neighborhood characteristics. Schools will respond differently to competition depending on the various social and economic characteristics of the families in the school and in the district.

To test for heterogeneity, I run several regressions with varying racial cutoffs to isolate the effect of composition among certain schools. I calculate percentile cutoffs for black, Hispanic, and white students in each Florida school. I analyze schools where the proportion of black or Hispanic students is in the 25th percentile or lower and schools where this proportion is in the 75th percentile or higher. I only run these specifications for black and Hispanic students and compare my results against the omitted schools. Last, I run a specification for "diverse" schools, those with proportions of black, Hispanic, and white students in the 50th percentile or higher. I eliminate my school fixed effects in this specification to isolate overall average trends in the effect of competition between races. This test for heterogeneity is expressed by,

$$\ln(y_{it}) = \alpha + \beta_1 x_{1it} + \beta_2 x_{2it} + \beta_3 x_{3it} + \beta_4 x_{4it} + \beta_5 x_{5it} + \beta_6 x_{6jt} + \beta_7 Year_{it} + \epsilon_{it}$$

Where:

- y_{it} = costs per pupil (either total school costs, salaries, or purchased services)
- x_{1it} = total public school density for school *i* in year *t*
- x_{2it} = out-of-district density for school *i* in year *t*
- x_{3it} = private school density for school *i* in year *t*
- x_{4ijt} = proportion of total students transferring via COE in school *i*'s corresponding district *j* in year *t*
- x_{5it} = school-level controls
- x_{6jt} = district-level controls for school *i*'s corresponding district *j*
- $Year_{it}$ = time effects for school *i*. These are represented by two dummies for the years 2017-18 and 2018-19. 2016-17 is omitted.

4.3.4 School Quality Specification

As an alternative to my cost specification, I test whether COE-induced competition affects school grade. The goal of this specification is to capture effects of competition on charter schools, so I run separate regressions for charter and non-charter schools. The pooled OLS model is expressed by,

$$y_{it} = \alpha + \beta_1 x_{1it} + \beta_2 x_{2it} + \beta_3 x_{3it} + \beta_4 x_{4it} + \beta_5 x_{5it} + \beta_6 x_{6jt} + \beta_7 Year_{it} + \epsilon_{it}$$

Where:

- y_{it} = 1 if school *i* receives a grade of A or B, or D or F in year *t*
- x_{1it} = total public school density for school *i* in year *t*
- x_{2it} = out-of-district density for school *i* in year *t*
- x_{3it} = private school density for school *i* in year *t*
- x_{4ijt} = proportion of total students transferring via COE in school *i*'s corresponding district *j* in year *t*
- x_{5it} = school-level controls
- x_{6jt} = district-level controls for school *i*'s corresponding district *j*
- $Year_{it}$ = time effects for school *i*. These are represented by two dummies for the years 2017-18 and 2018-19. 2016-17 is omitted.

5 Data

To conduct my analysis, I construct a panel dataset using a variety of data at both the school and district level. I focus on data spanning the 2016-17, 2017-18, and 2018-19 school years to observe changes before and after s. 1002.31.

The majority of my school-level data comes from the Florida DOE. I collect data on enrollment, proportion of students receiving free or reduced-price lunch, school grade, and membership by race and grade. Out of privacy for the students, the Florida DOE reports observations as missing if the number of students in a category is less than ten. However, if the student count is 0, that will be reported. Therefore, because my membership by race data is also by grade (meaning some race counts are quite small), there is a portion of that data which is missing. In this data, a missing value could be anywhere from 1 to 9. Therefore, I replace these missing observations with 5 as an average.

Additionally, I collect time-invariant data on magnet status, charter status, school level, and a variety of density variables measuring school competition. I omit virtual schools, adult education, juvenile detention centers, and hospital homebound programs from my analysis. In total, I have data for 3,890 Florida public schools in 67 districts for the three school years.
I also construct density variables for each school using the concept of "Tiebout Choice." As discussed in Section 4, these density variables count the number of alternative school choice for each school in three different categories: total public schools, public schools out of the district, and private schools.

Table 5.1 presents summary statistics for Florida public schools. These statistics are averaged over the three school years.

Table 5.1 *Summary Statistics for Selected School-Level Characteristics*

Variable	Mean	St.Dev	Min	Max
Enrollment	774.3400	577.5820	10	4797
Proportion of students receiving free/reduced-price lunch	.4150	.3400	0	1
Magnet status	.1480	.3550	0	1
Charter status	.1710	.3760	0	1
White	.3810	.2710	0	.9960
Black	.2610	.2410	0	.9910
Hispanic	.3140	.2540	0	.9950
Total public school density	15.3430	21.4720	0	220
Within district density	14.5260	19.9520	0	189
Out-of-district density	.7820	3.9820	0	72
Private school density	9.7750	19.1670	0	216
Grade A	.2460	.4310	0	1
Grade B	.2080	.4060	0	1

Grade C	.2600	.4390	0	1
Grade D	.0400	.1960	0	1
Grade F	.0040	.0630	0	1

Notes: Data comes from the Florida DOE Bureau of PK-20 Education Reporting and Accessibility and Florida School Accountability Reports. Geocodes used to calculate private school density come from the Private School Universe Survey. Density is my own calculation using geocodes in the data and is a count of schools within five miles of $School_{kj}$

For my cost data, I obtained per pupil expenditures for each public school from the Florida DOE for the three school years. Unfortunately, the DOE only has cost information on public non-charter schools. Therefore, my analysis of the effect of competition on school spending is limited to these non-charter schools. Overall, I have cost data for 3,188 Florida public schools for the three school years. As discussed, I also investigate whether competition affects school grade to account for the effects of competition on charter schools. Table 5.2 presents summary statistics on all reported sources of per pupil costs. These statistics are averaged over the three school years.

