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Effects of Public-School Choice on Private Schools: Evidence from Open Enrollment Reform

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Effects of Public School Choice on Private Schools: Evidence from Open Enrollment Reform*

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Abstract

This paper investigates the effect of a policy-induced increase in public school competition on private school enrollment and budget outcomes. I exploit a natural experiment created by the introduction of an open enrollment policy that expanded public school choice opportunities and increased competitive pressure on private schools. Using a new data set constructed from mandatory nonprofit information returns and school enrollment records, I find that an increase in public school competition reduces private school enrollment. Secular and Catholic school enrollment is most responsive to increased public school choice, whereas other Christian and other faith schools experience no reduction in enrollment. The negative enrollment effects are concentrated among high school age students. I find no evidence that private schools respond to this increased public school choice by adjusting their revenue and spending choices.

Keywords: school choice, school competition, open enrollment, private schools.

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1 Introduction

School choice remains an important topic of debate in education research and policy. Proponents argue that school choice can improve outcomes of families via two main channels: by allowing families to enroll their children in better schools or schools more suited to their children's needs; and by providing market incentives for schools to produce better outcomes as they compete for students. While numerous empirical and theoretical studies have investigated how competitions from private school affects public school outcomes,[1] very little attention has been paid to the ways in which private schools respond to increased public school choice, possibly due to lack of data.

This paper addresses this gap and provides the first evidence of how competition from public school open enrollment affects private school outcomes. Open enrollment is a very common policy that aims to increase choice by allowing students to attend public schools outside their neighborhood attendance zone.[2] I investigate how the increased public school competition arising from the introduction of open enrollment affects the number of students enrolled in private schools, tuition prices and expenditures.

The idea that private school choice incentivizes public schools to produce better educational outcomes relies on the premises that families (i) value school quality when making school choice decisions and (ii) view private and public schools as close substitutes. I test the latter premise by studying how the expansion of public school choice affects private school enrollment. I answer whether private schools show active competitive behavior by adjusting prices and spending in response to a negative demand shock. The supply side responses also helps to interpret the effects on enrollment. For example, if schools lower prices in response to a negative demand shock, the change in enrollment alone will underestimate the magnitude of the demand shock.

If increased public school choice results in reduction in private school enrollment, then the goal of open enrollment of making education provision more equitable can be undermined. Private school students may migrate from private schools to take available spots in high-quality public schools that would otherwise go to disadvantaged students residing in an out-of-catchment neighborhood. Furthermore, as the private sector often accounts for a growing share of total enrollment,[3] policies that affect private school can impact the school

[1] See Urquiola (2016) for a summary of those theoretical and empirical results.

[2] In 2019, all but three states in the US have policies addressing intra or interdistrict open enrollment policy (Education Commission, 2019). Among many jurisdictions, Chile in 1981, Sweden in 1992, England in 1998, and British Columbia, Canada in 2002 have also adopted some form of open enrollment policy.

[3] Private schools account for 13% in British Columbia, 47% in Chile, 12% in Denmark, 70% in Holland, 15% in New Zealand, 10% in Sweden of K-12 enrollment (Friesen, Meilman Cohn, & Woodcock, 2019). In the US, 32 percent of parents reported considering both private and public schools, according to the 2007

system overall. For example, as funding for public schools is tied to student enrollment, changes in private enrollment can affect government budgets to fund students.

Increased public school choice may not raise competitive pressure on private schools, for at least two reasons. First, families might view public schools as imperfect substitutes to private schools given their differentiated curricula.[4] That is, private schools might differentiate themselves along dimensions of faith, academic focus, or an alternative learning environment. Second, if families have preference over peers, public school students who experience or anticipate a reduction in peer or school quality under open enrollment might decide to attend a private school instead. [5]

I frame my analysis using a simple stylized model of school choice in an environment where spatially differentiated private schools choose price and quality to maximize profits. I assume families have preferences over school characteristics, such as proximity, quality of instruction, and price. Under this model, private schools that charge higher prices and are located in areas with more high-quality proximate public schools experience stronger negative demand shocks when open enrollment is introduced. To maximize profits, private schools choose tuition price in response to their local market power, which in turn depends on their market share and its sensitivity to changes in price. The choice of quality also depends on market power, but it can be constrained by government funding rules. If higher competition from public schools decreases demand for private schools, the model predicts that private schools will reduce tuition and provide higher school quality.

I empirically evaluate the impact of open enrollment policy on private school outcomes using a natural experiment created by the introduction of an open enrollment policy that relaxed restrictions on enrollment in public schools out of the neighborhood attendance zone. My identification strategy relies on the variation in the intensity of exposure to local public school competition among private schools before and after the policy. For private schools located in areas where public schools are very distant from one another, students are less likely to opt out of private schools following the introduction of open enrollment because

National Household Education Survey. World Bank (2011) highlights the growing importance of nonstate provision of education. The share of private sector enrollment for primary and secondary school is highest in South Asia (around 30 and 50 percent, respectively) and in Latin America and the Caribbean (around 15 and 18 percent, respectively).

[4]MacLeod and Urquiola (2013) discuss how schools strategically offer differentiated products to exploit the fact that families do not have unanimous preferences. Gilraine, Petronijevic, and Singleton (2019) provide evidence that charter school entry increases test scores of exposed students, but when the charter schools are horizontally differentiated (e.g: by choosing an alternative curriculum to the one used in traditional public schools), then there is no effect on student achievement. This result suggests that competitive effects may be muted if product differentiation makes schools less substitutable.

[5]In a theoretical model of public school choice, Barseghyan, Clark, and Coate (2019) show that if peer preference is strong, open enrollment can reduce the quality of public schools in affluent neighborhoods when the benefits of increased school effort are offset by the cost of inferior peer groups.

open enrollment creates fewer new local alternatives and travel is costly. In contrast, private schools located in areas where public schools are spatially dense experience a greater increase in competition under open enrollment. In those areas, I hypothesize that students who would otherwise attend private school are more likely to attend an out of catchment public school under the new policy.

Using a new data set constructed from nonprofit information returns and administrative school data for the population of private schools in British Columbia (BC), Canada, I compare pre- and post-treatment enrollment and school budget outcomes for K-12 private schools that were differentially exposed to increased public school competition, depending on the concentration of nearby public schools. My empirical specification differences out any unobserved time-invariant factors at the school and grade level that influence outcomes and are correlated with the spatial concentration of public schools. I investigate how the estimated impacts are mediated by the underlying school market structure. In particular, I assess heterogeneity of the effects across school characteristics, including curriculum/school type, funding level, tuition price,[6] and expenditure per student. This paper is the first to use nonprofit information returns in Canada to study private school budgets.[7]

I find that increased public school choice reduces private school annual enrollment by 1.2 students per grade for a private school with the median number of nearby public schools. This effect correspond to about 3.4 percent of the average number of students per grade in private school. The initial effect is small but grows in magnitude over time. After five years, the effect on a private school facing median competition level is -1.8 students per grade. Effects are concentrated in secular and Catholic schools. In contrast, other Christian and other faith schools experience no reduction in enrollment under increased public school choice. This result indicates that public schools are better substitutes for secular and Catholic schools than for other faith schools, potentially due to similarity in curricula. This result echoes the finding in Gilraine et al. (2019) that demand for horizontally differentiated charter schools (by different curriculum choice) is unresponsive to public school quality. The enrollment effects I find are also concentrated in private schools that offer secondary education. Since students have to change schools when they start high school, I conjecture that greater competition from public schools was more salient to students in these grades. These effects are robust to several checks including various measures of competition and model specifications.

On the supply side, I find no empirical evidence that private schools respond to increased competition by adjusting per student revenue or expenditure. The competition created from

[6] I use revenue per student net of government grants and donations as a proxy for tuition price.

[7] Hungerman and Rinz (2016) use data of similar nature to investigate the effect of large-scale subsidies on private school enrollment and revenue in the US.

open enrollment causes a small negative shock to private school demand, but it is not strong enough to affect private school spending and pricing choices.

My enrollment results are related to the literature on the effects of charter school entry on private school enrollment in Michigan. Using school fixed effects and instrumental variables to address endogenous location of new charter schools in their estimation, Chakrabarti and Roy (2016) find no effect of charter school entry on enrollment in either secular or faith private schools. Toma, Zimmer, and Jones (2006) find that private schools lose around one student for every three students gained by charter schools, but their analysis was limited to county-level data for a narrower period and does not account for pre-policy trends or endogenous charter location. Unlike these two papers, the environment I study eliminates concerns about treatment endogeneity arising from school location. Furthermore, I go beyond enrollment outcomes and investigate whether private schools respond by adjusting expenditures and tuition prices. Consequently, I can rule out the hypothesis that enrollment changes (or lack thereof) were a result of price changes and learn whether private schools show active competitive behavior.

This paper also contributes to the literature that investigates how private schools and their students respond to large scale government programs. Dinerstein, Smith, et al. (2015) find that increasing subsidies for New York public schools increased the likelihood of private school closure. Hsieh and Urquiola (2006) study the effect of private school entry in response to the introduction of Chile's voucher system on test scores, repetition rates, and years of schooling of students. They find no effect of choice on educational outcomes, but they observe an increase in sorting due to cream-skimming. Menezes-Filho, Moita, and de Carvalho Andrade (2014) investigate the effect of *Bolsa-Familia* cash transfer program in Brazil on private school entry. Their results show that towns where the skill distribution of students widened due to the expansion of *Bolsa-Familia* program saw higher rates of private school entry.

A third related literature to my paper studies the effects of public school open enrollment on student achievement. Friesen, Cerf, and Woodcock (2019) assess the effect of the same open enrollment reform that I study here on student achievement. Unlike this paper, they use student-level data restricted to BC Lower Mainland students in grade 4 and 7 and focus on public school students. Their evidence that many more parents enrolled their children in out-of-catchment public schools following the reform shows that the policy had a positive impact on increasing public school choice. However, they do not investigate whether out-of-catchment students came exclusively from in-catchment public schools or whether they had previously been enrolled in private school. Exploiting variation in the intensity of competition from nearby schools, they find small positive effects of open enrollment on

student achievement. Lavy (2010) evaluates a public school choice reform implemented in Tel Aviv, Israel. He finds that the reform significantly improved student attainment as reflected in reduced drop-out rates, higher test scores, and better behavioral outcomes. For the UK, Gibbons, Machin, and Silva (2008) exploit geographical variation in choice and use instrumental variable strategy to account for the potential endogeneity of residential sorting. They find little evidence that choice affects student achievement but found a positive effect of competition on school performance. Also in the UK, Bradley and Taylor (2002) find stronger productivity gains using a difference-in-difference approach.

The remainder of the paper is organized as follows. Section 2 reports the institutional context of the school system in BC and the details of the open enrollment policy. Section 3 sets up a simple theoretical framework. Section 4 describes the data and section 5 presents the empirical strategy. In section 6, I present the results. I conclude in section 7.

2 Institutional Context and Open Enrollment

I study the introduction of open enrollment legislation in BC during the 2002/2003 school year. Before 2002, public school choice was fairly restricted in BC and the prevailing assumption was that a student would attend his or her neighborhood school. Transfers across school catchments required approvals from the sending and receiving school principals. Since 2002, parents were granted the right to enroll their children in any public school in the province that has space available after students who reside in the catchment area have enrolled.[8] When public schools are over-subscribed, school boards give priority to students who reside within the district. Boards may elect to give priority to siblings of children who are already enrolled. Within these enrollment criteria, public school principals have discretion over which students to enroll.

In addition to regular public schools, parents have the choice to send their children to independent (non-public) schools that charge tuition (private schools henceforth), public magnet programs, or they may opt for home schooling. French Immersion is the most popular public magnet program, accounting for 9.3%[9] of total enrollment in the public sector in 2017/2018 school year. Spaces in French Immersion programs are often allocated by lottery.

Operating and capital funding from the BC Ministry of Education goes directly to public

[8] In Canada, while all provinces permit interdistrict transfers, only three have legislation of intradistrict transfers, and BC is the only province that does not requires educators to approve the transfers of students (Brown, 2004). Wixom (2017) reports that, in 2016, nearly all states in US (46 states plus District of Columbia) have policies addressing open enrollment.

[9] Based author's calculations from administrative data from the BC Ministry of Education.

school districts. Districts receive operating funds in proportion to enrollment, with supplementary funding for Aboriginal students, gifted students, students with disabilities and students who qualify for English as a Second Language (ESL) instruction. Public districts and schools are not permitted to raise any additional revenue and are required to teach the provincial curriculum. Hiring, firing and remuneration of teachers is determined by a collective agreement between the government and the BC teachers' union. Teachers are usually hired on permanent contracts and are difficult to fire.

Since 1977, private schools that conform to provincial curriculum standards and meet various provincial administrative requirements receive subsidies. BC provides 50 percent of the per student public school grant to private schools whose operating costs are no higher than in the public system (funding group 1), and 35 percent to those whose operating costs are higher (funding group 2). The BC Ministry of Education does not limit the total subsidy to each school.

To be eligible for the subsidies, private schools must operate on a not-for-profit basis, offer the provincial curriculum, hire qualified BC teachers and participate in standardized testing programs. Unlike public schools, private schools may provide a faith-based learning environment and offer religious instruction. They may charge any amount of tuition and they have discretion to admit students as long as it does not violate the Canadian Charter of Rights and Freedoms or the provincial Human Rights Code. Private schools have autonomy to hire, fire and remunerate teachers subject only to provincial labor standards legislation. Private faith schools in BC serve a variety of religious communities, including Catholic, Protestant, Sikh, Jewish and Muslim. Secular schools include "prep schools" that are focused on academic excellence and university preparation. A smaller group of private schools offer Montessori or Waldorf programs, or specialized education for students with special learning needs. Tuition fees range widely, from several thousand dollars per year at some faith schools to $25,000 or more at top-ranked prep schools. Private schools are also supported through donations (gifts) from individuals and from supporting foundations and organizations.

All public and provincially funded private schools in BC are required to administer standardized tests to students in grades 4 and 7 in reading and numeracy each year. A centralized grading system ensures that a consistent standard is applied across schools. These test are low stakes as their scores do not contribute to students' academic records and play no role in grade completion, and there are no financial incentives for teachers or schools related to student performance. The Ministry of Education began posting school-average test scores on their website in 2001. The Fraser Institute, an independent research and educational organization, began issuing annual "report cards" on BC's elementary schools in June 2003 (Cowley, Easton, & Thomas, 2003). These reports include school scores and rankings based

on test scores. From the outset, the school report cards have received widespread media coverage in the province's print, radio and television media.

BC is an ideal setting to study the competitive pressure of the public school system on private schools because there is a narrower quality gap[10] than in other jurisdictions and the cost of private school education is more accessible to families compared to school markets where private schools are not subsidized and are for profit.

3 Theoretical Framework

The simplified theoretical framework that follows characterizes the ways families trade off different school characteristics when making their choices. Spatially differentiated private schools choose quality and prices to maximize profits.[11] The objective of this model is to provide intuition for the empirical analysis that estimates the impact of increased public school choice on private school outcomes. After open enrollment, families might find that the schools added to their choice set yield larger utility than their current choice depending on their characteristics, such as distance, quality and price. Private schools experience increased competition from public schools by adjusting prices and/or investments in quality in order to maximize profits and adapt to the new environment.

