

June 2018

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## Recommended Citation

Fleming, D. J., Lavertu, S., & Crawford, W. (2018). High School Options and Post-Secondary Student Success: The Catholic School Advantage. *Journal of Catholic Education*, 21 (2). <http://dx.doi.org/10.15365/joce.2102012018>

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## High School Options and Post-Secondary Student Success: The Catholic School Advantage

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*Recognizing that post-secondary student attainment and achievement is of increasing import for economic success, this study compares the post-secondary performance of students who attended public and private high schools. The results generally indicate that students who attended Catholic high schools had higher college grade-point averages (GPAs), were more likely to graduate, and were more likely to graduate with a STEM degree. This Catholic school advantage was wide-ranging, benefiting many subgroups of students, including non-white, low income, urban, and low-achieving students. We controlled for a rich set of factors and conducted sensitivity analyses to establish the strength of these results.*

### Keywords

Catholic education, post-secondary education, STEM, school choice

Receiving a college degree has perhaps never been more important. Compared to a high school diploma, a college degree is worth an additional \$1.6 million (USD) in lifetime earnings (Carnevale, Smith, & Strohl, 2010), and the college wage premium has doubled since the 1980s (James, 2012). According to one study, by 2018 63% of the almost 47 million jobs created by the U.S. economy will require a college degree or some other type of postsecondary schooling, and labor market demand for college graduates will exceed supply by three million people (Carnevale et al., 2010). Of particular importance, the American economy will create one million more science, technology, engineering, and mathematics (STEM) jobs than available STEM graduates over the next decade, according to estimates from the President's Council of Advisors on Science and Technology (2012). Consequently, experts

and policymakers are concerned with increasing post-secondary educational attainment, particularly in the STEM fields.

At the same time, the number of voucher and tax credit programs funding private K-12 education has increased significantly in recent years. Yet, despite the personal and societal importance of a college diploma—particularly a diploma in a STEM field—research comparing the impact of K-12 private and public schooling options generally focuses on more proximate measures of student success, such as scores on standardized tests and the probability of high school graduation.<sup>1</sup> The few studies that link private school attendance and postsecondary attainment and achievement generally looked at college entrance rates or college grade-point averages (GPAs) and did not examine the probability of graduation or the type of degree students earn. Given the increased attention paid to producing college-ready students and the increased need for a college-educated workforce—particularly in STEM fields—an analysis that compares the college success of students who attended public high schools to those who attended private ones could prove instructive.

This study examines the educational performance of students at a large public university who entered as freshmen between the fall of 2000 and the fall of 2008. We examine the relationship between the type of high school these students attended—private Catholic, other private-religious, private nonsectarian, or public—and their college GPAs, graduation rates, and the likelihood of earning degree in a STEM field. Importantly, we employ an expansive set of controls to account for selection into high school and college, including measures of socioeconomic status and educational ability, as well as the cities in which students attended high school. While an observational study of this type cannot completely account for all forms of selection bias, the statistical controls we employ account for important differences between students. Additionally, as we discuss below, we conduct a number of analyses examining differences in outcomes within student subgroups and within the private school sector (i.e., limited to students who attended private high schools) in order to establish the robustness of our results.

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1 Some scholars have emphasized the relationship between standardized test scores and economic growth and claim that this is a more important predictor of economic growth than educational attainment (e.g., Hanushek, Peterson, & Woessmann, 2013). Nevertheless, policymakers and education experts consider post-secondary attainment as a critical policy goal.

## Review of Literature

### The Effectiveness of Private and Public Schools

The academic debate regarding the efficacy of private versus public education has raged for decades, and the growing prevalence of school choice programs has added to the controversy. Early studies found that students in private schools outperformed those in public schools on achievement tests (e.g., Coleman & Hoffer, 1987; Coleman, Hoffer, & Kilgore, 1982). Additionally, more recent research indicated that students who attended Catholic high schools were more likely to attend four-year universities than similar public school students (Coughlin & Castilla, 2014; Evans & Schwab, 1995; Nguyen, Taylor, & Bradley, 2006). Catholic high school attendance is also associated with attending a more selective college (Eide, Goldhaber, & Showalter, 2004), as well as graduating from college (Coughlin & Castilla, 2014; Neal, 2002). While these studies point to a private, especially Catholic, school advantage, a recent analysis by Lubienski and Lubienski (2013) found that elementary public school students outperform private school students in mathematics after adjusting for student and family background characteristics.