Table 5.2 *Average Per Pupil Expenditures by Source*

Variable	Mean	St.Dev	Min	Max
Salaries	4412.5340	7820.0970	0	396100
Employee Benefits	1366.7350	2691.0340	0	161717
Purchased Services	667.0790	5961.0870	0	335470
Materials/Supplies	167.9870	478.7930	0	33210
Other Expend.	59.8540	168.0890	0	7068
Capital Outlay	60.1850	511.2960	0	33309
Total Direct Costs	6734.3890	13116.9500	0	571600
School Indirect Costs	3238.7580	9384.7900	0	610451
Total School Costs	9973.1450	20580.7600	0	1131007
District Indirect Costs	499.7970	1512.9200	0	83923
Total Program Cost	10472.9400	21821.8600	0	1214931

Notes: All data comes from the Florida Department of Education Bureau of PK-20 Education Reporting and Accessibility

Besides school density, I include a variable on the proportion of students in each district who transfer via COE. I have district-level data on public school COE transfers from the Florida DOE for the three school years. I chose not to use school-level transfer data because there was a significant amount of missing data. As previously mentioned, the Florida DOE reports observations as missing if the student count is less than ten. Because for many schools the number of transfers does not exceed 10, this dataset had a significant number of missing values. Therefore, I use district-level transfer data to proxy the degree to which a school may be affected by COE. I have data on the total number of students in each district who transfer via COE by district and year, as well as the number of students within that total who transfer to another district.

I supplement my school-level data with district-level demographic data to control for various economic and social characteristics. I collect state-wide employment, income, and family demographic data (for people with school-aged children) from the American Community Survey. These controls are time-invariant because ACS releases data in four-year intervals, with the latest release spanning 2013-2017. Table 5.3 presents a summary of district-level economic and social characteristics.

Table 5.3 *District-Level Economic and Social Characteristics*

Variable	Mean	St.Dev	Min	Max
Labor Force Characteristics				
Labor participation rate (total)	.5880	.0700	.2340	.6690
Labor participation rate (age 16-19)	.3220	.0680	.0850	.5570
Unemployment	.0730	.0100	.0370	.1280
Race	0.7520	0.0930	0.4150	0.927
White	0.1630	0.0780	0.0290	0.558
Black	0.2490	0.1920	0.0240	0.680
Hispanic				
Economic Characteristics				
Income	50689.6900	6365.1780	31816	73640
Income (white)	53855.6100	6814.4840	36458	74042
Income (black)	37296.5200	5931.5000	19167	57150
Income (families)	61329.3800	8393.6700	40174	90682
Parents Education				
Less than 9th grade	.0410	.0280	0	.2580
Some high school	.0650	.0200	.0210	.1530
High school diploma	.2520	.0510	.1330	.6070
Some college	.2100	.0340	.0830	.3030
Associate's degree	.1170	.0180	.0420	.1710
Bachelor's degree	.2030	.0480	.0400	.3610
Graduate/Professional Degree	.1120	.0390	.0050	.2530

Notes: All data comes from the US Census American Community Survey

6 Results

In this section I present my empirical results. I first review the results for my baseline specification, which measures the effect of COE-induced competition on per pupil expenditures. Then, I present the results to my tests for heterogeneity and school quality specification.

6.1 Effect of Competition on Per Pupil Expenditures

Table 6.1 presents the results of my baseline specification. I estimate the average effect of competition on total school costs, salaries, and purchased services using pooled OLS. To measure fixed effects, I include six arbitrary school dummies for different densities.