3.1 Demand side

I develop a simple model of school choice, conditional on residential choice. The family of student i living in neighborhood k chooses a school j from a set of C_k schools and obtains utility:

$$U_{ij} = \beta q_j + \lambda p_j + \gamma d_{jk} + \alpha_{ij} + \epsilon_{ij}$$

where q_j is the quality of school $j \in C_k$, p_j is the tuition price of j, d_{jk} is the travel distance to school j for residents of neighborhood k. The parameters $\beta > 0$, $\lambda < 0$ and $\gamma < 0$ represent taste for school quality, tuition price and travel distance, respectively. α_{ij} is a random taste parameter of student i for school j and ϵ_{ij} is an independent and identically distributed random shock.

After evaluating utility from schools in the choice set, families choose school j when $U_{ij} \geq U_{ir}\ \forall\, r = 1, 2, ..., n_k$. That is,

[10] Friesen, Meilman Cohn, and Woodcock (2019) document a large overlap in the distributions of school quality, peer quality and student ability of private and public schools.

[11] The setup of my model parallels Card, Dooley, and Payne (2010) and Friesen, Cerf, and Woodcock (2019) on the demand side, and Neilson (2017) on the supply side.

$$\beta \Delta q_{jr} + \lambda \Delta p_{jr} + \gamma \Delta d_{jr,k} + \delta_{jr,i} \geq \epsilon_{ir} - \epsilon_{ij}$$

$$\forall\, r = 1, 2, ..., n_k$$

where $\Delta q_{jr} = q_j - q_r$, $\Delta p_{jr} = p_j - p_r$, $\Delta d_{jr,k} = d_{jk} - d_{rk}$ and $\delta_{jr,i} = \alpha_{ij} - \alpha_{ir}$.

Consider now the families that maximize their utility by choosing a private school. Denote this private school $j \in C_k$ that maximizes the utility of family i as j^*. Open enrollment expand families' choice sets to include additional public schools. Let the new choice set be C'_k. The probability that family i prefers a public school $r \neq j^*$ added to the choice set is:

$$1 - F\left[\beta \Delta q_{j^* r} + \lambda p_{j^*} + \gamma \Delta d_{j^* r,k} + \delta_{jr,i}\right] \tag{1}$$

where F is the distribution function of the random variable $\epsilon_{ir} - \epsilon_{ij^*}$, normalized to have mean zero. p is zero for public schools added to the choice set, so only p_{j^*} is in eq. (1).

The partial derivatives of eq. (1) with respect to school quality q_r, price of private school p_{j^*}, and travel distance to school d_{rk} are:

$\frac{\partial(1-F)}{\partial q_r} = \beta f(\beta \Delta q_{j^* r} + \lambda p_{j^*} + \gamma \Delta d_{j^* r,k} + \delta_{jr,i}) > 0$ (since $\beta > 0$)

$\frac{\partial(1-F)}{\partial p_{j^*}} = -\lambda f(\beta \Delta q_{j^* r} + \lambda p_{j^*} + \gamma \Delta d_{j^* r,k} + \delta_{jr,i}) > 0$ (since $\lambda < 0$)

$\frac{\partial(1-F)}{\partial d_{rk}} = \gamma f(\beta \Delta q_{j^* r} + \lambda p_{j^*} + \gamma \Delta d_{j^* r,k} + \delta_{jr,i}) < 0$ (since $\gamma < 0$)

where f is the density function of $\epsilon_{ir} - \epsilon_{ij^*}$. All else equal, the probability that a family will choose a school different than j^* is *increasing* in the quality of the new public schools available relative to private school j^*, in the price of j^*, and in the number of schools added to the choice set. It is *decreasing* in the travel distance to the additional schools relative to school j^*.

Assuming the area is partitioned in neighborhoods $k = 1, 2, ..., K$, and that all homes in neighborhood k have the same relative distance to each school, the market share of school j is given by:

$$s_j(Q, P, D) = \sum_{k}^{K} \sum_{i \in A_k} \prod_{r \neq j} F\left[\beta \Delta q_{jr} + \lambda p_j + \gamma \Delta d_{jr,k} + \delta_{jr,i}\right] \tag{2}$$

where A_k is the set of students that live in neighborhood k and Q, P, D are vectors of relative qualities, prices, and relative distances of all schools in the market. In words, the market share of school j is the product of the probabilities of school j being preferred to each other school for each student, summed over all students in all neighborhoods.

3.2 Supply side

Spatially differentiated private schools maximize profits[12] by choosing quality and price in a market with N students:

$$\underset{p_j,q_j}{max}\ \pi_j(P,Q) = Ns_j(P,Q)(p_j - MC(q_j)) - FC_j$$

where j indexes schools, s is market share, p is the tuition price, MC is the marginal cost, q is school quality and FC is the fixed cost. The marginal cost of an extra student is assumed to be constant and an increasing function of school quality delivered to students. Market share s_j is determined by demand for school j, which is a function of vectors of prices, relative qualities and relative distances of the schools in the local market (P, Q, and D).

The first order condition with respect to price is:

$$\frac{\partial \pi_j(P,Q)}{\partial p_j} = N\frac{\partial s_j(P,Q)}{\partial p_j}(p_j - MC(q_j)) + Ns_j(P,Q) = 0$$

$$p_j^* = MC(q_j) + s_j(P,Q)\left[-\frac{\partial s_j(P,Q)}{\partial p_j}\right]^{-1} \tag{3}$$

The first term in the right-hand side corresponds to the competitive price for school j ($= MC(q_j)$) and the second term is a price mark-up.

The first order condition with respect to quality is:

$$\frac{\partial \pi_j(P,Q)}{\partial q_j} = N\frac{\partial s_j(P,Q)}{\partial q_j}(p_j - MC(q_j)) - Ns_j(P,Q)\frac{\partial MC(q_j)}{\partial q_j} = 0$$

Assume $MC(q_j) = c_0 + c_1 q_j$ [13], then:

$$q_j^* = \frac{p_j - c_0}{c_1} - s_j(P,Q)\left[-\frac{\partial s_j(P,Q)}{\partial q_j}\right]^{-1} \tag{4}$$

The first term in the right-hand side corresponds to the competitive quality for school j ($= \frac{p_j - c_0}{c_1}$)[14] and the second term is a quality mark-down, which also measures market power.

According to this simple model, private schools respond to a negative demand shock that reduces their market share by adjusting revenue and quality. If market shares responds

[12] Unlike private businesses, nonprofit schools cannot distribute profits to its shareholders, but it can use the surplus (difference between revenue and costs) to improve working conditions or pursue social goals valued by staff. Even though the incentives of nonprofit schools to maximize surplus are not as strong as they would be had they been able to distribute cash, they can be modeled similarly, as in Hoxby (2003).

[13] I also assume c_0 and $c_1 > 0$ are constants.

[14] With perfect competition $p_j^* = MC(q_j)$. By plugging in marginal cost, we get $q_j^* = \frac{p_j - c_0}{c_1}$.

negatively to price increase and positively to quality increase, a new equilibrium would consist of higher private school quality and lower tuition serving a smaller number of students. The degree to which the optimal prices and qualities will be affected by open enrollment depends on the sensitivity of demand to price and quality changes, the size of the market share, and how much this market share is reduced if at all. From the demand side, the market share of school j, in turn, will decrease the closer in distance the additional public schools available are to the families, the higher quality they are relative to j, and the higher the price of j.

The impacts of the policy on enrollment depends on whether private and public schools are operating at full capacity. For a private school not operating in full capacity, the demand shock facing each private school will depend on the extent to which the surrounding public schools face binding capacity constraints. That is, if most public schools around a private school are operating at full capacity with students of their corresponding catchment area before the introduction of open enrollment, then there should be a negligible effect of the policy on enrollment for that private school. Conversely, if surrounding schools are not operating at full capacity, a private school with binding capacity constraint and a wait list of students before the policy would not experience any effect on its enrollment, but it will likely experience a change in the quality of students from which it can select.

Families residing in the more densely populated areas are more likely to experience choice as there are more private and public schools around them. If capacity constrains in public and private school are more likely to bind in those areas, the enrollment response to open enrollment reform will be limited. Thus, it is not clear that the theoretical predictions derived here will materialize in practice.

3.2.1 Extension of the supply side model

Private school in BC receive either 50 percent or 35 percent of the per student public school grant if operating costs are lower or higher than in the public system, respectively. As a result, for the low-cost private schools in funding group 1 (those receiving the higher grant per student), their ability to increase quality (via spending) is constrained by the rule that their operating cost is below the public school one. I incorporate this institutional feature in the model and the profit maximizing problem becomes:

$$\begin{aligned}\max_{p_j,q_j} \pi_j(P,Q) =& Ns_j(P,Q)(p_j + 0.5G^{pub}\mathbb{1}\{MC(q_j) \leq G^{pub}\} \\ &+ 0.35G^{pub}\mathbb{1}\{MC(q_j) > G^{pub}\} - MC(q_j)) - FC_j\end{aligned}$$

where G^{pub} is the per student public school grant. The condition to receive the higher grant ($0.5G^{pub}$) is that the marginal cost per student is less than or equal to the per student public school grant, otherwise the school receive the lower grant ($0.35G^{pub}$).[15]

For low-cost private schools facing high competition or serving demand for higher school quality, the $MC(q_j) = G^{pub}$ and thus quality will be fixed ($q_j = MC^{-1}(0.5G^{pub})$).[16] In this case, quality q_j would not be a choice variable anymore and the optimal price is:

$$p_j^* = 0.5G^{pub} + s_j(P,Q)\left[-\frac{\partial s_j(P,Q)}{\partial p_j}\right]^{-1} \tag{5}$$

Low-cost private schools might not be able to compete by adjusting quality so that they stay eligible to the government grant. Higher public school competition would then have no effect on quality of those schools, only reduction of the price markup.

For the purposes of assessing the comparative statics, the optimal prices and qualities for private schools in which grant constraints do not bind remain with similar interpretation as in the model without grants.[17]

4 Data

The data used in this study come from several sources. The primary data used are enrollment records, private school's nonprofit information returns, and neighborhood level Census data. The enrollment data is publicly available from the BC Ministry of Education. The financial information returns of private schools' nonprofit organizations come from Canada Revenue Agency.

The enrollment data contains school-grade level records for the population of students of private and public schools they are enrolled on September 30 of each year. It also contains information on the share of enrolled student who are female, who are aboriginal, and whether the school offers full-day kindergarten. I used the school postal codes to link mean Census neighborhood (enumeration or dissemination area, depending on year) characteristics to schools in each year.[18]

[15] Since marginal cost is constant for each extra student, this constraint implicitly assumes that the per student grant public schools receive corresponds to the per student operating cost in public schools.

[16] While I do not observe operating costs per students, I observe a clear mode of total expenditure per student for schools in funding group 1 category. This suggests that schools are bunching just below the operating cost limit and thus the modelled constraint seem to binds for a large share of low-cost schools.

[17] For low-cost private schools, with non-binding grant constraint, optimal price and quality are: $p_j^* = MC(q_j) - 0.5G^{pub} + s_j(P,Q)\left[-\frac{\partial s_j(P,Q)}{\partial p_j}\right]^{-1}$ and $q_j^* = \frac{p_j - c_0 + 0.5G^{pub}}{c_1} - s_j(P,Q)\left[-\frac{\partial s_j(P,Q)}{\partial q_j}\right]^{-1}$. For high-cost schools, $p_j^* = MC(q_j) - 0.35G^{pub} + s_j(P,Q)\left[-\frac{\partial s_j(P,Q)}{\partial p_j}\right]^{-1}$ and $q_j^* = \frac{p_j - c_0 + 0.35G^{pub}}{c_1} - s_j(P,Q)\left[-\frac{\partial s_j(P,Q)}{\partial q_j}\right]^{-1}$.

[18] The data appendix includes a detailed description of my procedures to link Census neighborhood char-

The nonprofit information returns data contain the list of all nonprofit registered charities[19] in the province each year and their reported expenses and revenues, including government grants and donations. In addition to revenues and expenses broken into subcategories, the data also include the date of registration of each organization. I link the nonprofit organizations legal name to private schools using the authority name reported in the school database.

4.1 Stylized Facts

Before describing the sample I use for the empirical exercise, I highlights some stylized facts to contextualize the analysis.

Private school share of total enrollment has been increasing since 1999. Figure 1 shows that the share of enrollment has been declining for public schools and increasing for private schools, such that private school enrollment went from 9% in 1999 to 12% in 2017. Figure 2 shows that enrollment in special programs also increased quickly, particularly for French Immersion (early and late) in the public sector and English Language Learning in the private sector. Altogether, these figures indicate the growing interest in greater school choice among families in BC.

In the figures described above, there is no clear structural break in enrollment trends after the implementation of open enrollment policy. That is not surprising as out-of-catchment enrollment increased gradually over the years that followed the fall of 2002[20] and each private school was affected differently depending on the level of public school competition they faced, their student capacity constraints and the demand for private schools in each location. In contrast, there is clear increase in private school share of total enrollment in the year after the public teachers' strike that occurred from April to September 2014. In this case, all public schools were affected similarly as teachers were on strike together until after the scheduled start of classes in the fall. The change in enrollment shares after the public teachers' strike suggests that private schools can be substitutes for public school for some students if the incentives are strong enough.

Families are more likely to choose a different school when a cycle is about to start as it is less disruptive to the students, and easier to find available spots. At those moments, students often have to move to a different school anyways, because their school does not offer later grades. Figure 4 shows the number of students who moved ("movers") from private to public

acteristics via postal code.

[19]Organizations with registered charity status can issue tax receipts for donations, need to meet various regulatory requirements defined by the Canada Revenue Agency (CRA), and must submit an annual information return (T3010) to CRA that reports its activities, revenues, and expenditures.

[20]This is documented in Friesen, Cerf, and Woodcock (2019).

school and vice versa over the years. The number of movers in both direction is particularly high in grade 8, at the start of high school.

Regarding the finances of private schools, it is important to distinguish schools in funding group 1 and in funding group 2[21] as they face very different incentives. Figure 5 shows that schools in funding group 1 have lower revenue and expenditure, but higher grants and gifts than schools in funding group 2. This figure illustrates that the funding rules (that determine the value of the grants based on the operating expenditure per student), the requirement to operate at a nonprofit basis, and the demand for private school education seem to explain the differences between these two groups of schools. The differences between government grants received across the school categories can be explained by the variation in value of the provincial grant according to the school district, but also by differences in specific grants from federal or municipal governments that the nonprofit organization can receive. In the fall of 2005, the supplementary funding for special education students in private schools changed from half the amount per student in special education in public schools to the full amount. The number of special education students after 2005 help to explain the divergence of other secular and Waldorf/Montessori schools after the change in the funding formula.

4.2 Sample

I combine the data sets with enrollment, neighborhood characteristics, and school financial information to create a panel of school-grades for the years from 2000 to 2007. I restrict my sample to schools that offer any grade between Kindergarten to grade 12, that were operating in 2001, and have non-missing values for all relevant variables in the analysis. The sample includes 147 private schools, of which 91 were matched to nonprofit returns data. Not all schools could be matched with the financial data for two reasons. Few schools had missing information for the name of their corresponding nonprofit organization [22] in the data from the Ministry of Education of BC. Most of the unmatched schools had information on the name of their nonprofit organization, but those organizations were not in the list of charities/nonprofit organizations that reported information to Canada Revenue Agency. Table 1 reports descriptive statistics for schools in the sample. An average private school has about 35 students per grade, has 12 public schools and 4 private schools within 5km of travel distance. 41 percent of schools offer at least one grade in the range kindergarten to grade 3, 37 percent in the range from grade 4 to 7, and 22 percent in the range from

[21] funding group 1 private schools receive 50 percent of the per student public school grant and funding group 2 private schools 35 percent.