Despite the importance of educational attainment, only a small number of school voucher evaluations have examined this topic. The few studies that exist indicate that voucher usage increases high school graduation rates (Cowen, Fleming, Witte, Wolf, & Kisida, 2013; Wolf et al., 2013). In the first study to use a randomized lottery to examine the effects of private school vouchers on college attainment, Chingos and Peterson (2015) found no overall significant effects on college enrollment or four-year degree attainment. However, they did find that a voucher offer significantly increased the likelihood of degree attainment for African-American students and those students born to non-immigrant mothers.

### High School Options and Post-Secondary Student Achievement and Attainment

The research on college attendance and persistence usually either analyzes large, nationally representative longitudinal surveys that track K-12 students through college, or evaluates K-12 reform programs, such as school vouchers. We follow a third approach and use data on incoming students to a university in order to examine a richer set of post-secondary student achievement and attainment data. The handful of studies that have used this design have generated conflicting results.

Horowitz and Spector (2005) examined students who enrolled at Ball State University in 2002. They found that students who attended a religious high school had a higher college GPA early in their college careers than students who attended non-religious private schools or public schools. They also found that this religious school advantage diminished over time and disappeared by the junior (grade 11) and senior (grade 12) years. Controlling for a host of factors, Cyrenne and Chan (2012), examining students at the University of Winnipeg, found that students who attended private high schools had GPAs 0.10 points higher than those who attended public high schools. Unlike Horowitz and Spector (2005), however, they found no evidence that the religious nature of some high schools increased college grades. Pike and Saupe (2002) followed 8,674 first-year students attending a major research university in the Midwest. The study found that students from private high schools generally had higher first-year college GPAs than students who attended public high schools. Monto and Dahmen (2009) came to a different conclusion. Studying students at the University of Portland, a private Catholic university, they compared first year GPAs of students who attended private and public high schools. After adjusting for SAT scores, they found that public school graduates had a higher college GPA than private school graduates. Although private and public school graduates selected into somewhat different academic programs or majors, students who attended a public high school generally outperformed those who attended private high schools regardless of the academic program.

Our study moves the literature forward in four important ways. First, as outlined above, studies of this type have come to conflicting conclusions: students who attended private high schools have been found to outperform, underperform, or perform at the same level in college as those who attended a public high school.

Second, we are able to examine a greater number of performance outcomes. Previous studies only examined cumulative GPA (Cyrenne & Chan, 2012; Horowitz & Spector, 2005) or first-year GPA (Monto & Dahmen, 2009; Pike & Saupe, 2002). In this study, we examine cumulative college GPA<sup>2</sup> and the likelihood of graduation. Our examination of college graduation is of particular importance, as this outcome is associated with many positive benefits.<sup>3</sup>

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2 For students who dropped out of school, student GPA is determined by the student's final cumulative GPA when they are last observed in the data.

3 Examining the college wage premium, James (2012) finds that the value of college

Third, we examine how high school type is related to graduating with a degree in a STEM field. Few evaluations have examined this outcome; when scholars have, they often focus on having a STEM major rather than graduating with a STEM degree (e.g., Horowitz & Spector, 2005). This is an important distinction, as fewer than 40 percent of students who intend to major in a STEM field when they enter college finish with a STEM degree (President's Council of Advisors on Science and Technology, 2012). Finally, our analysis allows us to examine different types of private schools—Catholic, other religious, and nonsectarian. Previous analyses have been unable to examine how different types of private high schools might be related to college success.