Table 6.1 *Baseline Specification Results – Per Pupil Expenditures*

Variable	(1) Log Total School Costs	(2) Log Salaries	(3) Log Purchased Services
Density (public schools)	-0.0014***	-0.0026*	0.0092***
	(0.0003)	(0.0015)	(0.0015)
Density (non-district)	0.0003	0.0011	-0.0137***
	(0.0006)	(0.0018)	(0.0031)
Density (private schools)	0.0016***	0.0030**	-0.0214***
	(0.00032)	(0.0012)	(0.0019)
Prop. COE transfers	-0.0518***	-0.0393	-0.2620***
	(0.0138)	(0.0478)	(0.0577)
Enrollment	-0.0003***	2.99e-05	-0.0004***
	(1.11e-05)	(3.13e-05)	(3.12e-05)
Magnet	-0.0185***	0.0709***	-0.0844***
	(0.0056)	(0.0148)	(0.0240)
Black	0.1400***	-0.2390***	0.4690***
	(0.03190	(0.0893)	(0.0744)
Hispanic	0.14400***	-0.0515	0.5570***
	(0.0363)	(0.0782)	(0.0819)
Grade A	0.0103	-0.0180	-0.0688***
	(0.0074)	(0.0179)	(0.0257)
Grade D or F	-0.0351***	0.0551***	0.0424
	(0.0090)	(0.0194)	(0.0419)
Year Effects			
2017	0.0357***	0.0376*	0.2330***
	(0.0062)	(0.0197)	(0.0256)
2018	0.0593***	0.0398**	0.2040***
	(0.0063)	(0.0200)	(0.0258)
School Fixed Effects:			
High Density			
Elementary school	-0.12500***	-0.15700***	0.85200***
	(0.02820)	(0.03390)	(0.23600)
Middle school	0.03860***	-0.12800***	1.53200***
	(0.00736)	(0.0296)	(0.14000)
High School	-0.09570***	0.112***	-0.28700*
	(0.01670)	(0.03420)	(0.16600)
Low Density			
Elementary school	-0.0269*	-0.0800***	0.1820
	(0.0154)	(0.0263)	(0.2070)
Middle school	0.0659***	-0.1970***	0.8070***
	(0.0218)	(0.0489)	(0.1130)
High School	0.1820***	0.1740***	0.3230***
	(0.0186)	(0.0291)	(0.0564)
Constant	7.0800***	7.8460***	-9.9100***
	(0.4090)	(1.3190)	(1.3810)

R-squared	0.4010	0.0720	0.4600

Notes: All regressions include the following controls: dummies for school level, school demographics, log median income (district), unemployment (district), parents' income (district), and district demographics. In specifications 1 and 3 nearly all controls are significant at $p<0.01$. Specification 2 has all controls significant except for parents' education and income. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

School density is significant at the 1% level for total costs and purchased services and significant at the 10% level for salaries. Private school density is also significant at the 1% or 5% level for all three measures of cost. This is likely because schools have been exposed to this competition prior to s. 1002.31. Private school competition is associated with increases in total cost and salaries per pupil, but a decrease in purchased services. The cost increases are likely because private schools are often in wealthier areas. However, increased private school competition may induce schools to cut costs where they can, and perhaps this is in purchased services. It is not surprising that at this time, the out-of-district densities are insignificant or have very small effects on costs. Because statewide COE was passed only three years ago, the effect of this type of competition is probably not evident yet.

Specification 1 reports results for total school cost per pupil. Overall, my result is consistent with my hypothesis that increased competition induces schools to decrease costs. On average, schools with higher public school densities are associated with a decrease of 0.14% in total cost per pupil. While this result is significant, a 0.14% decrease in total cost per pupil does not seem practically significant. However, schools in districts with more COE transfers see an additional average decrease of 5.05% in total cost per pupil[4]. These two results combined suggest that competition created by transfers and school density is associated with lower overall per pupil costs.

My school fixed effects provide further evidence that competition drives schools to decrease their total costs per pupil. All dummies are significant (most at the 1% level), and each high-density school spends less money on total per pupil costs than its low density counterpart. For example, my high-density high school is associated with an additional 9.13% decrease in total school cost per pupil. On the other hand, the low-density high school sees an 19.9% increase. Furthermore, even though the coefficient for the high-density middle school is positive (suggesting this school sees increased total costs per pupil), the coefficient for the low-density middle school is also positive and even larger. Therefore, overall, the low-density middle school is still spending more per pupil than the high-density middle school.

Specification 2 reports results for salaries per pupil. Schools with higher densities spend 0.25% less on salaries per pupil on average. The effect of COE transfers is not significant. However, an increased presence of private schools is associated with a 0.3% average increase in salaries per pupil. While this effect is small, it is significant and expected: an increase in private school competition would increase labor demand for public schools. I would expect similar results in the presence of public school competition, however, it is possible that the law was passed too recently to observe this labor demand change.

[4] The estimated effects of COE transfers are likely overstated in each of my specifications. Because I measure COE transfers at the district level, the loss of within-district variation biases my results. While I believe the direction of the coefficients is correct, it is likely the magnitude is less intense.

All school fixed effects are significant at the 1% level. While I did not observe increased labor costs in the main effect, the fixed effects results suggest competition is reflected in some school salaries. The high density middle school spends more on salaries than its low density counterpart. Additionally, even though the high density high school spends less than its low density counterpart, the coefficient is positive. Again, after longer exposure to COE I would expect the opposite trend to occur. It is possible schools mainly try to decrease labor costs when they are first exposed to competition, but the increased need for labor will reverse this in the future.

Specification 3 reports results for purchased services per pupil. It is evident that schools with more public schools within 5 miles spend on average 0.92% more on purchased services per pupil. However, schools in areas with more COE transfers spend on average 23% less on purchased services per pupil. Both of these coefficients are significant at the 1% level. It is interesting that the two measures of competition produce opposite effects. One potential reason for this result is that high density schools are located in dense, high cost areas and have always spent more on purchased services, regardless of COE. Therefore, the negative coefficient on COE transfers suggests the threat of transfers induces schools to cut costs.