[22] Specifically, they had missing information in the "authority name" variable. The nonprofit organizations that fund each private school are labeled in the data from the Ministry of Education of BC as school authorities.

grade 8 to grade 12. Only 13 percent of private schools are in funding group 2, all of which are Waldorf/Montessori or other secular. The remaining schools are in funding group 1 with representation in all school categories.[23] Other secular private schools are located in areas with more educated population, higher average income per family, higher density of dwellings and population. In contrast, other Christian schools are located in neighborhoods with lower education levels, lower income per family and lower share of immigrants. The schools in the other categories seem to fare between these two groups of schools in terms of the neighborhood characteristics.

Also for the period from 2000 to 2007, I create a panel of schools that could be matched with nonprofit financial data. I use enrollment per school-year as a denominator to create financial variables per student so that budget variables of small and large schools could be compared. Since there are some nonprofit organizations that fund multiple private schools in the sample[24] and their financial reports do not specify how much each of their schools generates of revenue or spends, I aggregate the enrollment of all schools funded by an organization so that I can create per student variables. The number of questions and the granularity of the information required in the form T3010, that nonprofit organizations have to submit, changed over the years of the sample. Consequently, the choice of variable that could be used was constrained to variables that were consistently reported in the years of the sample. Table 1 shows in the lower rows the mean budget outcomes at the school-year level. Revenue and expenditure per student are, on average, 9.5 thousand Canadian dollars per student for the private schools in the sample. The lowest average values are in Catholic schools, below C$ 5,000. Not surprisingly, schools categorized as Waldorf or Montessori and other secular have the highest spending and revenue per students as substantial share of those schools in the funding group 2, which had operating cost per student above the one in public school.[25] Some of the Montessori schools offer early education in addition to Kindergarten and elementary school grades. Since I do not have information on enrollment in early education programs, the average budget variables per student are overestimated for Montessori schools, which also helps to explain their disproportionately high means. Gifts/donations account for a larger share of total revenue in religious non-Catholic schools which likely come from

[23] Around 3 percent of the schools are either in other funding groups that do not receive funding or have missing information on the funding group they belong.

[24] As reported in Table 1, 52 nonprofit organizations fund 91 schools in the sample. For example, the Catholic Independent Schools of Vancouver Archdiocese funds all catholic schools in Vancouver and their financial returns report only the aggregate figures each year.

[25] While private schools have to operate at nonprofit basis to be eligible to the provincial grants, the average revenue does not equal the average expenditure per student. If schools have positive surplus (revenue minus expenditure) in a given year, it can accumulated as retained earnings to be used in the future for capital expenditure or for other specific purpose.

their respective congregation members, in addition to gifts from students' parents. I use net revenue per student (revenue net of gifts and grants) as a proxy for tuition price that parents pay. Except from the artificially inflated mean in Montessori/Waldorf schools, net revenue varies from the close to C$11,000 in other secular schools to C$1,280 in Catholic schools. While this measure does not exactly match the tuition listed for each schools for the period of analysis, I consider that its variation can reveal how private schools respond by changing their price and/or the provision of discounts to families.

5 Empirical strategy

5.1 Empirical model

Students who live in areas that are served by a larger number of proximate public schools experience a greater increase in meaningful school choice options under open enrollment than those who live in sparsely populated areas where public schools are widely dispersed. Consequently, open enrollment also leads to a greater increase in competition between schools in areas where schools are more spatially dense. My identification strategy exploits this variation in the intensity of treatment under open enrollment to identify the effects of interest. I build up from the insights of the demand side model to create measures of local competition. This empirical approach follows insight from the literature that quantifies school competition using geographically based school competition indicators to explore implicit variation in the level of choice available to families in different markets.[26]

My empirical strategy follows a difference-in-differences design that leverages the natural experiment created by some private schools being more exposed to competition from public schools than others. I compare changes in outcomes before and after open enrollment in private schools that faced different levels of competition from local public schools. Under reasonable identifying assumptions, differential changes in outcomes are attributed to differential exposure to open enrollment. I consider several outcomes: per grade enrollment, per student revenue, and per student spending.

Private schools are spatially spread across the province with different levels of public school competition. Figure 6 shows that schools offering K-12 education have higher concentration in the more densely populated areas of Metro Vancouver and Greater Victoria. For example, Figure 7 illustrates that within Metro Vancouver, there is also significant spread of private schools with varying numbers of nearby public schools.

[26]See for example Gibbons et al. (2008), Friesen, Cerf, and Woodcock (2019), Hoxby (2000), Rothstein (2007).

Let Y_{jtg} denote enrollment level of private school j, in year t, and in grade g using the model below:

$$Y_{jtg} = X'_{jt}\beta_X + \eta\, Comp_{jg} + \theta\, OE_t * Comp_{jg} + \tau_t + \gamma_g + \delta_j + \epsilon_{jtg} \tag{6}$$

where X_{jt} is a vector of school, grade and Census neighborhood characteristics. $Comp_{jg}$ is an indicator of exposure to local competition. OE_t is a dummy variable that equals one for the years when open enrollment reform was effective, 2003 onward. τ_t, γ_g, and δ_j are year, grade and school fixed effects. β_X is a vector of parameters and η, θ are parameters to be estimated. ϵ is the idiosyncratic error term. Standard errors are clustered at the school level.[27] The coefficient of interest θ represents the effect of public school competition on private school outcomes. It measures the net difference in the outcome variable between pre- and post-treatment for private schools whose locations face larger number of public school competitors, compared to schools whose locations face less competition .

I measure local competition $Comp_{jg}$ in two ways: i) number of public schools that offer grade g and are located within a defined radius of a privates school j in the period prior to open enrollment reform, ii) indicator weighting each public school-grade by the inverse of their distance from school j and/or the inverse of a measure of student capacity. I report results using 5km radius[28], but I experimented with radii from 2 to 8 km and results are qualitatively similar. Thus, for each additional public school within the radius, open enrollment changes private school outcome in θ units. For example, if a private school has 10 within-radius public schools, then the effect of open enrollment correspond to $10 \times \theta$ units of outcome.

The weighted competition indicator is calculated according to the equation:

$$Comp_{jg}^{weighted} = \sum_{k \in M_{jg}} (d_{kj} \times c_k)^{-1}\, \mathbb{1}_k$$

In words, $Comp_{jg}^{weighted}$ is a weighted sum of all public schools k within 5km of private school j that offer grade g, that combined make the set M_{jg}. The weights are defined as the product of the inverse of the distance d_{kj} and the inverse of a measure for student capacity constraint c_k of each public school k. The student capacity constrain c_k is defined as the

[27] I confirm the presence of serial correlation of the mean school-year residuals from a regression of enrollment on school, grade and year fixed effect (as in Bertrand, Duflo, and Mullainathan (2004)). I cluster standard error at the school level to allow for serial correlation and heteroskedasticity (arising from schools being of different sizes).

[28] 5km corresponds to the 90th percentile of the distance between private school students' residence and private school. The implicit assumption is that schools located closer to more public schools face greater competition after open enrollment reform, as families located in these areas would have more public school choice.

ratio of per grade enrollment in year 2001 over maximum per grade enrollment from 1997 to 2001.[29]

Covariates in the vector X include school and neighborhood characteristics. In the former, I include: share of female students, share of aboriginal student, whether school offer full-day kindergarten, number of private schools within 5km of travel distance. For neighborhood characteristics, I include share of population with trade or diploma, with college, with some university, with university degree or higher, who are recent immigrants, average family income, number of dwellings, population size, population size in the age ranges 0 to 4, 5 to 9 10 to 14, and 15 to 19.

The specification described above does not control for pre-existing trends in private schools outcomes. Using insight from Hoxby (2003), I follow two-stage procedure used in Chakrabarti and Roy (2016) to control for pre-existing trends. First, I estimate linear time trend for each private school-grade using only its pre-policy outcome data, then I extrapolate the predicted values for the entire period including the post-policy years. In addition to eq. (6), I estimate the model:

$$Y_{jtg} = X'_{jt}\beta_X + \eta\, Comp_{jg} + \theta\, OE_t * Comp_{jg} + \alpha\, Trend_{jtg} + \tau_t + \gamma_g + \delta_j + \epsilon_{jtg} \qquad (7)$$

where $Trend_{jtg}$ controls for pre-policy differences in outcome trends across individual school-grades.

After open enrollment, information about out-of-catchment public schools can take time to disseminate to families. With more information, parents may decide whether to enroll their children in those schools. As a results, private schools may experience changing levels of competitive pressure in the period after open enrollment reform. If the effects are dynamic over time, then an average effect post-policy can underestimate the effect of public school competition. In order to account for dynamic effects, I also estimate the model:

$$Y_{jtg} = X'_{jt}\beta_X + \eta\, Comp_{jg} + \sum_{k=2003}^{2007} \theta_k\, \mathbb{1}_{t=k} * Comp_{jg} + \alpha\, Trend_{jtg} + \tau_t + \gamma_g + \delta_{c(j)} + \epsilon_{jtg} \quad (8)$$

Identification of the causal impact requires the outcomes of schools with different levels of local competition to follow similar trends in the absence of open enrollment. While this assumption cannot be directly tested, I can test empirically for the pre-policy trends by

[29]For brevity, I only report results for these two measures of local competition. Qualitatively similar results with an indicator that only uses inverse distance as weight are available upon request.

rewriting the estimation model above including individual year interactions in the pre-policy period:

$$Y_{jtg} = X'_{jt}\beta_X + \sum_{r=2000}^{2002} \theta_r \, \mathbb{1}_{t=r} * Comp_{jg} + \sum_{k=2003}^{2007} \theta_k \, \mathbb{1}_{t=k} * Comp_{jg} + \tau_t + \gamma_g + \delta_{c(j)} + \epsilon_{jtg} \quad (9)$$

If schools facing different levels of public school competition $Comp_{jg}$ followed parallel trends before open enrollment, then $\theta_{2000} = \theta_{2001} = \theta_{2002}$. The identifying assumption would also be violated if another shock occurred in the private school market after 2002 and is correlated with my competition indicator. I include time-varying neighborhood and school controls that deal with this potential issue but ultimately this violation cannot be tested empirically. I undertake various robustness checks to address identification concerns.

I investigate the heterogeneity in the effects of open enrollment by estimating the following model:

$$Y_{jtg} = X'_{jt}\beta_X + \eta \, Comp_{jg} + \theta \, OE_t * Comp_{jg} + \theta_h \, OE_t * Comp_{jg} * Z_j + \alpha \, Trend_{jtg} + \tau_t + \gamma_g + \delta_j + \epsilon_{jtg} \quad (10)$$

where Z_j is a pre-policy dummy variable for school j such as private school type, funding level, tuition price. θ_h is a parameter that captures the differential effect for schools with $Z = 1$, in comparison to schools with $Z = 0$.

I estimate eq.(6)-(10) on per grade enrollment for a sample of 147 school for the period from 2000 to 2007, totaling 6,746 school/grade/year observations. I estimate slightly different specifications to measure the effect of public school competition on school budget outcomes using school/year level data. In this case I estimate specifications without grade fixed effects and the measures of public school competition are averaged over all grades offered by each private school[30]. The school budget dependent variables are defined using the reported financial information divided by the total enrollment in each school-year. Since most of the variation in this variable come from the the numerator, I cluster the standard error at the level of the nonprofit organization and account for serial correlation of observations funded by the same nonprofit organization.

[30]Specifically, eq. (7) using data at the school-year level becomes: $Y_{jt} = X'_{jt}\beta_X + \eta \, Index_j + \theta \, OE_t * Index_j + \alpha \, Trend_{jt} + \tau_t + \delta_j + \epsilon_{jt}$.

6 Results

6.1 Enrollment

Table 2 reports the estimated $\hat{\theta}$s from eq. (6) and (7) with private school enrollment as outcome variable. In columns 1-6, public school competition is measured with the number of public schools ($Comp_{jg}$) within 3, 5 and 7km of a private school. In column 7-8, I use the weighted competition indicator ($Comp_{jg}^{weighted}$) defined with the 5km radius. The estimates in the even numbered columns include a control for pre-policy trends. Results from all specifications show statistically significant negative effect on enrollment for private schools facing more competition from public schools after open enrollment was effective. The estimates are slightly attenuated once pre-policy trends are included in the estimation. According to column 4, for a median private school with 10 public schools within 5km, open enrollment caused a net loss of 1 student per grade ($= 10 \times -0.10$). I focus on 5km radius for the measures of public competition for brevity purposes, but estimates using other radii are qualitatively similar.[31]

The estimates in Table 2 are based on a conditional differences-in-differences model with non-binary treatment. Table 3 compares the estimates of the unconditional model ("base") [32] with the estimates of the conditional model ("full") reported in column 4 of Table 2. The base model reported in column 1 indicates that the unconditional effect on enrollment is significant and negative. Once time-varying covariates, pre-policy trend control, school and grade fixed effects are included, then $\hat{\theta}$ is attenuated but remains significant at the 5% level, as shown in column 2. This change from estimated impact in base model $\widehat{\theta}^{base}$ to full model $\widehat{\theta}^{full}$ is consequence of neighborhood and school characteristics, that help explain variation in enrollment, being correlated with the measure of public school competition. Following the decomposition proposed in Gelbach (2016)[33], Table 4 shows how much each group of covariates/fixed effects accounts for in the difference in $\hat{\theta}$ between the full and base specifications from column 2 and 1 of Table 3. Table 4 indicates that the variation in school fixed effects explains 95 percent of the coefficient gap and their component is precisely estimated. The remaining components reported for the other covariates account for a smaller share and are not precisely estimated. As school fixed effects captures the time-invariant

[31] Appendix Figure A2 plots the impact estimates for number of public school within radius from 2 to 8 km. Not surprisingly, for smaller radii the effect of open enrollment is stronger, as the presence of the same number of public schools within a smaller radius create more opportunities to families to transfer out of private school.

[32] Based on the following specification: $Y_{jtg} = \eta\, Comp_{jg} + \theta\, OE_t * Comp_{jg} + \tau_t + \epsilon_{jtg}$

[33] This decomposition accounts for the role that covariates and fixed effects have in changing the value of $\hat{\theta}$ from the unconditional diff-in-diffs specification to the full conditional specification, using the omitted variables bias formula. Estimates in column (1) of Table 4 correspond to $\widehat{\delta} = \widehat{\theta}^{full} - \widehat{\theta}^{base}$.

enrollment size of schools and are negatively correlated with the number of public schools nearby, the addition of school fixed effects contribute to attenuate the estimated effects of public competition.

Exploring the dynamics of the effects over the years after open enrollment was adopted, Figure 9 plots the estimated θ_k's from eq. (9), using the number of nearby public schools as a measure of competition in (a) and the weighted competition indicator in (b)[34]. While the estimated θ_k's are negative for the entire period after open enrollment, the impact becomes significantly larger after 2004 in both specifications. This indicates that it took some time for the policy to affect the private school market as the effect is growing in magnitude over time. This effect gradually changing is in line with the evidence that out-of-catchment enrollment in public schools also had a gradual increase after 2002[35]. By 2007, the net change of grade-level enrollment for a median school with 10 public schools nearby was -1.8 students. A similar pattern of increasing impact magnitudes over the years after open enrollment is observed for the estimates with the weighted competition indicator.