## Method

### Hypotheses

While the evidence of private school effectiveness outlined above is somewhat mixed, studies that have examined attainment, rather than standardized test scores, have been more consistently supportive of the conclusion that there is a private school advantage (Chingos & Peterson, 2015; Cowen et al., 2013; Wolf et al., 2013). Perhaps, private schools and other schools of choice “produce larger effects on attainment than on test scores because they are endowing students with skills, knowledge, work habits, motivation, and values that are important for long-term success but are not fully captured by test scores” (Booker, Gill, Sass, & Zimmer, 2014, p. 3).

*H*<sub>1</sub>: Students who attended private high schools will have higher college GPAs and a higher likelihood of graduating than students who attended public high schools.

Research on the effects of private schooling generally finds that urban, African-American, Hispanic, and economically disadvantaged students are the most likely to benefit from private schools (e.g., Altonji, Elder, & Taber, 2005; Coleman & Hoffer, 1987; Grogger & Neal, 2000; Neal, 1997). Neal (1997) suggested that disadvantaged, minority, and urban students are the

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in terms of wages has increased significantly over the past three decades, but all of these gains have gone to those who complete a four-year degree. Compared to those with just a high school degree, workers with some college experience but no degree have experienced little growth in earnings over the past thirty years.

most likely to benefit from Catholic education because their local public schools are often of low quality.

*H*<sub>2</sub>: Minority, low-income, and urban students, as well as those with lower ACT scores, who attended private high schools will exhibit more positive student outcomes than similar students who attended public high schools.

Early research on the achievement differences between Catholic and public schools found that Catholic schools increase student learning.<sup>4</sup> Catholic education has also been associated with greater attainment, as students who attend Catholic high schools are more likely to graduate high school, attend college, and graduate from college (e.g., Altonji et al., 2005; Evans & Schwab, 1995; Neal, 1997; Nguyen et al., 2006).

*H*<sub>3</sub>: Students who attended Catholic high schools will have higher college GPAs and a higher likelihood of graduating than students who attended public high schools or other types of private high schools.

We expect a relationship between high school sector and the likelihood of graduating with a degree in a STEM field. Early research on Catholic schools found that the greater learning gains in Catholic schools may be attributed to a more rigorous curriculum and more inclusive tracking placements (Bryk, Lee, & Holland, 1993; Gamoran, 1996). Compared to public schools, Catholic schools often offer fewer electives and steer their students toward more advanced courses (Hallinan & Kubitschek, 2012). While many analyses found that Catholic schools required more advanced mathematics coursework than do public schools (e.g., Domina & Saldana, 2012; Saw & Broda, 2012), there is some evidence that Evangelical Protestant school graduates were less likely to have taken upper-level math courses (Cardus Education Survey, 2014). Further, college students who attended Evangelical Protestant high schools were found to be underrepresented in the life and physical sciences, computer and information sciences, and engineering, and overrepresented in the social and behavioral sciences (Sikkink, 2014). Graduates from Catholic and nonreligious private high schools, on the other hand, were generally found to be overrepresented in the STEM majors.

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<sup>4</sup> It should be noted that other analyses find no advantages to Catholic school education (e.g., Jepsen, 2003; Willms, 1985).

What may explain these differences? One possibility is that some fundamentalist Protestants may have religious beliefs that are incompatible with advanced science courses. Misgivings about evolution, the use of the scientific method, and “new math” may lead some in conservative Protestant communities to choose other career paths (Darnell & Sherkat, 1997).<sup>5</sup> Current Catholic doctrine has a less strident relationship with modern science than do many fundamentalist Protestant churches (Sherkat, 2011). While Sikkink’s (2014) analysis may suggest that Evangelical Christian education is incompatible with advanced science and math training, that argument does not explain why Evangelical students would be overrepresented in the social and behavioral sciences (p. 4). Rather, other explanations, such as an emphasis on direct human service in Evangelical Christianity or the lack of quality science labs and teachers in high school, may be why graduates of Evangelical high schools are less likely to graduate college with a STEM degree (Sikkink, 2010, 2014).

*H<sub>4</sub>*: Students who attended Catholic high schools will be more likely to graduate with a STEM degree than students who did not attend Catholic high schools.