The fixed effects produce mixed results. The high density elementary and middle schools spend much more on purchased services than their low density counterparts. This result is in line with the coefficient for density. The opposite trend exists for the high schools. Overall, I believe that the opposite coefficients for density and COE transfers suggest that while increases in purchased services may be due to other sources of competition, schools that are exposed to more COE activity spend less.

6.2 Heterogeneity in the Effect of Competition on Per Pupil Expenditures

Table 6.2 presents the effects of competition on total per pupil costs with varying racial cutoffs in each specification. Specifications 1 and 2 are schools with the proportion of black or Hispanic students in the 25th percentile or lower, respectively. Specifications 3 and 4 are schools with the proportion of black or Hispanic students in the 75th percale or higher, respectively. Specification 5 is "diverse" schools with proportions of black, Hispanic, and white students in the 50th percentile or higher.

The effect of competition on schools with low proportions of black or Hispanic students is largely inconclusive. The effect of school density and COE transfers is insignificant. Density of non-district schools, however, has a significant and negative effect on total per pupil spending for schools with low proportions of black or Hispanic students. Schools with proportions of black or Hispanic students above the 75th percentile are associated with significant decreases in total per pupil spending. On average, schools with more than 37% black students see a 0.5% decrease in total per pupil costs due to high public school density and a 21% decrease due to COE transfers. Schools with more than 44% Hispanic students see average decreases in costs of 0.22% due to high public school density and 13.3% due to COE transfers.

Table 6.2 *Heterogeneity Across Race – Total Per Pupil Expenditures*

	(1)	(2)	(3)	(4)	(5)
Variable	<6% Black	<11%	>37% Black	>44%	Diverse

		Hispanic		Hispanic	
Density (public schools)	0.00028	-0.00020	-0.0046***	-0.0022***	-0.0107***
	(0.0004)	(0.0008)	(0.0008)	(0.0008)	(0.0025)
Density (non-district)	-0.0037***	-0.0026*	0.0037***	-0.0014	-0.0195
	(0.0014)	(0.0015)	(0.0011)	(0.0016)	(0.0157)
Density (private schools)	3.27e-05	0.00142	0.00399***	0.00193***	0.0239***
	(0.0003)	(0.0001)	(0.0008)	(0.0006)	(0.0054)
Prop. COE transfers	0.0045	-0.0332	-0.2420**	-0.1430**	-0.2390*
	(0.0164)	(0.0286)	(0.0946)	(0.0594)	(0.1230)
Enrollment	-0.0002***	-0.0003***	-0.0004***	-0.0003***	-0.0004***
	(1.78e-05)	(2.40e-05)	(1.90e-05)	(1.99e-05)	(3.00e-05)
Magnet	0.0047	-0.0013	-0.0405***	-0.0325**	0.0569
	(0.0127)	(0.0105)	(0.0107)	(0.0149)	(0.0388)
High school	0.0511**	0.1470***	0.2150***	0.2320***	0.2120***
	(0.0227)	(0.0275)	(0.0288)	(0.0366)	(0.0515)
Middle school	-0.0974***	-0.0767***	-0.0935***	-0.0814***	-0.0248
	(0.0091)	(0.0101)	(0.0153)	(0.0115)	(0.0339)
Grade A	0.0251***	-0.0182***	-0.0241	-0.0018	0.1210*
	(0.0075)	(0.0070)	(0.0232)	(0.0133)	(0.0620)
Grade D or F	0.0035	0.0203	-0.0295**	-0.0341**	-0.0568
	(0.0224)	(0.0147)	(0.0134)	(0.0156)	(0.0496)
Free/reduced price lunch	0.0977***	0.0254	0.0801**	0.0621**	0.1730*
	(0.0151)	(0.0174)	(0.0347)	(0.0306)	(0.0904)
Year Effects					
2017	0.0328***	0.0151	0.0469**	0.0420***	0.0808
	(0.0078)	(0.0099)	(0.0183)	(0.0162)	(0.0527)
2018	0.0700***	0.0401***	0.0443**	0.0681***	0.0969*
	(0.0077)	(0.0099)	(0.0187)	(0.0165)	(0.0542)
Constant	7.1460***	10.1600***	7.3460***	2.2820	6.8930
	(0.6690)	(0.4750)	(1.7320)	(1.8970)	(4.9330)
R-squared	0.4710	0.4400	0.3620	0.3510	0.3970

Notes: All regressions include the following controls: school demographics, log median income (district), unemployment (district), parents' income (district), district demographics. In specifications 1, 3 and 5 nearly all controls are significant at $p<0.01$. Specifications 2 and 4 have all controls significant except for some parents' education controls. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Diverse schools see the largest effects of competition on per pupil costs, with an average decrease of 1.1% due to high public school density and 21.3% due to COE transfers. Diverse schools are often in cities, which I would expect to see the largest effects of competition because they are densely populated and have lower travel costs. Diverse schools also see the largest increases in per pupil costs with respect to students receiving free/reduced price lunch. If these schools are concentrated in cities as I predict, then they perhaps have more resources to support lower socioeconomic students, which is reflected in this result.