Figure 11 plots the estimated θ for all years before and after the policy took place, based on eq. (9). The year before open enrollment was effective, 2002, was normalized to zero. All the coefficients were also normalized to $\hat{\theta}_{2002}$.[36] The common trends assumption seems to be reasonably satisfied as the estimated θ's for the pre-policy years are at similar level. After 2002, the value of θ decreases more each year, in comparison to the pre-policy period. I also performed a Wald test on the joint equality of the pre-policy $\hat{\theta}s$. The estimated p-values are higher than 10 percent for the specification that uses the number of nearby public schools as a measure of competition, thus I fail to reflect the null of the joint equality of pre-policy $\hat{\theta}s$. This result supports the common trends assumption my specification requires for identification of the causal effect of open enrollment. In contrast, when the weighted competition indicator is used, the test suggests rejecting the null.[37]

In order to make the effects of public competition more concrete, Figure 10 plots the counterfactual of how the mean private school enrollment per grade would have been in the absence of open enrollment reform, according to estimates based on eq. (9).

Altogether, there is strong evidence of negative impacts on grade-level private enrollment. While the effects are modest, they are statistically significant, and are robust to different model specifications, including an unconditional difference-in-differences model, and various measures of public school competition.

[34] See Table A1 for the estimated coefficients and corresponding standard errors plotted in this figure.
[35] This is documented for the Lower Mainland, the more densely populated area of BC, in **?**.
[36] I subtracted $\hat{\theta}_{2002}$ from all coefficients, so that the effect coefficient in 2002 is zero.
[37] See Table A2 for the estimated coefficients.

6.1.1 Heterogeneity of effects

I explore the impact heterogeneity of open enrollment across subgroups by estimating eq. (10). Table 5 reports $\hat{\theta}$ and $\hat{\theta}_h$. Estimates from column 1 of Table 5 show that, other secular, Catholic and Waldorf or Montessori schools lost more student compared to other Christian schools. This suggests that the demand for other faith and other Christian private schools are less responsive to competition than demand for schools in the other categories. In other words, parents whose children attend other faith and other Christian private schools view public schools as weaker substitutes than parents whose children attend the other private schools

Column 2 indicates that enrollment effects for schools in funding groups 1 and 2 differ but are not statistically significant. For all the remaining specifications in columns (3)-(6), effects vary but are not statistically different from each other (since $\hat{\theta}_h$ is not significant), when comparing schools above and below median competition (number of nearby public schools), expenditure per student, price (measured with net revenue per student) and school age (measured with age of nonprofit organization).

Table 5 provides evidence that the most important school characteristic to explain heterogeneity of effects of public school competition on enrollment is the school category based on the choice of curriculum. Families that have their children in those schools likely have larger taste parameters associated with them (represented by α in the demand side model) for sharing the same religious beliefs that those schools teach in their curricula. If families perceive that private schools supply differentiated products and school choice is based on idiosyncratic taste for a particular school (α in the demand side model)[38], then private schools might be imperfect substitutes for public schools. From Table 5, public schools seem to be unlikely substitutes for Christian and other faith schools, but more likely for secular, Catholic and Waldorf/Montessori schools. While private schools in BC are required to offer the same curriculum as public schools (if recipient of provincial grants), they also differentiate by supplementing curriculum with religious education or an alternative learning environment.

To assess the heterogeneity of effects by grade, I split the sample based on grades offered and estimate eq. (7) for each subsample. While I loose statistical power when I split the sample, the specification on subsamples is less restrictive as it accounts for private high schools having larger cohort sizes and fewer public school competitors than elementary private schools.[39] Figure 12 plots $\hat{\theta}$ for each subsample indicating that the negative impact on

[38]For charter schools, Walters (2018) shows that students do not choose schools based on school-specific match effect in academic achievement.

[39]In other words, the intensity of treatment of one additional public school nearby is greater for private

enrollment is concentrated for private schools that offer grades 8, 9 and 10. This result is not surprising since the number of movers from public school to private school is disproportionately larger in high school.[40] At the transition to high school, as most students are moving to different schools anyways, they are more susceptible to move from private to public schools if they have enough incentives. As high schools students are older and more likely independent travellers, the opportunity to attend schools out of their neighborhoods seem to be more appealing than students in earlier grades. This result suggest that preferences for schools are not homogeneous across all grades, specifically the disutility of longer travel distance (γ in the stylized demand side model) seems to be smaller in high school than in earlier grades.

6.2 Private School Budget

Tables 6 and 7 reports $\hat{\theta}$s from eq. (6) and (7) for specifications using the following per student school outcomes: gifts, grants, total revenue, net revenue (net of grants and gifts), and total expenditure. Gifts are the sum of donations with and without a tax receipt. Grants include federal, provincial, and municipal government grants. Net revenue is the total revenue net of gifts and grants. In the odd numbered columns the outcome variables are defined as ratios of financial information over enrollment in the same year. Since school enrollment is in the denominator, effects on enrollment could be the drivers of the observed effects. In the even numbered columns, I test this hypothesis by creating the outcome variables using average enrollment in the pre-policy period[41] in the denominator of the outcome variables. Effect estimates in odd and even numbered columns differ but they seem to be qualitatively similar indicating that the observed results are not only explained by variation in enrollment. Results in Table 6, using number of public schools within 5km radius as measure of competition, indicate that private schools with higher exposure to competition did not experience significantly different changes in total revenue or total spending per student. By examining the effects on the components of revenue, estimates show significant negative effects on government grants per student. Effects on net revenue are not significant but positive and compensate for the lower access to grants in schools more exposed to public school competition. These results are not robust to using the weighted competition indicator as statistically significant effects disappear.

Figures 13 plot the pre-policy $\hat{\theta}_r$ and post-policy $\hat{\theta}_k$ based on estimates of eq. (9). In the cases of grants and net revenue per student as outcome variables, there is a clear change

high schools than elementary high schools as the cohort sizes are, on average, larger in high school as there are fewer public high schools than public elementary schools.

[40] See Figure 4.

[41] Using year 2000 and 2001 as pre-policy years.

in the estimates after 2002. Private schools more exposed to public school competitions after 2002 responded by collecting higher net revenue per student (ex.: by increasing tuition prices or giving less discounts/scholarships) to compensate for the lower access to government grants while keep expenditure per student unchanged. This result is not robust to using the outcome variables with pre-policy school enrollment in the denominator, as Figure 14 shows. Estimated θs do not follow a pattern suggesting that private school responded to public school competition by adjusting their budget outcomes. Estimates of θs for gifts, expenditure and net revenue per student go up and down in the post-policy period which would be unlikely if schools were responding to higher competition of public school that remained after open enrollment was effective. In sum, the pattern suggestive of effects on grants and net revenue per students shown in Figure 13 seem to be driven by enrollment effects, as those outcomes are scaled by total school enrollment.

Table 8 reports effects of open enrollment based on eq. (8). For the specifications using outcomes scaled by pre-policy enrollment, the estimates are not significant and the sign of the estimated coefficients flip over the years. The notable exception is reported in column 4, with government grants per student as outcome. Among the school budget variables, government grants is the one that private schools have less discretion to affect, as it is determined by the government.

Altogether, evidence presented here indicates that private schools did not adjust their budget as a result of open enrollment. The effects on budget outcomes were not robust to different measures of local public competition. Once pre-policy enrollment is used to scale per pupil outcome variables, the patterns of effects over the years seem erratic and unlikely related to increased public school choice. This lack of response of private schools in terms of revenues or expenditures is not surprising when placed in context. First, the funding incentives from the government constrain private school expenditure per student for most private schools, which are in funding group 1. Second, the estimated effect of increased public school choice on enrollment are negative but modest[42], even for the most affected schools. Finally, demand for a large share of private schools (non-Catholic faith schools) were unresponsive to open enrollment.

7 Conclusion

This paper examines the effects of increased public school choice on private school outcomes. After the introduction of open enrollment reform, students could exert greater public school

[42]This result also holds when considering the sample of school matched to nonprofit organization data. See Appendix Table A3.

choice and enroll in out-of-catchment schools that had availability. Using the insights of a stylized model and exploiting spatial variation in public school competition, I estimate effects of open enrollment using a difference-in-differences research design with non-binary treatment. Access to novel data set with information on private school revenues and expenditure permits examining whether enrollment effects are a result of a demand shock or simply a change in quantity demanded and prices along the private school demand curve.

Estimation results reveal significant but modest negative effects of higher public school competition on private school enrollment per grade. Those effects were concentrated in secular, Catholic and Waldorf/Montessori schools and in high school. In my causal analysis, I see no evidence of private schools responding to increased competition by adjusting per student revenue or expenditure. When the voucher system has a sharp threshold criterion to determine funding, private schools can be constrained to adjust spending when facing increased competition. These results combined indicate that open enrollment caused a small negative shock on private school demand.

It is worth noting two limitations of my analysis. First, my analysis is at the school level which limits my scope, particularly in accessing the heterogeneity of effects. Second, it is possible that local public competition would be more precisely captured by including a measure of relative quality between private and nearby public schools. By having measures of school quality, the analysis could be expanded to investigate whether demand for private school is sensitive to public school quality. These limitations can be opportunities for future research.

This paper provides evidence that a sizable part of the demand for private education is unresponsive to higher public school choice, even in BC where the public school system offers a wide range of high-quality alternatives. This suggest that not all private schools represent competitive incentives for public schools to improve outcomes.

The findings in this paper are of general interest beyond the Canadian context. When introducing increased public school choice,[43] policymakers will want to know to which extent it can crowd out private schools. Furthermore, knowing what type of private schools generate competitive incentives to public schools can help design voucher programs to targeted schools that could generate greater externality.

[43]In addition to open enrollment, other potential sources of public school competition to private schools are market-designed approaches to public school choice, charter school and magnet school expansion.

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Data Appendix

Control variables

As additional control variables for unobserved student background characteristics, I use mean characteristics from Census Enumeration or Dissemination Area (EA or DA, respectively) where each school is located. Postal code level controls include the number of proximate private schools. Details of the construction of these variables are provided below. School level controls include the proportion of peers who speak Chinese, Punjabi or other non-English home languages, who are Aboriginal and who are female. Details of the construction of these variables are provided below.

Coding of Neighborhood Characteristics

To proxy for the socioeconomic status of the student body of each private school, we match the school postal code to the most recent public-use estimates of neighborhood average income, share of recent immigrants, share with high school, share with some college, share with bachelors or more, from the 1996, 2001, and 2006 Census long-form. Statistics Canada publishes these variables at the Enumeration Area (EA) or the Dissemination Area (DA) level, depending on Census year. 1996 Census estimates were published at the EA level, where an Enumeration Areas typically included 125 to 440 dwellings (in rural and urban areas, respectively). Since the 2001 Census, Statistics Canada has replaced EA-level estimates with estimates at the DA level. A Dissemination Area comprises 400 to 700 persons, so EAs and DAs are comparable in size. For the years between the Census years, I linearly interpolated the values of the neighborhood variables.

I link postal codes to an EA/DA using Statistics Canada's Postal Code Conversion File (PCCF+), which contains the longitudinal history of each postal code (postal codes are routinely retired). Postal codes are smaller than EAs/DAs, although they sometimes straddle multiple EAs or DAs. In these cases, I follow PCCF+ methodology which uses population-weighted random allocation for many postal codes that link to more than one geographic area. The PCCF+ also includes the latitude and longitude of the postal code's centroid, which I use to compute the distance between each student's residence and nearby schools.

Coding of Proximate School Alternatives

I obtained the address for all schools in BC from public sources and geocoded their locations using Here Maps API Hess (2015) and the PCCF+ to assign a latitude and longitude to each postal code in each year. Then I calculated the distance (in km) between the student's

residence and all schools in our data set. These distances were calculated in two ways: the shortest distance (geodetic distance) and driving distance according to Google Maps. For each private school postal code in each year, I then calculated the number of active public and private schools within a circle centered on each private school postal code and with radius equal to 5km.

Categorizing Private Schools

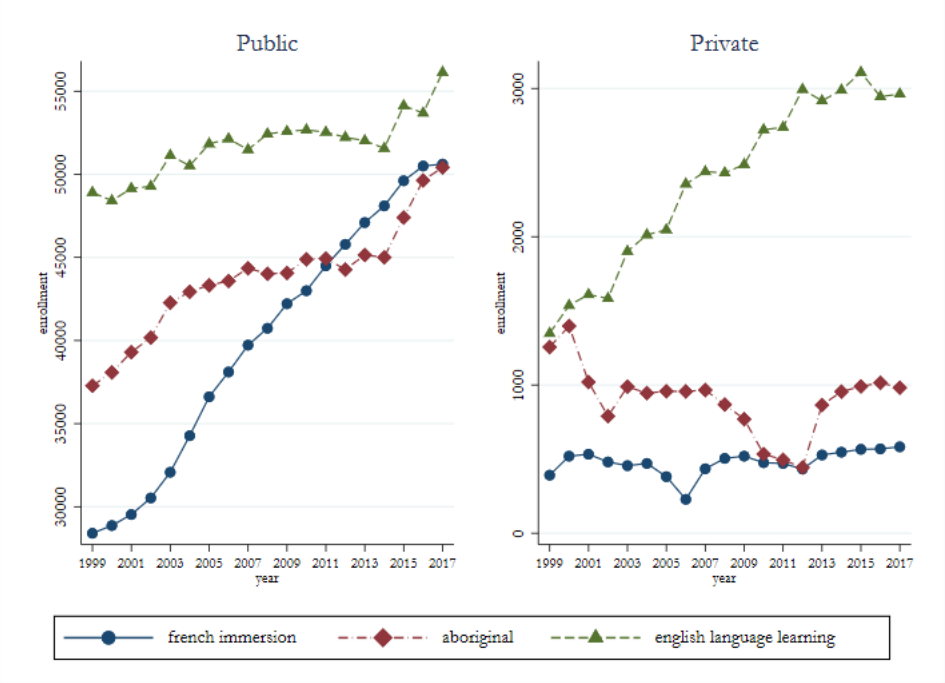
I categorized private schools into secular and faith categories according to the names of the school and the nonprofit organization. For example, schools categorized as "Other Christian" contained in their name any of the following words: Christian, Gospel, church, Lutheran, Mennonite.