### Empirical Strategy

This analysis examines the relationship between the type of high school students attended (private-Catholic, private-“other religious,” private-nonsectarian, or public) and students’ college GPAs, probability of ever graduating, probability of graduating in four years, and the probability of graduating with a degree in a STEM field. Specifically, the results below are from statistical models that estimate the student-level cross-sectional relationship between high school type and post-secondary performance for in-state students who matriculated as freshmen in the fall semesters between 2000 and 2008. To mitigate the role of bias resulting from selection into high schools and selection on the part of students and the university during the college admissions process, we include an extensive battery of covariates that account for observed student characteristics. Additionally, the university does not consider high school type in the admissions process.<sup>6</sup> The data structure allows us to

5 In stark contrast to the public school setting, Rosen (2005) notes that some fundamentalist teachers begin science class with a Bible verse.

6 This fact was confirmed via interviews of administrators and staff. However, admissions officers do consider high school quality more generally, which may be correlated with sector.

compare students within the same cohort at the same university who attended different types of high schools. Finally, we conduct a number of analyses within student subgroups and high school types that allow us to examine the possibility of differential effects of private schooling.

The results presented below are from ordinary least squares (OLS) regression models with the following specification:

$$Y_{ij} = \beta_0 + \beta_1 CATH_j + \beta_2 OTHER_j + \beta_3 NONSECT_j + \gamma COV_i + \varepsilon_{ij}$$

where  $Y_{ij}$  is the outcome of interest (e.g., probability of graduation or GPA) for student  $i$  who attended high school  $j$ .<sup>7</sup> The variables  $CATH_j$ ,  $OTHER_j$ , and  $NONSECT_j$  indicate whether (1) or not (0) a high school is Catholic, “other religious,” or nonsectarian, respectively, as opposed to public. The student-level covariates,  $COV_i$ , include binary indicator variables for household income (middle or high, as opposed to low), race (black, Hispanic, Asian, or unknown, as opposed to white), sex (female, as opposed to male), cohort (for each entering class 2001–2008, as opposed to 2000), college major<sup>8</sup>, and for each possible ACT score (15–36, as opposed to 14). We also include two variables that we treat as continuous—student age and the number of college credits earned prior to matriculation. Finally, we demeaned the data in order to account for the fixed effects of the city in which high schools reside and clustered the errors by high school.

Though our preferred specification includes all of the covariates listed above, variables capturing ACT scores and earned college credits are potentially problematic because they are, to some extent, a product of the high schools students attend. In other words, accounting for them should decrease the size of our estimated effects because they capture some of the positive effect that schools might have on post-secondary outcomes. Indeed, models that exclude these variables yield stronger results across nearly all models we

7 Note that equation 1 is a linear probability model. We use this robust estimation technique because it enables us to account for city fixed-effects and allows for easy interpretation of marginal effects. We also estimated all models using a probit link function and without city fixed-effects. The results of the probit models are similar to those of OLS models that omit city fixed effects. Specifically, as is the case with the OLS models, removing city fixed effects leads to null results for many models estimating the probability of graduation with a STEM major, whereas the results of all other models (estimating the probability of graduation and GPA across all students and by student subgroup) remain similar.

8 Indicators for college majors are not included in the model estimating the probability of graduating with a STEM degree.

report below.<sup>9</sup>

On the other hand, capturing students' academic aptitude carefully is critical to our identifying the impact of high school options. For example, ACT and college credits earned in high school are important predictors of selection into college, as well as success in college (e.g., Betts & Morell, 1999). According to a survey of university admission counselors, academic performance in college prep courses is the most important factor in college admissions, and ACT/SAT scores are seen as more important than overall GPA, class rank, and letters of recommendation from teachers and counselors (Clinedinst, Hurley, & Hawkins, 2012). Thus, because accounting for academic aptitude and performance in college prep coursework is so important, and to err on the side of reporting conservative estimates, we report only the results of the models that account for ACT scores and college credit hours earned while in high school. Indeed, we account for ACT score via a series of 20 indicator variables to avoid imposing a functional form on such an important factor.