6.3 School Quality Specification

Table 6.3 presents results for the effect of competition on school grade. I run these specifications for both charter and non-charter schools.

Total public school density has small and inconclusive effects. For all schools, more schools within five miles slightly increases the chances of a school receiving a grade of D or F. This is probably driven by inner-city schools in high density areas. For non-charters, density has a slightly negative effect of receiving an A or a B, which is again probably driven by inner-city schools.

Table 6.3 *Effect of Competition on School Grade—Charter vs. Non-Charter*

Variable	(1) Grade A or B (non-charter)	(2) Grade D or F (non-charter)	(3) Grade A or B (charter)	(4) Grade D or F (charter)
Density (public schools)	-0.0036***	0.0008***	0.0016	0.0017*
	(0.0006)	(0.0003)	(0.0016)	(0.0009)
Density (non-district)	0.0079***	-0.0035***	0.0170***	-0.0086***
	(0.0015)	(0.0006)	(0.0044)	(0.0018)
Density (private schools)	0.0044***	-0.0007**	-0.0013	-0.0019***
	(0.0006)	(0.0003)	(0.0015)	(0.0007)
Prop. COE transfers	0.0632**	-0.0307***	-0.0343	-0.0423*
	(0.0312)	(0.0119)	(0.0837)	(0.0236)
Enrollment	8.79e-05***	2.49e-05***	0.0003***	-4.95e-05***
	(1.09e-05)	(3.78e-06)	(3.34e-05)	(1.37e-05)
Magnet	0.0521***	-0.0252***	-	-
	(0.0137)	(0.00653)		
Free/reduced price lunch	-0.0807***	-0.0105	-0.1270***	0.0273
	(0.0180)	(0.0106)	(0.0433)	(0.0245)
Black	-0.7800***	0.2180***	-0.8710***	0.1240***
	(0.0292)	(0.0161)	(0.0680)	(0.0373)
Hispanic	-0.3690***	0.0274**	-0.3390***	0.0220
	(0.0331)	(0.0129)	(0.0780)	(0.0407)
Constant	-6.2590***	2.4650***	6.7540***	0.2480
	(0.7730)	(0.3780)	(2.3790)	(1.1020)
R-squared	0.2230	0.0740	0.2910	0.0540

Notes: All models include the following controls: dummies for school level, school demographics, log median income (district), unemployment (district), parents' income (district), district demographics. In specifications 1,2, and 3, nearly all controls are significant at p<0.01. Specification 4 has several race controls insignificant, such as parents' education, income, and some race variables. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

For both charters and non-charters, higher non-district density increases their chances of scoring well and decreases their chances of scoring poorly. While I did not see much influence of non-district schools on costs, they are influential on school grades. This result is encouraging: the fact that this type of density is significant and has the same effect for all schools suggests that quality may be influenced by competition.

The effect of COE transfers is significant in all but specification 3 and has expected results. Schools in districts with more COE transfers are more likely to receive a high grade and less likely to receive a low grade. Whereas the density variable is likely biased by inner city schools, the coefficients for COE transfers suggest real effects of competition. Private school competition leads to similar results, and again supports the idea that competition of any type leads schools to improve.

Overall, while the effect of public school density on school grade is inconclusive, all schools see expected effects from other forms of competition: non-district density, private schools, and COE transfers. This could suggest that the threat and prevalence of transfers is starting to affect these schools. However, it is not surprising that the effect of density on school grade is inconclusive. It is easy for schools to change their costs on a yearly and as-needed basis, while it may take several years for them to make evident changes in quality. Therefore, there is likely a lag in the effect of competition on quality. Nonetheless, these results provide compelling evidence that both charter and non-charter schools experience similar effects from competition.

6.4 Robustness Checks

Next, I run my previous specifications under alternative assumptions as tests for robustness. First, I compare schools with varying degrees of competition prior to s. 1002.31. Then, I run my baseline cost and school grade specifications for 2018 only to see if effects hold in this year alone.

Table A.1 presents results for the effect of competition on costs for schools that were exposed to transfer competition prior to s. 1002.31 and those that were not. I create two subsets of districts for comparison: those that had more than 0.5% of their students transfer in the year prior to s. 1002.31, and those that had fewer than 0.5%. Specifications 1, 2, and 3 test the subset of schools with fewer than 0.5% of students transferring prior to s. 10002.31, and 4, 5, and 6 test the other subset. I find that the main effects of competition (both in and out of district) on costs per pupil are largely similar for all costs in both groups. One difference is that the effect of transfers on schools without prior exposure to COE is positive, while it is negative for schools with prior exposure. As discussed, this could be due to the fact that schools with prior exposure have had more time to adjust to competition. That the overall effects of competition are similar for both groups suggests that s. 1002.31 is affecting schools regardless of prior exposure to competition.

I run the same robustness check in Table A.2 for the effect of competition on school grade. The direction of the coefficients of interest are the same and the magnitudes are very similar. As in the analysis section, higher school density is associated with decreased probabilities of receiving good school grades. This is again likely driven by inner city schools; it may be too early to observe true effects of competition on school grades.