Figures

Figure 1: K-12 enrollment in public and private sectors in BC, 1999-2017

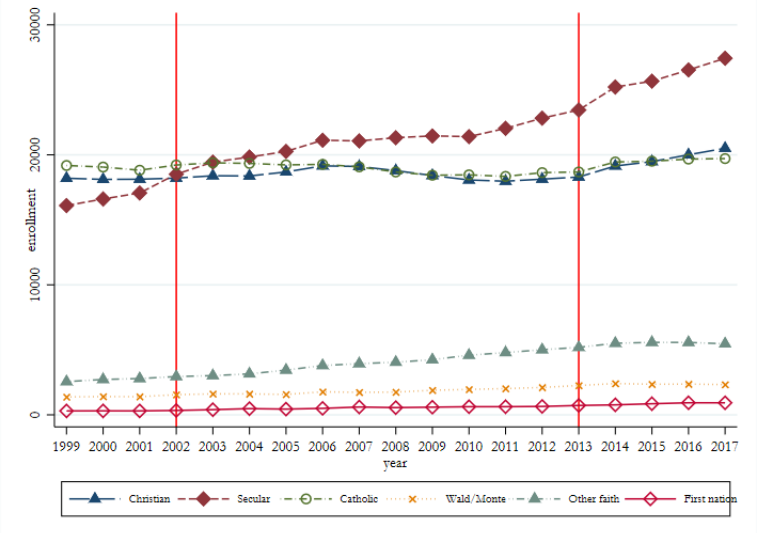
Notes: Public and private school enrollment measured on the left and right axes, respectively. In school-year 2003-2004, the open enrollment policy was effective. Teacher strikes lasted from spring to fall of 2014. Source: author's calculations using administrative data from BC Ministry of Education (2019). Disclaimer: all inferences, opinions, and conclusions drawn in this figure are those of the author, and do not reflect the opinions or policies of the Data Steward.

Figure 2: K-12 enrollment in special programs in public and private schools in BC, 1999-2017



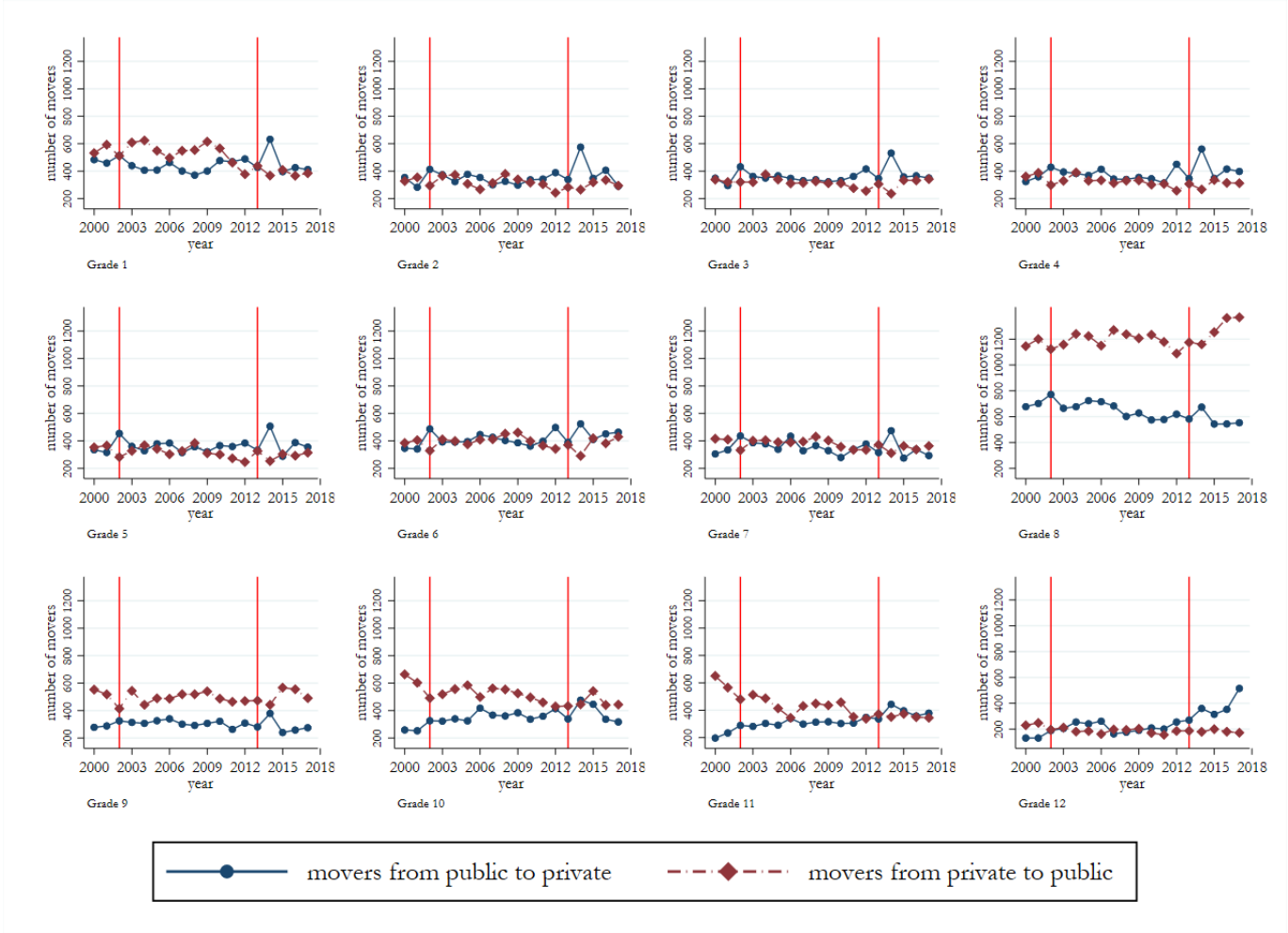
Notes: Enrollment in french immersion includes both early and late french immersion programs. Enrollment in aboriginal program correspond to the sum of enrollment of "aboriginal language and culture", "aboriginal support services", and "other aboriginal program". Source: author's calculations using administrative data from BC Ministry of Education (2019). Disclaimer: all inferences, opinions, and conclusions drawn in this figure are those of the author, and do not reflect the opinions or policies of the Data Steward.

Figure 3: Private school K-12 enrollment in BC by school type, 1999-2017



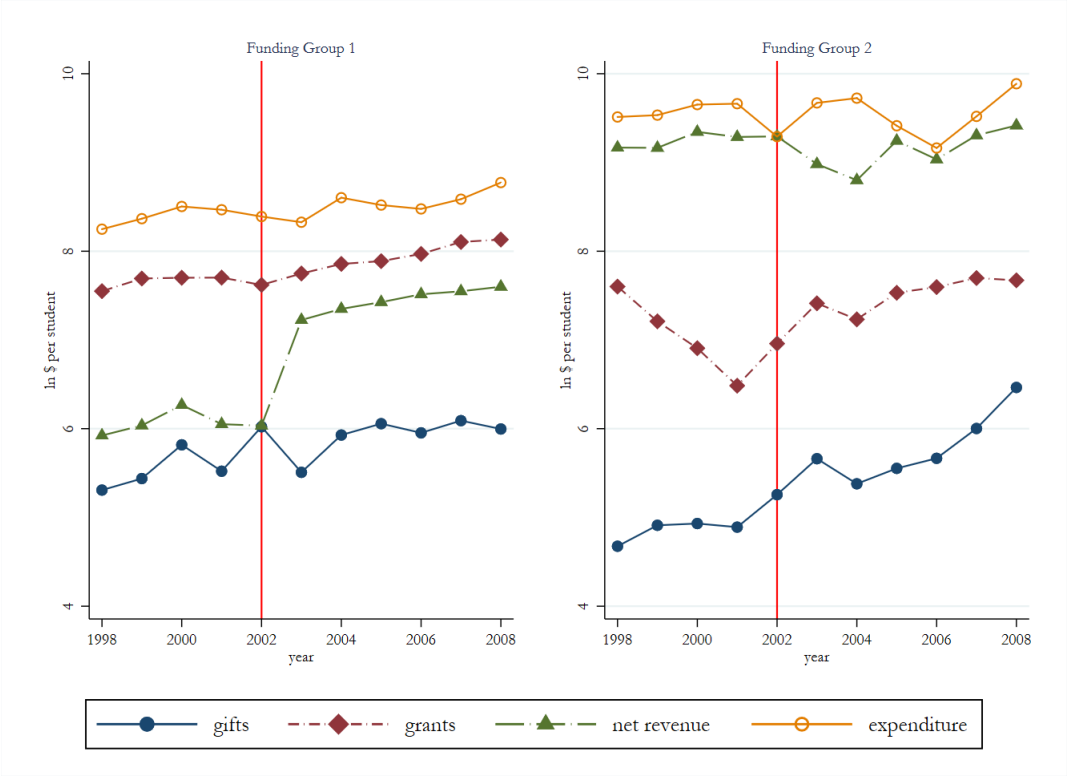
Source: author's calculations using administrative data from BC Ministry of Education (2019). Disclaimer: all inferences, opinions, and conclusions drawn in this figure are those of the author, and do not reflect the opinions or policies of the Data Steward.

Figure 4: K-12 movers between private and public schools in BC by grade, 2000-17



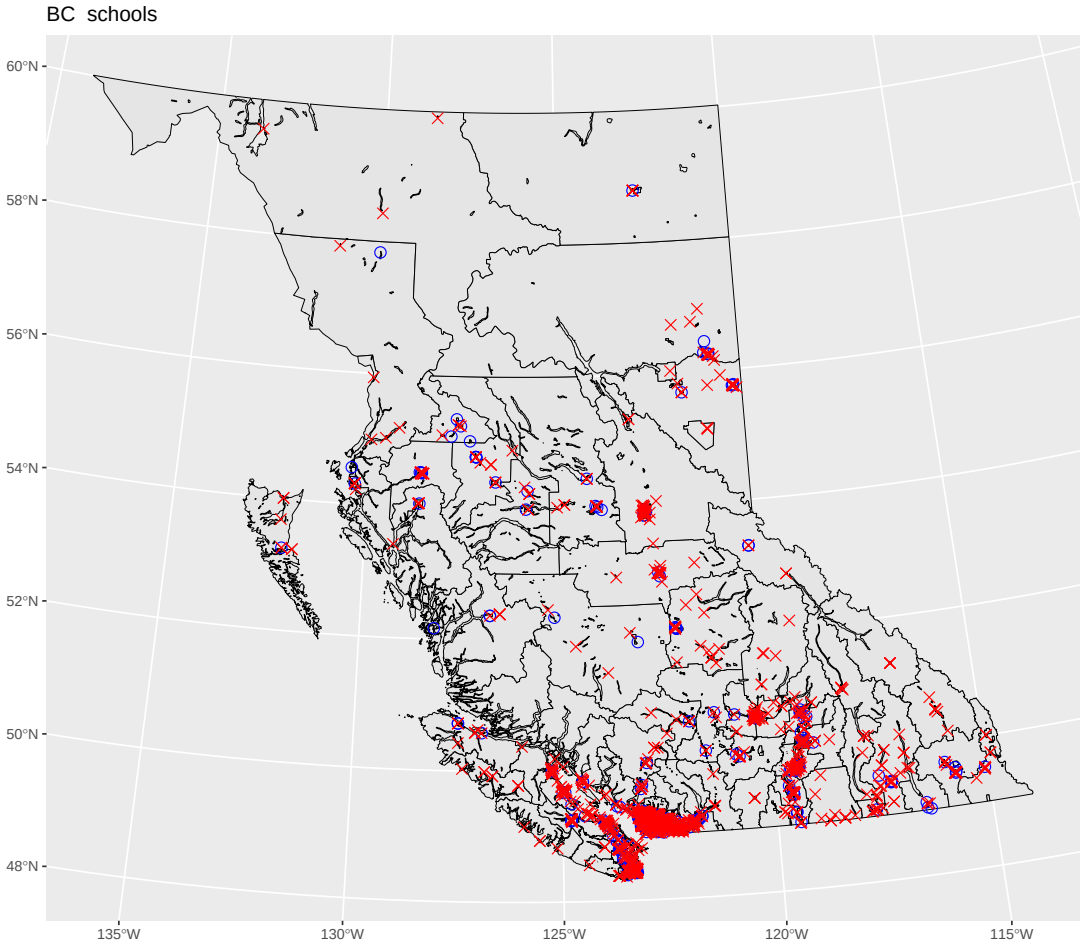
Source: author's calculations using administrative data from BC Ministry of Education (2019). Disclaimer: all inferences, opinions, and conclusions drawn in this figure are those of the author, and do not reflect the opinions or policies of the Data Steward.

Figure 5: Mean per student private school revenues and expenditure by government funding category, 1998-2018



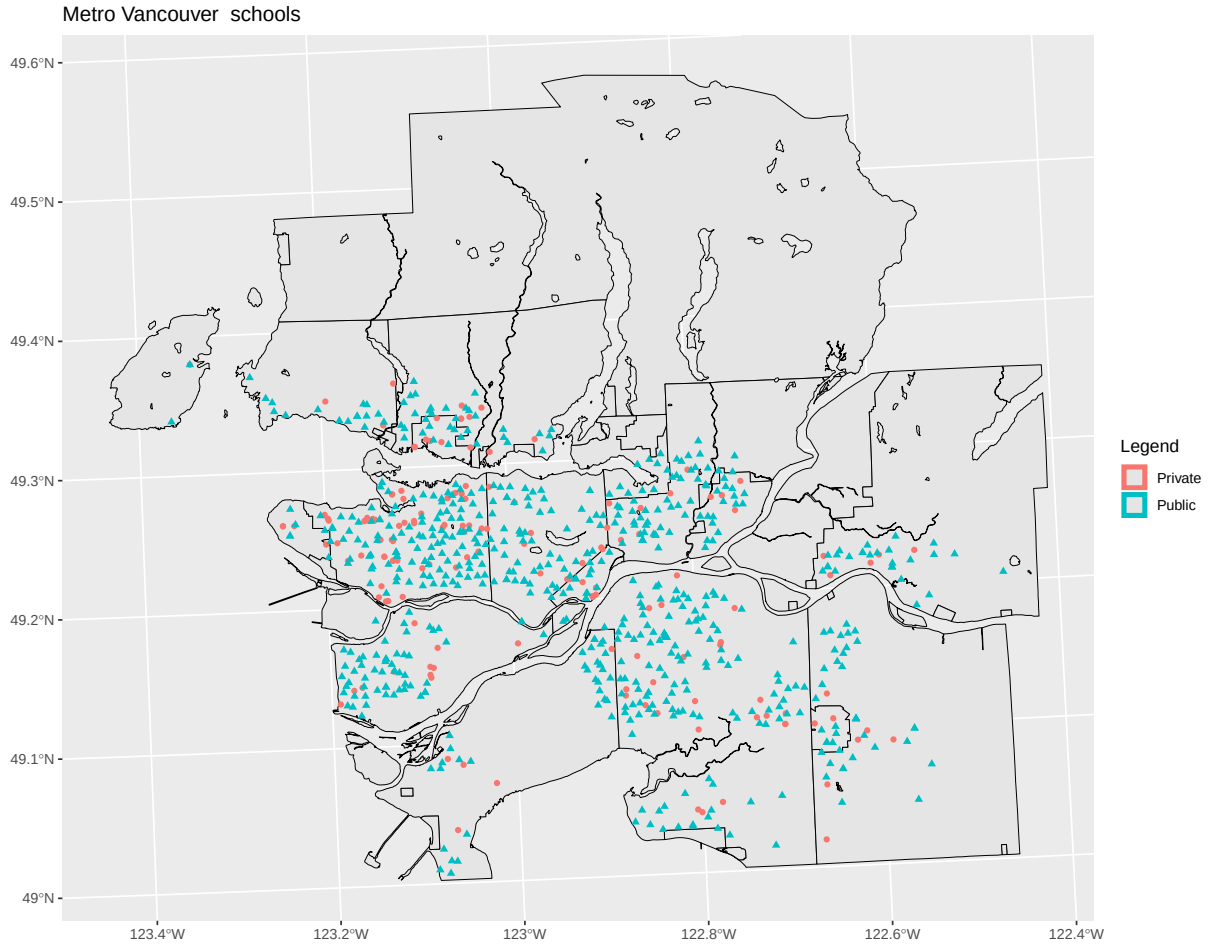
Notes: Funding group 1 and 2 receive 50% and 35% of what public schools receive per student, respectively. Gifts correspond to donations with or without a tax receipt. Grants include federal, provincial, and municipal government grants. Net revenue corresponds to total revenue net of gifts and grants. Expenditure correspond to total expenditure. All values are expressed in nominal terms. Source: author's calculations from CRA data.