### Data

The data cover nine different freshmen cohorts of in-state students at one of the largest public universities in the United States, providing much needed empirical variation. The university's office of enrollment services provided all student-level data, including high schools' ACT identifiers. We classified high schools by sector using data made publicly available by the state (for public schools) and the National Center for Education statistics (for private schools). The entire dataset includes 45,728 students, including 39,009 students from public schools, 5,698 from private Catholic Schools, 206 from private nonsectarian schools, and 491 students from other private-religious high schools.<sup>10</sup> The high school addresses provided by state and federal sources enabled us to identify the city in which schools are located.

The university created the socioeconomic classification scheme based on residential density and income by tying the zip codes from students' home addresses to Census data. This variable is used as a proxy for students' income level. The race and gender data are based on self-reports on student applications. We employed student ACT scores because over 93% of students had ACT scores, whereas just over half had SAT scores. For the seven percent

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9 These results are available from the authors upon request.

10 There were 324 students in the dataset that did not fit into one of the five high school options, and they were excluded from this analysis.

of students without ACT scores, we imputed values using an SAT-ACT concordance table that the College Board makes available online. Finally, we coded student majors into eight categories based on the College Board coding scheme: Arts and Humanities, Business, Health and Medicine, Multi-Interdisciplinary Studies, Public and Social Services, STEM (specifically, “Science, Math, and Technology”), Social Sciences, and Trades and Personal Services.

Table 1 presents descriptive statistics that illustrate important differences in student demographics by school type. Whereas over 80% of students who attended public, Catholic, and other religious high schools are white, white students make up only 61% of students who attended nonsectarian private schools. Asian students made up a larger proportion of the student body that attended these nonsectarian high schools. There is relatively little difference between school types in the proportion of students from low-income neighborhoods; however, students who had attended nonsectarian and other religious high schools were more likely to come from high income areas than students who had attended Catholic or public high schools. The table also reveals important differences by urbanicity. Students who attended public high schools were more likely to come from rural areas, while private school students were relatively more likely to have lived in suburban or urban settings. The average ACT score was roughly similar across students from all school types, ranging between 26 and 27. Finally, in terms of our outcomes of interest, students who attended Catholic high schools had the highest college GPAs, total college graduation rate, and four-year college graduation rate, and they were more likely than students who attended other high school types to have graduated with a STEM degree.

Table 1  
*Descriptive Statistics by School Type*

Variable	Public	Private– Catholic	Private– Other Religious	Private– Nonsectarian
Number of Students	39,009	5,698	491	206
Number of Schools	725	77	52	14
White	82.4%	87.8%	80.2%	61.2%
Black	7.8%	4.2%	10.0%	11.7%
Hispanic	2.1%	3.0%	1.6%	1.5%
Asian	6.2%	3.4%	5.7%	19.9%
Other/Unknown Race	1.6%	1.6%	2.4%	5.8%
Female	50.8%	47.6%	41.1%	59.2%
Low Income	12.5%	9.7%	10.6%	10.2%
Medium Income	45.9%	50.8%	43.8%	30.1%
High Income	41.1%	39.2%	44.6%	58.7%
Town/Country	45.3%	25.1%	30.3%	33.5%
Suburban	40.1%	53.2%	49.9%	45.6%
Urban	14.1%	21.5%	18.7%	19.9%
Average Age at entry	18.1	18.1	18.2	18.0
Average ACT Score	25.8	26.5	26.7	27.3
Average College Credits at Entry	11.9	10.4	10.6	16.0
College GPA	3.04	3.13	3.11	3.00
Graduation Rate - Total	79.3%	83.9%	76.2%	81.1%
Graduation Rate - 4 Years	48.5%	52.1%	44.6%	46.1%
STEM Graduate	23.8%	24.1%	22.4%	22.3%

## Results

Using a dataset of almost 45,000 observations, we examined college grade point averages, the likelihood of graduating within four years, the likelihood of ever graduating, and the likelihood of graduating with a STEM degree for students who attended a public high school, Catholic high school, other religious high school, or nonsectarian private high school. Table 2 presents the results of models estimated using the specification in equation 1 above, which accounts for fixed effects associated with the city in which a high school resides; indicator variables capturing student demographics, students' ACT scores, college major, and student cohort at the university; and the number of post-secondary credit hours earned while in high school. The large sample sizes in these analyses mean that even substantively small differences may be statistically significant.