Table A.3 presents results for the effect of competition on per pupil expenditures and school grades for 2018 only. The direction and magnitude of the density coefficients for costs are the same as those in the pooled regression results. However, the coefficient for salaries is insignificant in this specification. This suggests significant changes in salaries may take several years to be evident. I include the same school fixed effects as before in this specification and find similar trends in all cost areas to the pooled regression results. One major difference in this specification is that the coefficients for COE transfers are all insignificant except for total cost per pupil. While this coefficient was also insignificant for salaries in the pooled regression results, I lose the significant effect for purchased services. Overall, isolating 2018 shows that the effects on total cost per pupil hold while some of the effects on sub-costs are only evident in the pooled results. This is not surprising as I would expect to see trends over several years with fluctuations in certain sub-costs year-to-year. The school grade results are also largely similar to the main specification. Again, while the density coefficients suggest that higher density leads to worse school grades, the effect of COE transfers on receiving a poor grade is negative. Therefore, even in 2018 alone, more COE transfers is associated with better school grades.

6.5 Discussion

In my analysis, I find that effects of COE-induced competition are most evident in per pupil expenditures. In my main specification, public school and private school density have significant average effects on total costs, salaries, and purchased services. Because the number of schools in an area does not change in the span of a few years, it is possible that the perceived effect of school density is driven by competition that existed prior to s. 1002.31. However, district COE transfers do have a significant average effect on total costs and purchased services, which suggests at least some of the change in costs is due to COE transfer activity. The expected effect of school density is also present in the school fixed effects. High density schools have lower total costs and salaries per pupil, but higher purchased services per pupil. That purchased services increase with density suggests that this effect is a result of longstanding competition from high density schools in high cost areas. The distinction between sources of competition is evident in coefficient for COE transfers, which is negative. Therefore, regardless of a school's historical spending on purchased services, these costs decrease with more COE transfers.
In my tests for heterogeneity, diverse schools have the largest changes in per pupil costs. This result is not surprising because diverse schools are likely to be in dense, high cost areas. These schools face a lot of competition due to more nearby schools and decreased travel costs.

Additionally, schools with minority student populations in the 75th percentile or higher have greater changes in costs than schools with minority student populations in the 25th percentile or lower. This result is likely caused by stratification that occurs both historically and as a result of school choice policies (Hastings 2009, Denice and Gross 2016). Schools with large minority populations are typically in low income neighborhoods and do not perform as highly as schools with large white populations. As a result, these schools face the biggest threat of enrollment loss in an open enrollment program, and thus may be induced to cut costs. This effect of competition on disadvantaged schools could be problematic if their decreases in costs have adverse effects on quality. Furthermore, competition could cause these schools to close altogether if they cannot compete.

Lastly, my school grade specifications reveal the most prevalent source of competition at this time comes from non-district density, private school density and COE transfers. Currently, public school density actually decreases a school's chance of receiving a high grade, which is likely not due to COE competition but driven by inner city schools. I predict there is a lag in the effect of competition on school grade because it can take several years for changes in quality to be evident. Nonetheless, the threat of transfers either through non-district density, private school density, or COE has the expected effect on school grades. It is interesting that the non-district and private school densities have significant effects on school grades and overall public school density does not. Private schools were likely a competitive threat prior to s. 1002.31, but it is unclear why non-district schools would affect quality while within-district schools do not. Perhaps there is some unobserved characteristic associated with non-district density that affects quality. Overall, these effects are largely similar for both charter and non-charter schools and show that schools of all types are similarly affected by COE.

It is important to note that due to some data limitations, my COE coefficients are likely biased upwards. Because I use district-level COE counts to avoid missing data, I lose variation that occurs within districts. Therefore, my estimated effects of COE transfers are likely overstated. Overall, the results from my pooled regressions show small to moderate effects of competition. Because statewide COE was passed only three years ago, it is not surprising that these effects are small. Nonetheless, it is interesting that in only two school years there are evident effects of competition, as evinced in the significant coefficients of interest. That changes in per pupil expenditures occur so quickly suggests schools are very sensitive to competition.

7 Conclusion

In this paper, I attempt to argue that Florida's statewide COE creates competition which impacts school supply-side behavior. Using theory from Tiebout's model of local public goods, I argue that reductions in travel and switching costs caused by COE influence the market for education. Granting more choice to parents means schools must compete for enrollment, which I predict influences their cost and quality choices. In my results, I find small to moderate effects of competition of all types on per pupil expenditures, and evidence of the effect of COE and some school densities on school grades.

While I find significant effects of competition, I did come across many data limitations in my analysis. As previously stated, I faced many issues of missing data due to the Florida DOE's privacy restrictions. Because student counts of less than ten are missing from the data, I am not able capture school-level COE activity. I instead use district-level COE to avoid bias from missing data. However, the district-level data is not without limitations itself; I am likely losing variation of transfers that occurs within districts. Therefore, these effects are likely overstated. Student transfer counts are currently low because s. 1002.31 was passed only three years ago. After more time has passed and parents are more informed on the policy, more students will transfer via COE. I would be interested in testing this model again in the future when enough students transfer such that the school-level COE data is complete. Then, I could account for school-level transfer variation. Additionally, I believe that the effect of competition will only increase with time, and that changes in costs and quality will be more evident.