Figure 6: Private and Public Schools in BC



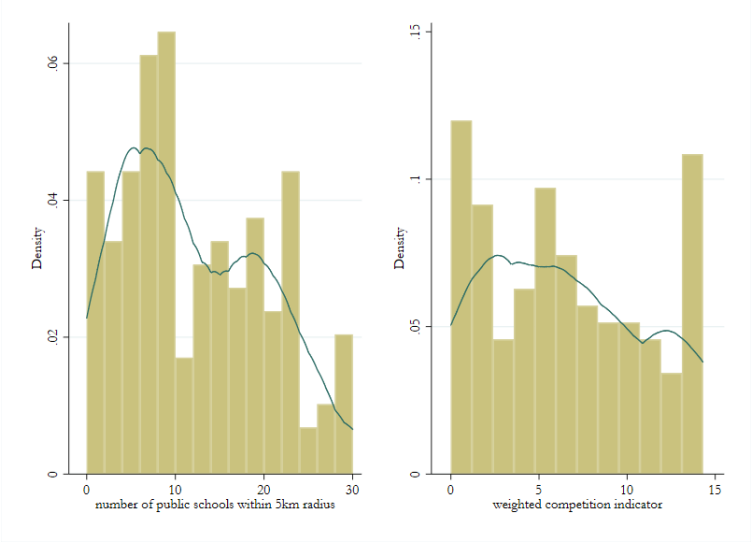
Legend: × represent public schools and ◯ represent private schools.Source: author's calculations.

Figure 7: Private and Public Schools in Metro Vancouver



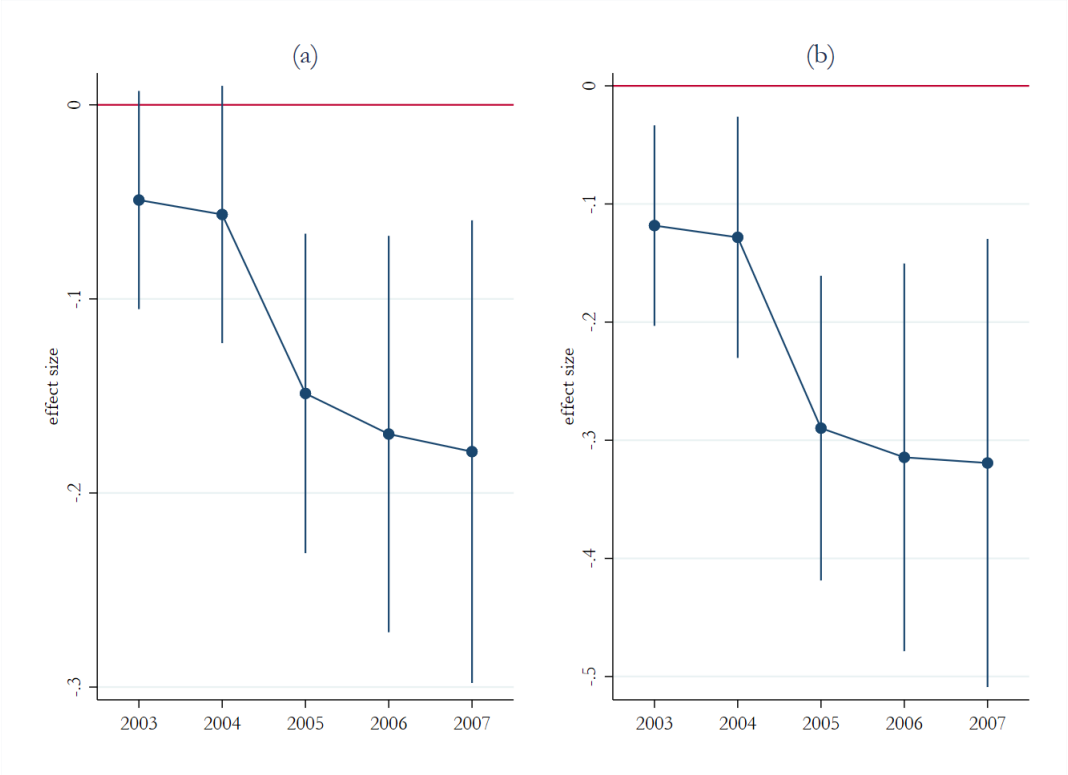
Source: author's calculations.

Figure 8: Distribution of number of public schools within 5km of a private school



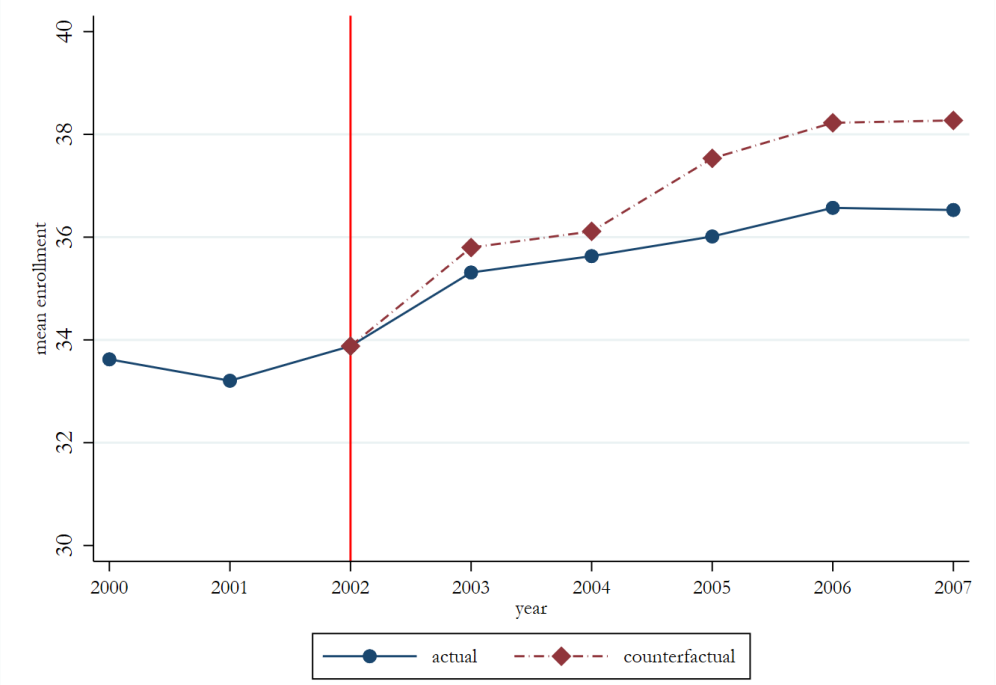
Notes: The mean number of public schools within 5 km is 11.6, the 25th percentile is 6, the median is 10, and the 75th percentile is 18. The weighted competition indicator is the number of public schools with 5km weighted by inverse distance and inverse capacity. Its mean is 6.4, the 25th percentile is 2.5, the median is 5.9, and the 75th percentile is 10.2.

Figure 9: Estimated effects of public school competition on private school enrollment per grade, 2003-07



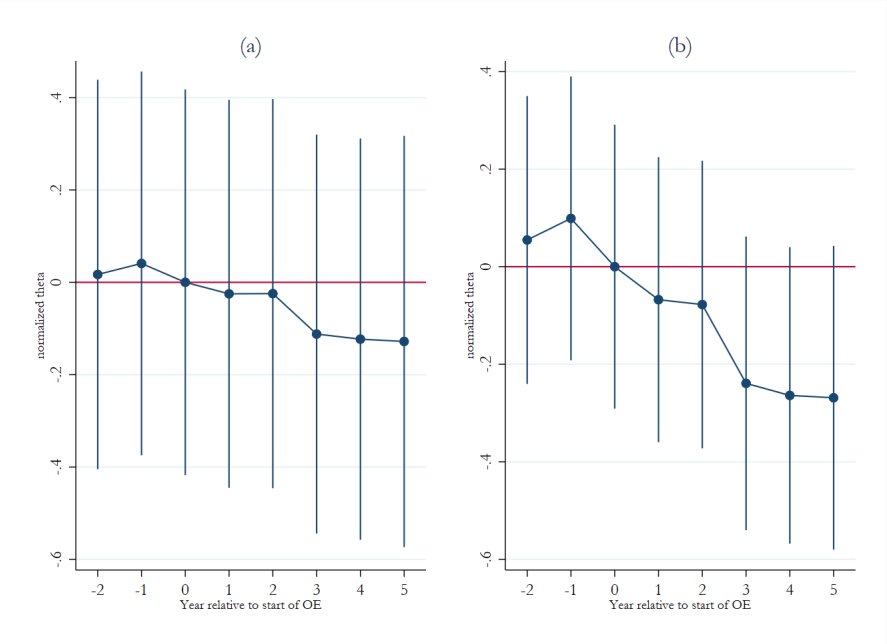
Notes: Figure plots θ for each year as defined in eq. (8). In (a) competition is measured using number of nearby public schools and in (b) the weighted competition indicator. 90% confidence intervals are estimated with clustered standard errors at the school level. Specification includes school controls (share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten, number of nearby private schools), neighborhood controls (share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree, average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19).

Figure 10: Actual and counterfactual private school mean enrollment per grade, 2003-07



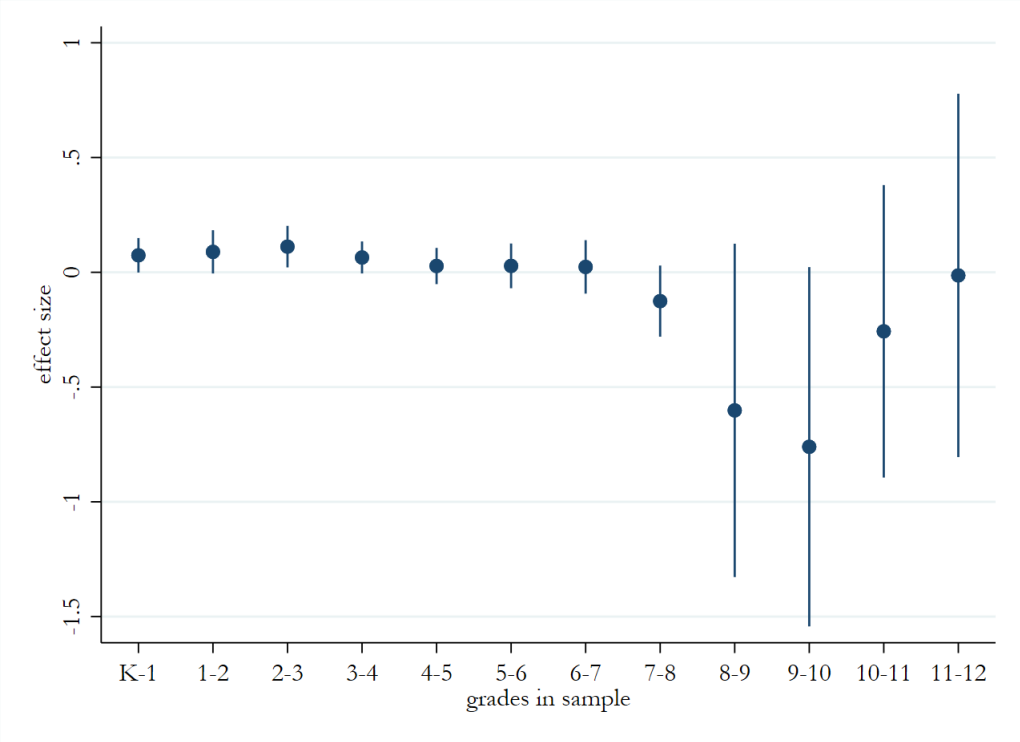
Notes: Figure plots actual and counterfactual mean private school enrollment per grade. Counterfactual was calculated using estimates from specification of eq. (7). Specification includes school controls (share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten, number of nearby private schools, and pre-policy trend), neighborhood controls (share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree, average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19), school, grade, year fixed effects.

Figure 11: Estimated effects of of public school competition on private school enrollment per grade, 2003-07



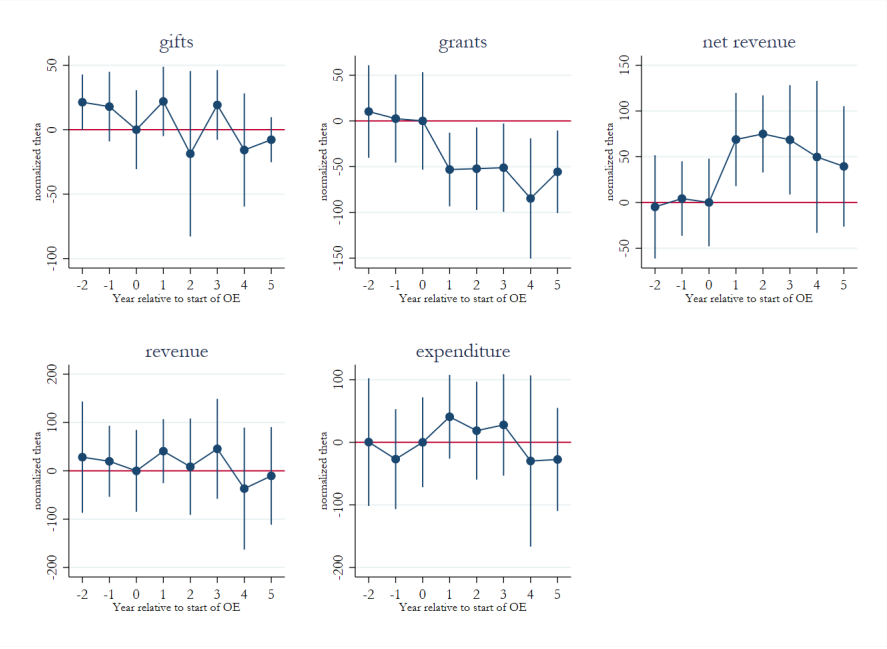
Notes: Figure plots θ for each year as defined in eq. (9). In (a) competition is measured using number of nearby public schools and in (b) the weighted competition indicator. 90% confidence intervals are estimated with clustered standard errors at the school level. Specification includes school controls (share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten, number of nearby private schools), neighborhood controls (share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree, average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19).

Figure 12: Heterogeneous effects of public school competition on private school enrollment by grade



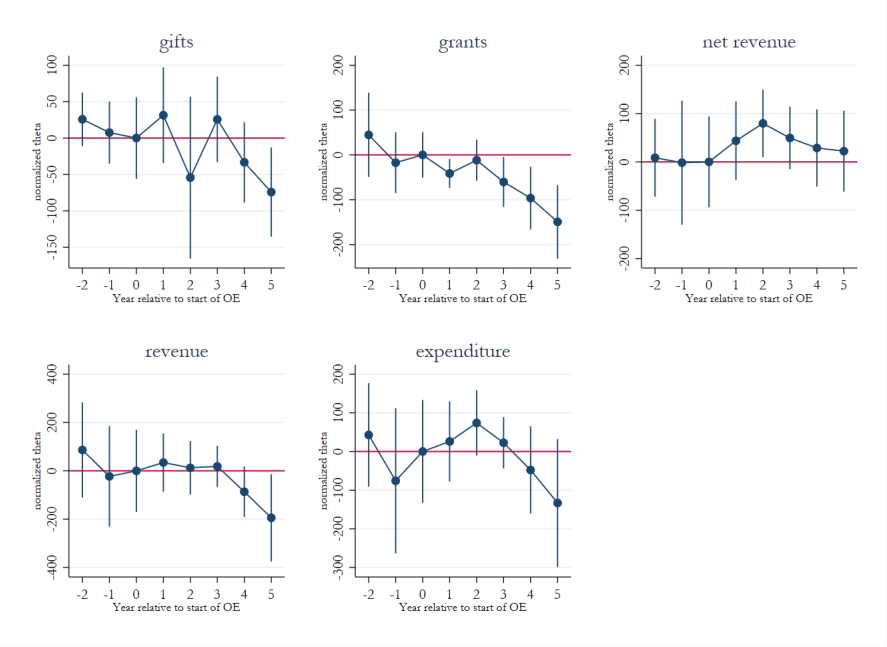
Notes: Figure plots θ as defined in eq. (7) for each sample of schools offering two grades. Competition is measured using number of nearby public schools. 90% confidence intervals are estimated with clustered standard errors at the school level. Specification includes school controls (share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten, number of nearby private schools), neighborhood controls (share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree, average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19).

Figure 13: Effects of public school competition on private school budget outcomes per student, 2000-07



Notes: 90% confidence intervals are estimated with clustered standard errors at the nonprofit organization level. Reported coefficients of interaction of competition indicator with OE are estimated in model with grade FE, year FE, school FE, school controls (share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten) and neighborhood controls (share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree; average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19). Outcome variables are expressed in nominal terms per student. Grants include federal, provincial, and municipal government grants. Net revenue corresponds to total revenue net of gifts and grants. Expenditure correspond to total expenditure. Primary schools defined as those that offer at least one grade in K-3, intermediate schools offer at least one grade in 4-7, secondary are school that offer at least one grade in 8-12.

Figure 14: Effects of public school competition on private school budget outcomes per student (using pre-policy enrollment), 2000-07



Notes: 90% confidence intervals are estimated with clustered standard errors at the nonprofit organization level. Reported coefficients of interaction of competition indicator with OE are estimated in model with grade FE, year FE, school FE, school controls (share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten) and neighborhood controls (share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree; average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19). Outcome variables are expressed in nominal terms per student. Grants include federal, provincial, and municipal government grants. Net revenue corresponds to total revenue net of gifts and grants. Expenditure correspond to total expenditure.

Tables

Table 1: Sample means, 2000 - 2007

	(1) All private	(2) Other Christian	(3) Other secular	(4) Catholic	(5) Waldorf/ Montessori	(6) Other Faith
school-grade-year level						
Enrollment per grade	35.07	30.03	45.15	35.64	18.76	27.1
Number of public schools within 5km	11.7	8.17	8.96	14.59	10.63	16.72
Number of public schools within 5km, weighted by distance and capacity ratio	6.52	4.37	4.78	8.32	6.18	9.4
Offers Kindergarten - grade3	0.41	0.37	0.3	0.46	0.71	0.52
Offers grades 4 - 7	0.37	0.35	0.25	0.45	0.15	0.38
Offers grades 9 - 12	0.22	0.29	0.45	0.08	0.15	0.09
Funding Group 1	0.82	0.92	0.24	1	0.84	1
Funding Group 2	0.13	0	0.62	0	0.09	0
Number of private schools within 5km	4.16	2.46	5.21	4.49	4.15	6.05
Share of female students	0.51	0.49	0.57	0.5	0.52	0.5
Share of aboriginal students	0.03	0.03	0.01	0.04	0.03	0
Offers full-day kindergarten	0.09	0.06	0.03	0.09	0.12	0.39
Neighbourhood characteristics						
Share with high school or less	0.34	0.42	0.24	0.35	0.37	0.36
Share with diploma or trade certificate	0.1	0.13	0.07	0.11	0.07	0.08
Share with college	0.22	0.23	0.2	0.22	0.21	0.2
Share with some university	0.08	0.07	0.1	0.08	0.08	0.09
Share with bachelor or higher	0.24	0.14	0.38	0.23	0.27	0.26
Average income per family	77,799	67,313	115,153	67,607	84,230	67,002
Average number of dwellings	289	285	359	274	230	198
Population	725	753	882	658	604	620
Share of recent immigrants	0.05	0.03	0.06	0.05	0.05	0.07
Population aged 0 - 4	36	39	40	34	26	29
Population aged 5 - 9	41	49	42	37	34	36
Population aged 10 -14	46	50	52	41	44	38
Population aged 15 - 19	49	51	65	41	46	40
Observations	6,746	1,793	1,377	3,010	241	325
Number of schools	147	32	40	51	17	7
School-year level						
Total revenue per student $	9,653	8,207	15,876	4,951	23,464	8,477
Total Expenditure per student $	9,487	7,708	15,592	4,883	23,649	8,285
Gifts/donations per student $	1,137	2,042	1,893	337	1,027	4,156
Government grants per student $	3,648	3,841	3,216	3,334	6,359	2,247
Revenue net of grants/gifts per student $	4,867	2,324	10,768	1,280	16,077	2,075
Observations	682	115	142	338	65	22
Number of schools	91	16	20	43	9	3
Number of non-profits	52	14	19	7	9	3

Notes: Neighborhood are defined according to Census enumeration or dissemination area where school is located. Nonprofits are defined as charities that filed T3010 form with information returns to Canada Revenue Agency and could be matched with private schools in the period from 2000 to 2007.

Table 2: Effect of public school competition on private school per grade enrollment, 2000-2007

	(1) 3km	(2) 3km	(3) 5km	(4) 5km	(5) 7km	(6) 7km	(7) 5km	(8) 5km
Number of nearby public school	-0.20***	-0.17**						
	(0.08)	(0.07)						
Number of nearby public school			-0.12**	-0.10**				
			(0.04)	(0.04)				
Number of nearby public school					-0.14***	-0.12***		
					(0.05)	(0.04)		
Weighted competition indicator							-0.27***	-0.23***
							(0.08)	(0.07)
N	6,746	6,746	6,746	6,746	6,746	6,746	6,746	6,746
R-squared	0.89	0.90	0.89	0.90	0.89	0.90	0.89	0.90
Year, school and grade FE	Y	Y	Y	Y	Y	Y	Y	Y
School controls	Y	Y	Y	Y	Y	Y	Y	Y
Neighbourhood controls	Y	Y	Y	Y	Y	Y	Y	Y
Control for pre-policy trends	N	Y	N	Y	N	Y	N	Y

Notes: coefficients correspond to θ from eq.(6) and (7). Competition is measured in columns (1)-(6) with number of public schools within either 3, 5 or 7 km of a private school. Competition indicator in columns (7)-(8) weights each public school within 5km by the inverse distance and the inverse student capacity ratio. Dependent variable is enrollment per grade. School controls include share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten. Neighbourhood controls include: share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree; average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19. Clustered standard errors at the school level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Effect of public school competition on private school per grade enrollment, 2000-2007

var	(1) base	(2) full
OE x Number of nearby public school	-0.16***	-0.10**
	(0.06)	(0.04)
Number of nearby public school	-0.42*	0.25
	(0.23)	(0.25)
share of female students		0.91
		(1.24)
share of aboriginal students		-5.77**
		(2.65)
offer full-day kindergarten		0.46
		(0.63)
Number of nearby private school		0.60
		(0.67)
share with trade or diploma		2.92
		(4.92)
share with college degree		-1.44
		(4.60)
share with some university		1.84
		(4.57)
share with bachelors degree or higher		5.17
		(3.82)
ln average family income		-0.16
		(0.11)
ln number of dwellings		-1.26
		(1.73)
ln population		2.92
		(2.57)
share of recent immigrants		-3.73
		(4.84)
ln population with age 0 to 4 years		-1.00
		(0.70)
ln population with age 5 to 9 years		0.39
		(0.75)
ln population with age 10 to 14 years		-0.31
		(0.62)
ln population with age 15 to 19 years		0.44
		(0.77)
N	6,746	6,746
R-squared	0.03	0.90
Year FE	Y	Y
School and grade FE	N	Y
School controls	N	Y
Neighbourhood controls	N	Y
Control for pre-policy trends	N	Y

Notes: column (1) reports base unconditional difference-in-differences estimation and column (2) shows coefficients of full model based on eq. (7). Competition is measured with number of public schools within 5 km of a private school. Dependent variable is enrollment per grade. Clustered standard errors at the school level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Decomposing the effect of public competition on per grade enrollment into components for each group of covariates

Covariates	(1) explained	(2) share_explained
neighbourhood SES	0.007	-.11
	(0.006)	
neighbourhood density	0.005	-.08
	(0.006)	
school characteristics	-0.019	.29
	(0.015)	
number of nearby private schools	0.002	-.03
	(0.003)	
grade FE	0.002	-.03
	(0.004)	
school FE	-0.063**	.95
	(0.027)	
Difference in $\hat{\theta}$ between full and base specifications	-0.066*	1
	(0.038)	
N	6,746	

Notes: numbers reported correspond to decomposition described in Gelbach(2016) to account for coefficient change in the coefficient θ from the base to the full specification. The base specification includes only comp, OE*comp, and year fixed effect. In addition to the variables included in base model, the full model includes school controls, neighbourgood controls, pre-policy trends, grade fixed effects, and school fixed effects. Neighbourhood SES includes: share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree; average family income. Neighbourhood density include: number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19. School characteristics include: share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten, pre-policy trend. Clustered standard errors at the school level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Heterogeneous effects of public school competition on private school per grade enrollment

	(1)	(2)	(3)	(4)	(5)
# of nearby public schools	0.08	-0.09**	-0.18	-0.09**	-0.09*
	(0.09)	(0.04)	(0.11)	(0.05)	(0.05)
other secular x # of nearby public schools	-0.26*				
	(0.14)				
Catholic x # of nearby public schools	-0.20**				
	(0.08)				
Waldorf/Montessori x # of nearby public schools	-0.20*				
	(0.11)				
other faith x # of nearby public schools	-0.04				
	(0.13)				
funding group 2 x # of nearby public schools		-0.17			
		(0.16)			
above median expenditure x # of nearby public schools			0.09		
			(0.09)		
above median price x # of nearby public schools				0.05	
				(0.07)	
above median school age x # of nearby public schools					0.30
					(0.20)
N	6,746	6,746	4,774	4,774	4,897
R-squared	0.90	0.90	0.93	0.93	0.93
Year, school and grade FE	Y	Y	Y	Y	Y
School controls	Y	Y	Y	Y	Y
Neighbourhood controls	Y	Y	Y	Y	Y
Control for pre-policy trends	Y	Y	Y	Y	Y

Notes: competition is measured with number of public schools within 5 km of a private school. Dependent variable is enrollment per grade. School controls include share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten. Neighbourhood controls include: share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree; average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19. Clustered standard errors at the school level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Effects of public school competition on private school budget, 2000-2007

	(1) gifts	(2) gifts	(3) grants	(4) grants	(5) net revenue	(6) net revenue	(7) revenue	(8) revenue	(9) exp	(10) exp
Number of nearby public school	-12.56	-30.42	-63.00***	-77.28**	60.67	43.42	-5.09	-57.93	16.28	4.62
	(12.18)	(26.78)	(22.57)	(36.26)	(36.93)	(54.80)	(58.19)	(105.16)	(57.17)	(86.15)
N	682	682	682	682	682	682	682	682	682	682
R-squared	0.67	0.74	0.76	0.79	0.88	0.90	0.83	0.88	0.85	0.90
Year and school FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
School controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Neighbourhood controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Control for pre-policy trends	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Outcome with pre-policy enrollment	N	Y	N	Y	N	Y	N	Y	N	Y

Notes: Coefficients reported correspond to θ from eq.(7). Competition is measured with number of public schools within 5 km of a private school. Outcome variables are per student. Gifts correspond to the sum of donations with or without a tax receipt. Grants include federal, provincial, and municipal government grants. Net revenue corresponds to total revenue net of gifts and grants. School control include share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten. Neighbourhood controls include: share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree; average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19. Clustered standard errors at the nonprofit level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Effects of public school competition on private school budget, 2000-2007

	(1) gifts	(2) gifts	(3) grants	(4) grants	(5) net revenue	(6) net revenue	(7) revenue	(8) revenue	(9) exp	(10) exp
Weighted competition indicator	65.38	50.27	-51.00	-32.31	40.37	22.42	62.50	-30.56	75.56	97.72
	(66.26)	(93.95)	(55.39)	(75.50)	(63.45)	(77.53)	(122.54)	(188.04)	(96.74)	(150.44)
N	682	682	682	682	682	682	682	682	682	682
R-squared	0.67	0.74	0.76	0.79	0.88	0.90	0.83	0.88	0.85	0.90
Year and school FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
School controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Neighbourhood controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Control for pre-policy trends	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Outcome with pre-policy enrollment	N	Y	N	Y	N	Y	N	Y	N	Y

Notes: coefficients reported correspond to θ from eq.(7). Competition indicator in the even columns weights each public school within 5km by the inverse distance and the inverse student capacity ratio. Outcome variables are per student . Gifts correspond to the sum of donations with or without a tax receipt. Grants include federal, provincial, and municipal government grants. Net revenue corresponds to total revenue net of gifts and grants. School control include share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten. Neighbourhood controls include: share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree; average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19. Clustered standard errors at the nonprofit level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

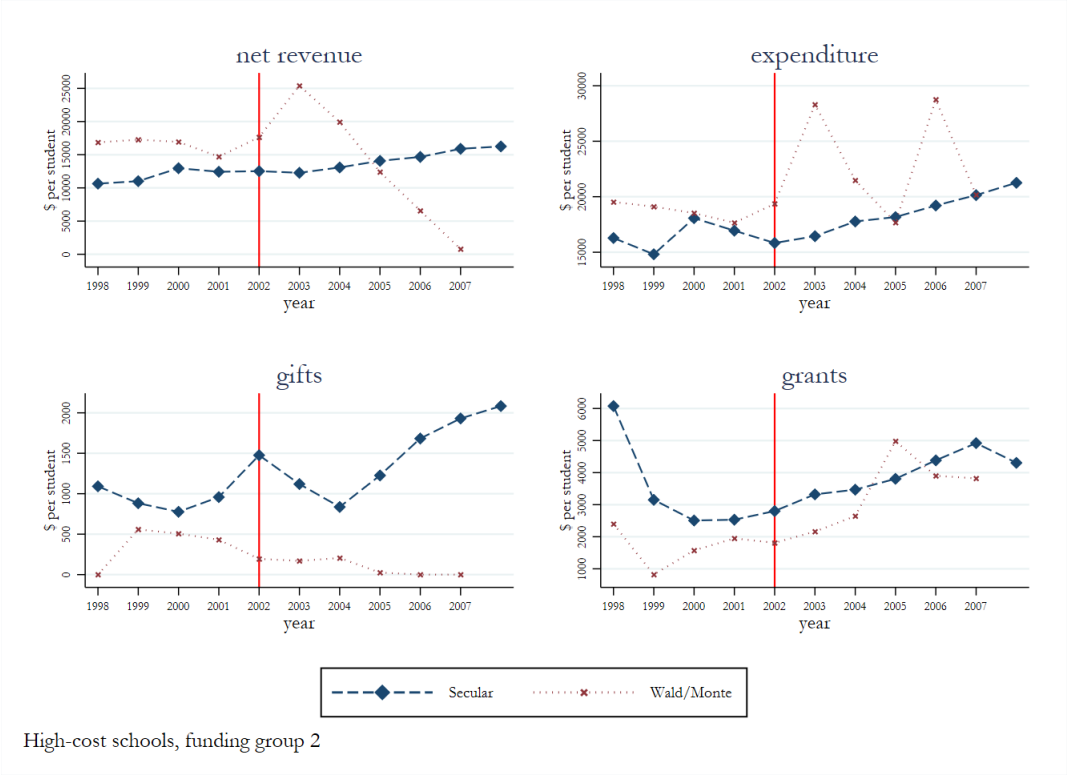
Table 8: Effects of public school competition on private school budget, 2000-2007