The evidence that schools do react to competition also has important policy implications. The evidence that schools alter their behavior in response to market changes is encouraging, but it is important to understand the consequences of changes in per pupil expenditures. While theory predicts competition will make schools more productive, large decreases in per pupil expenditures may have adverse effects. For example, COE may leave schools that suffer from stratification worse off if they cannot improve quickly and affordably. Future research should look to longitudinal studies to determine whether competition from policies like COE actually improves student outcomes. In the meantime, more student COE transfers and rigorous data collection will help researchers isolate the true effects of competition at the school level.

Appendix

Table A.1 *Comparison of Schools with Different COE Exposure – Per Pupil Expenditures*

Variable	(1) Log Total School Costs per pupil (no COE = 1)	(2) Log Salaries per pupil (no COE = 1)	(3) Log Purchased Services per pupil (no COE = 1)	(4) Log Total School Costs per pupil (no COE = 0)	(5) Log Salaries per pupil (no COE = 0)	(6) Log Purchased Services per pupil (no COE = 0)
Density (public schools)	-0.0028**	-0.015**	0.0191***	-0.0011***	-0.0011	0.0062***
	(0.0014)	(0.0066)	(0.0034)	(0.0003)	(0.0013)	(0.0016)
Density (non-district)	-0.0099***	-0.0254***	-0.0150*	-1.99e-05	1.17e-05	-0.0114***
	(0.0024)	(0.0076)	(0.0082)	(0.0006)	(0.0016)	(0.0032)
Density (private schools)	0.0045**	0.0203**	-0.0216***	0.0015***	0.0018*	-0.0185***
	(0.0022)	(0.0089)	(0.0062)	(0.0003)	(0.0010)	(0.0020)
Prop. COE transfers	2.6580***	2.6400	2.3840	-0.0527***	-0.0876*	-0.1510**
	(0.6310)	(1.8420)	(1.6830)	(0.0152)	(0.0532)	(0.0630)
Enrollment	-0.0003***	0.0001*	-0.0004***	-0.0003***	-6.34e-06	-0.0004***
	(2.88e-05)	(8.13e-05)	(6.55e-05)	(1.14e-05)	(3.21e-05)	(3.53e-05)
Magnet	-0.03260**	0.07600*	-0.2180***	-0.0389***	0.0476***	-0.0902***
	(0.0142)	(0.0423)	(0.0379)	(0.0068)	(0.0181)	(0.0328)
Grade A	-0.0187	0.0130	0.0111	0.0175**	-0.0315	-0.0914***
	(0.0168)	(0.0347)	(0.0361)	(0.00801)	(0.0200)	(0.0306)
Grade D or F	-0.0198	0.1020**	-0.0218	-0.0377***	0.0295	0.0723
	(0.0215)	(0.0486)	(0.0490)	(0.00974)	(0.0208)	(0.0510)
Black	0.3710***	0.5700	3.011***	-0.244***	0.0700	0.3620*
	(0.1360)	(0.4970)	(0.4450)	(0.0585)	(0.2110)	(0.1980)
Hispanic	0.5240***	0.4610*	-1.4550***	-0.0334	0.3710***	-2.6170***
	(0.1180)	(0.2730)	(0.2570)	(0.0391)	(0.1140)	(0.1650)
2017	0.00890	0.0152	0.0195	0.0369***	0.0353*	0.299***
	(0.0143)	(0.0489)	(0.0407)	(0.0067)	(0.0212)	(0.0307)
2018	0.0151	-0.0112	0.00345	0.0619***	0.0400*	0.263***
	(0.0154)	(0.0584)	(0.0456)	(0.0066)	(0.0213)	(0.0310)
Constant	0.9470	2.6500	-19.6000***	7.2840***	7.7890***	-13.8800***
	(1.6190)	(4.1770)	(3.9750)	(0.4300)	(1.5810)	(1.6480)
R-squared	0.3640	0.0950	0.4710	0.4470	0.0880	0.4710

Notes: Robust standard errors in parentheses. All models include the following controls: dummies for school level, school demographics, log median income (district), unemployment (district), parents' income (district), district demographics. *** p<0.01, ** p<0.05, * p<0.1.