	(1) gifts	(2) gifts	(3) grants	(4) grants	(5) net revenue	(6) net revenue	(7) revenue	(8) revenue	(9) exp	(10) exp
# of nearby public school x 2003	9.47	21.28	-57.00***	-48.30**	68.70*	41.75	25.58	17.25	50.08	40.07
	(16.75)	(32.67)	(13.33)	(21.19)	(37.94)	(30.14)	(49.16)	(59.90)	(49.28)	(41.58)
# of nearby public school x 2004	-31.20	-64.48	-56.10***	-18.79	74.87**	77.69	-6.69	-4.77	27.95	88.12
	(38.87)	(77.33)	(13.73)	(31.96)	(31.37)	(49.78)	(53.01)	(104.51)	(45.47)	(77.94)
# of nearby public school x 2005	6.60	15.26	-55.07*	-67.79	68.44	47.44	30.23	0.59	36.99	35.91
	(16.54)	(32.46)	(30.25)	(42.30)	(44.02)	(61.89)	(83.04)	(119.71)	(66.73)	(90.07)
# of nearby public school x 2006	-28.37	-43.54	-88.70***	-103.67**	49.69	26.78	-52.13	-104.14	-20.57	-34.04
	(31.44)	(42.52)	(33.12)	(49.98)	(53.21)	(69.14)	(81.61)	(116.49)	(97.25)	(123.44)
# of nearby public school x 2007	-20.32	-84.47	-59.54	-156.70**	39.39	20.17	-25.72	-212.24	-18.28	-119.98
	(14.73)	(51.68)	(41.36)	(72.60)	(51.75)	(91.97)	(86.09)	(183.93)	(69.23)	(150.12)
N	682	682	682	682	682	682	682	682	682	682
R-squared	0.67	0.75	0.76	0.79	0.88	0.90	0.83	0.88	0.85	0.90
Year and school FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
School controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Neighbourhood controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Control for pre-policy trends	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Outcome with pre-policy enrollment	N	Y	N	Y	N	Y	N	Y	N	Y

Notes: Coefficients reported correspond to θ from eq.(8). Competition is measured with number of public schools within 5 km of a private school. Outcome variables are per student. Gifts correspond to the sum of donations with or without a tax receipt. Grants include federal, provincial, and municipal government grants. Net revenue corresponds to total revenue net of gifts and grants. School control include share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten. Neighbourhood controls include: share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree; average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19. Clustered standard errors at the nonprofit level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

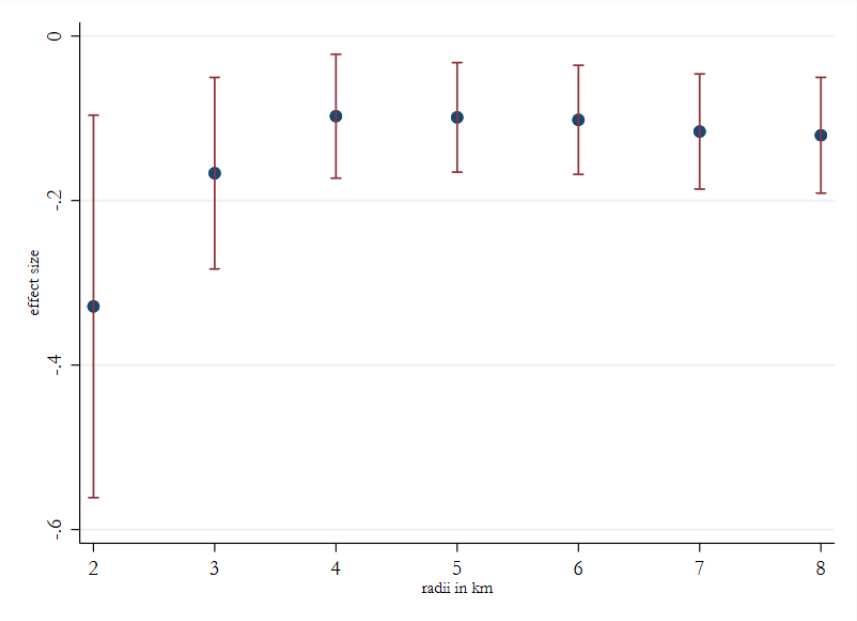
Appendix

Figure A1: Mean private school budget characteristics in BC by private school type, high-cost schools



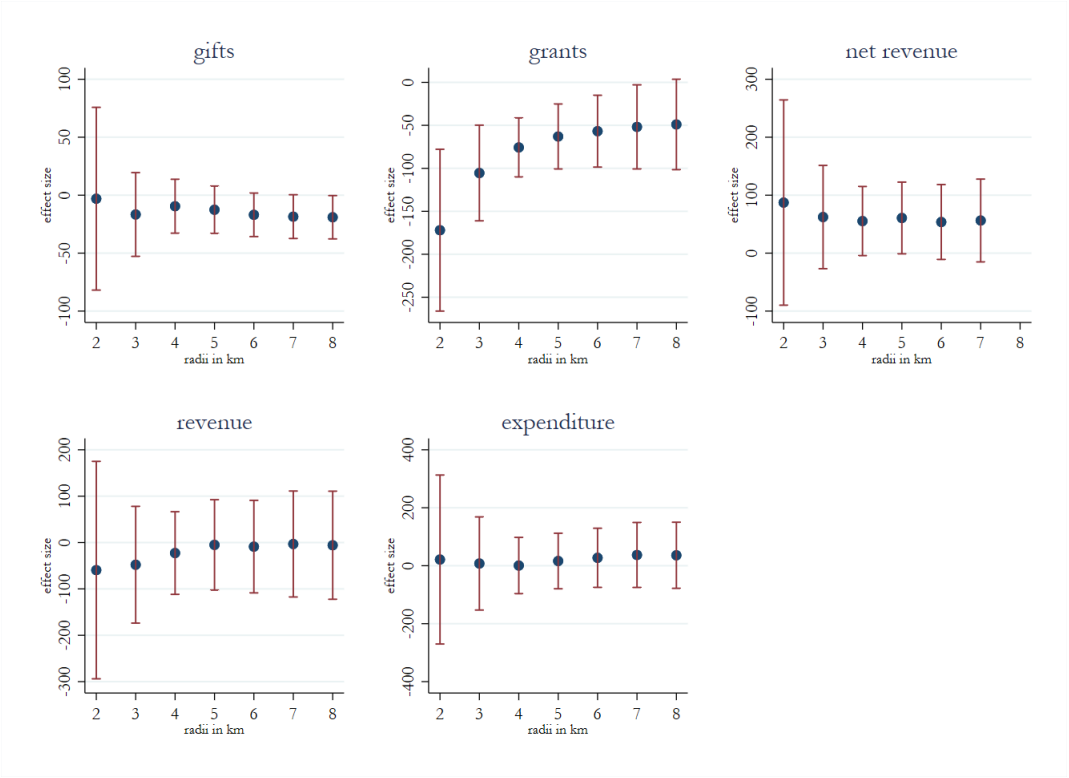
Notes: Only schools categorized as secular and Waldorf/Montessori are in the funding group 2 in my sample. Funding group 1 and 2 receive 50% and 35% of what public schools receive per student, respectively. Grants include federal, provincial, and municipal government grants. Net revenue corresponds to total revenue net of gifts and grants. Expenditure correspond to total expenditure. All values are expressed in nominal terms. Source: author's calculations from CRA data.

Figure A2: Estimated effects of public school competition on private school enrollment per grade using several radii



Notes: This figure shows the sensitivity of the effects on enrollment to the definition of the circle that determines the number of public schools near a private school. The figure plots θ based on eq. (7) for several radii (in km) of the circle around each private school. 90% confidence intervals are estimated with clustered standard errors at the school level. Specification includes school, grade, and year FE, pre-policy trend, school controls (share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten, number of nearby private schools), and neighborhood controls (share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree, average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19).

Figure A3: Estimated effects of public school competition on private school budget using several radii



Notes: This figure shows the sensitivity of the effects on enrollment to the definition of the circle that determines the number of public schools near a private school. The figure plots θ based on eq. (7) for several radii (in km) of the circle around each private school. 90% confidence intervals are estimated with clustered standard errors at the school level. Specification includes school, grade, and year FE, pre-policy trend, school controls (share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten, number of nearby private schools), and neighborhood controls (share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree, average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19).

Table A1: Effect of public school competition on private school per grade enrollment by year

	(1)	(2)	(3)	(4)
# of nearby public school x 2003	-0.05	-0.04		
	(0.03)	(0.03)		
# of nearby public school x 2004	-0.06	-0.04		
	(0.04)	(0.04)		
# of nearby public school x 2005	-0.15***	-0.13***		
	(0.05)	(0.05)		
# of nearby public school x 2006	-0.17***	-0.14**		
	(0.06)	(0.06)		
# of nearby public school x 2007	-0.18**	-0.15**		
	(0.07)	(0.07)		
Weighted competition indicator x 2003			-0.12**	-0.11**
			(0.06)	(0.05)
Weighted competition indicator x 2004			-0.14**	-0.11*
			(0.07)	(0.06)
Weighted competition indicator x 2005			-0.33***	-0.29***
			(0.09)	(0.08)
Weighted competition indicator x 2006			-0.38***	-0.32***
			(0.11)	(0.10)
Weighted competition indicator x 2007			-0.40***	-0.33***
			(0.13)	(0.12)
N	6,746	6,746	6,746	6,746
R-squared	0.89	0.90	0.90	0.90
Year, school and grade FE	Y	Y	Y	Y
School controls	Y	Y	Y	Y
Neighbourhood controls	Y	Y	Y	Y
Control for pre-policy trends	N	Y	N	Y

Notes: competition is measured in column (1) with number of public schools within 5 km of a private school. Competition indicator in columns (2) weights each public school within 5km by the inverse distance and the inverse student capacity ratio. Dependent variable is enrollment per grade. School controls include share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten. Neighbourhood controls include: share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree; average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19.(1)Clustered standard errors at the school level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A2: Effect of public school competition on private school per grade enrollment by year

	(1)	(2)	(3)	(4)
# of nearby public school x 2000	0.28	0.24		
	(0.28)	(0.25)		
# of nearby public school x 2001	0.31	0.27		
	(0.28)	(0.25)		
# of nearby public school x 2002	0.27	0.23		
	(0.28)	(0.25)		
# of nearby public school x 2003	0.24	0.20		
	(0.28)	(0.25)		
# of nearby public school x 2004	0.23	0.20		
	(0.28)	(0.25)		
# of nearby public school x 2005	0.14	0.11		
	(0.29)	(0.26)		
# of nearby public school x 2006	0.12	0.10		
	(0.29)	(0.26)		
# of nearby public school x 2007	0.11	0.10		
	(0.30)	(0.27)		
Weighted competition indicator x 2000			0.34	0.34
			(0.48)	(0.43)
Weighted competition indicator x 2001			0.42	0.39
			(0.47)	(0.42)
Weighted competition indicator x 2002			0.31	0.30
			(0.47)	(0.42)
Weighted competition indicator x 2003			0.24	0.24
			(0.47)	(0.42)
Weighted competition indicator x 2004			0.22	0.23
			(0.48)	(0.43)
Weighted competition indicator x 2005			0.03	0.05
			(0.49)	(0.43)
Weighted competition indicator x 2006			-0.02	0.03
			(0.49)	(0.44)
Weighted competition indicator x 2007			-0.05	0.01
			(0.51)	(0.45)
Ho: all interaction terms before 2003 are equal (P-value)	0.11	0.13	0.04	0.05
N	6,746	6,746	6,746	6,746
R-squared	0.89	0.90	0.90	0.90
Year, school and grade FE	Y	Y	Y	Y
School controls	Y	Y	Y	Y
Neighbourhood controls	Y	Y	Y	Y
Control for pre-policy trends	N	Y	N	Y

Notes: competition is measured with the number public school within 5km. Weighted indexes weight each nearby public school by the inverse distance, the inverse student capacity ratio, or both. School controls include share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten. Neighbourhood controls include: share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree; average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19. Clustered standard errors at the school level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A3: Effect of public school competition on private school per grade enrollment by year, sample of schools matched with CRA data, 2000-07

	(1)	(2)	(3)	(4)
# of nearby public school x 2003	-0.02	-0.01		
	(0.04)	(0.04)		
# of nearby public school x 2004	-0.03	-0.02		
	(0.05)	(0.04)		
# of nearby public school x 2005	-0.14**	-0.12**		
	(0.06)	(0.05)		
# of nearby public school x 2006	-0.20***	-0.17**		
	(0.07)	(0.07)		
# of nearby public school x 2007	-0.17**	-0.14*		
	(0.08)	(0.08)		
Weighted competition indicator x 2003			-0.06	-0.05
			(0.07)	(0.07)
Weighted competition indicator x 2004			-0.09	-0.07
			(0.09)	(0.08)
Weighted competition indicator x 2005			-0.28***	-0.25***
			(0.10)	(0.09)
Weighted competition indicator x 2006			-0.39***	-0.34***
			(0.13)	(0.12)
Weighted competition indicator x 2007			-0.34**	-0.28**
			(0.15)	(0.13)
N	4,787	4,787	4,787	4,787
R-squared	0.93	0.93	0.93	0.93
Year, school and grade FE	Y	Y	Y	Y
School controls	Y	Y	Y	Y
Neighbourhood controls	Y	Y	Y	Y
Control for pre-policy trends	N	Y	N	Y

Notes: competition is measured in column (1) with number of public schools within 5 km of a private school. Competition indicator in columns (2) weights each public school within 5km by the inverse distance and the inverse student capacity ratio. Dependent variable is enrollment per grade. School controls include share of aboriginal students, share of female students, indicator for whether school offers full-day kindergarten. Neighbourhood controls include: share of population with trade or diploma, with college degree, with bachelor's degree or higher, with university without degree; average family income, number of dwellings, population size, population by age groups 0-4, 5-9, 10-14, 15-19. Clustered standard errors at the school level in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The sample used for those estimates include only schools that were matched to nonprofit information returns data.