Table A.2 *Comparison of Schools with Different COE Exposure – School Grade*

Variable	(1) Grade A or B (no COE = 1)	(2) Grade D or F (no COE = 1)	(3) Grade A or B (no COE = 0)	(4) Grade D or F (no COE = 0)
Density (public schools)	-0.0050***	0.0019***	-0.0019***	0.0006**
	(0.0013)	(0.0006)	(0.0006)	(0.0003)
Density (non-district)	0.0094***	-0.0027**	0.0079***	-0.0039***
	(0.0026)	(0.0010)	(0.0016)	(0.0006)
Density (private	0.0033**	-0.0019***	0.0029***	-0.0006**

schools)				
	(0.0013)	(0.0005)	(0.0006)	(0.0003)
Prop. COE transfers	1.0840	0.0877	0.0358	-0.0447***
	(1.1070)	(0.4860)	(0.0314)	(0.0120)
Enrollment	0.0001***	2.07e-05***	0.0001***	9.32e-06**
	(1.95e-05)	(7.69e-06)	(1.16e-05)	(4.03e-06)
Magnet	0.1370***	-0.0421***	0.0044	-0.0150*
	(0.0244)	(0.0123)	(0.0177)	(0.0080)
Charter	0.1260***	-0.0160	0.0749***	0.00733
	(0.0287)	(0.0129)	(0.0157)	(0.0075)
Free/reduced price lunch	0.0337	-0.0450**	-0.1300***	-4.03e-05
	(0.0381)	(0.0178)	(0.0192)	(0.0119)
Black	-0.7390***	0.1790***	-0.7710***	0.2040***
	(0.0493)	(0.0280)	(0.0319)	(0.0176)
Hispanic	-0.5670***	0.0186	-0.2790***	0.0293**
	(0.0673)	(0.0285)	(0.0340)	(0.0140)
2017	-0.0124	-0.0085	0.0142	-0.0042
	(0.0241)	(0.0115)	(0.0133)	(0.0069)
2018	0.0379	-0.0029	0.0451***	-0.0231***
	(0.0269)	(0.0133)	(0.0133)	(0.0064)
Constant	1.5510	-0.1230	-6.7630***	2.3920***
	(2.1320)	(0.8320)	(0.8480)	(0.4260)
R-squared	0.2910	0.0760	0.2300	0.0710

Notes: Robust standard errors in parentheses. All models include the following controls: dummies for school level, school demographics, log median income (district), unemployment (district), parents' income (district), district demographics. *** p<0.01, ** p<0.05, * p<0.1.

Table A.3 *Effect of Competition on Per Pupil Expenditures and School Grades – 2018*

Variable	(1) Log Total School Costs	(2) Log Salaries	(3) Log Purchased Services	(5) Grade A or B	(6) Grade D or F
Density (public schools)	-0.0015***	-0.0036	0.0088***	-0.0026***	0.0014***
	(0.0006)	(0.0027)	(0.0025)	(0.0010)	(0.0004)
Density (non-district)	0.0006	0.0025	-0.0127***	0.0075***	-0.0035***
	(0.0010)	(0.0034)	(0.0048)	(0.0027)	(0.0010)
Density (private schools)	0.0017***	0.0042*	-0.0199***	0.0033***	-0.0015***
	(0.0005)	(0.0023)	(0.0030)	(0.0009)	(0.0004)
Prop. COE transfers	-0.0619***	-0.0635	-0.1290	0.0490	-0.0411***
	(0.0236)	(0.0854)	(0.1010)	(0.0508)	(0.0136)
Enrollment	-0.0003***	5.60e-05	-0.0003***	0.0001***	8.33e-06*
	(2.02e-05)	(5.48e-05)	(5.26e-05)	(1.68e-05)	(4.75e-06)
Magnet	-0.0247**	0.0793***	-0.0873**	0.0593**	-0.0158

	(0.0098)	(0.0256)	(0.0383)	(0.0238)	(0.0100)
Charter	-	-	-	0.1040***	0.0060
				(0.0226)	(0.0107)
Free/reduced price lunch	0.0484***	0.0157	-0.7070***	-0.0592**	-0.0181
	(0.0183)	(0.0708)	(0.0638)	(0.0286)	(0.0155)
Black	0.1430**	-0.2270	0.5090***	-0.7760***	0.1790***
	(0.0574)	(0.1560)	(0.1190)	(0.0480)	(0.0233)
Hispanic	0.1590***	0.0441	0.5380***	-0.3360***	0.0251
	(0.0564)	(0.1350)	(0.1270)	(0.0532)	(0.0192)
School Fixed Effects:					
High Density					
Elementary School	-0.1060***	-0.1840***	0.4230***	-	-
	(0.0171)	(0.0572)	(0.0589)		
Middle School	0.0465***	-0.1110***	1.3260***	-	-
	(0.0132)	(0.0316)	(0.0530)		
High School	-0.1090***	0.1170**	-0.3900***	-	-
	(0.0184)	(0.0550)	(0.0593)		
Low Density					
Elementary School	-0.0114	-0.0353	-0.2590***	-	-
	(0.0136)	(0.0370)	(0.0499)		
Middle School	0.1130***	-0.1780**	0.6260***	-	-
	(0.0265)	(0.0890)	(0.1000)		
High School	0.2200***	0.1930***	0.3940***	-	-
	(0.0191)	(0.0419)	(0.0635)		
Constant	7.4050***	7.3460***	-5.2610**	-4.5410***	1.3550**
	(0.7220)	(2.4010)	(2.3400)	(1.2580)	(0.5570)
R-squared	0.3810	0.0840	0.4860	0.2370	0.0690

Notes: Robust standard errors in parentheses. All models include the following controls: dummies for school level, school demographics, log median income (district), unemployment (district), parents' income (district), district demographics.
*** p<0.01, ** p<0.05, * p<0.1.

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