The first column of results in Table 2 reveals that after controlling for a host of factors, students that attended religious high schools, both Catholic and non-Catholic, had a higher GPA than those who attended public high schools. Specifically, students who attended Catholic high schools had college GPAs that were 0.11 points higher than students who attended public high schools, whereas those who attended other religious schools had GPAs that were 0.08 points higher. Students who attended private nonsectarian high schools had the lowest average college GPA. As expected, socio-economic status mattered, as those from medium- and high-income families had higher GPAs than those from low-income families. Female students had a 0.22 point higher GPA than male students, which is consistent with previous research (Betts & Morell, 1999; Holmgren & McCracken, 2014).

The second and third models in Table 2 indicate that students who had attended Catholic high schools were six percentage points more likely to ever graduate from this university, and six percentage points more likely to graduate within four years, than those who attended public high schools. There were no statistically significant differences in the likelihood of graduation between those who attended other religious high schools and those who went to public high schools, but those who attended private, nonsectarian high schools were 8 percentage points less likely to graduate in four years.

Table 2  
Relationship between School Type and Outcomes of Interest

	GPA		Graduated		Graduated in 4 Years		Graduated with STEM Degree	
Catholic	0.11	***	0.06	***	0.06	***	0.02	**
	(0.02)		(0.01)		(0.01)		(0.01)	
Other Religious	0.08	*	-0.02		0.01		-0.01	
	(0.05)		(0.02)		(0.03)		(0.01)	
Nonsectarian	-0.09	**	-0.01		-0.08	**	-0.04	
	(0.04)		(0.02)		(0.04)		(0.03)	
Age	0.04	***	0.00		0.01		0.00	
	(0.01)		(0.00)		(0.01)		(0.00)	
Medium Income	0.06	***	0.02	***	0.01		0.01	
	(0.01)		(0.01)		(0.01)		(0.01)	
High Income	0.10	***	0.05	**	0.03	***	0.02	**
	(0.01)		(0.01)		(0.01)		(0.01)	
Suburban	0.04	***	0.01	**	0.02	**	0.02	***
	(0.01)		(0.01)		(0.01)		(0.01)	
Town/Country	0.02		0.01		0.01		0.02	***
	(0.01)		(0.01)		(0.01)		(0.01)	
Black	-0.24	***	-0.03	***	-0.04	***	-0.01	
	(0.02)		(0.01)		(0.01)		(0.01)	
Hispanic	-0.14	***	-0.04	***	-0.05	***	-0.01	
	(0.02)		(0.01)		(0.01)		(0.01)	
Asian	-0.02		0.03	***	0.03	***	0.12	***
	(0.01)		(0.01)		(0.01)		(0.01)	
Other/Unknown Race	-0.10	***	-0.03	**	-0.05	***	0.01	
	(0.03)		(0.01)		(0.02)		(0.02)	
Female	0.22	***	0.03	***	0.19	***	-0.13	***
	(0.01)		(0.00)		(0.00)		(0.00)	
Constant	1.94	***	0.52		-0.17		0.12	
	(0.28)		(0.36)		(0.29)		(0.11)	
F	154.15	***	754.82	***	220.52	***	92.50	***
Adj. R-squared	0.23		0.17		0.15		0.12	
N	44,557		44,557		44,557		45,293	

*Note:* \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.10$ . The OLS models presented above also include indicator variables capturing student cohorts, ACT scores, and college major, as well as the number of college credit hours earned while in high school. We exclude these coefficients in the interest of space. Additionally, models account for fixed-effects associated with the city in which high schools reside. Robust standard errors are clustered by high school and reported below the estimated coefficients in parentheses.

Finally, we hypothesized that students who attended a Catholic high school are most likely to graduate with a STEM degree, whereas those who attended non-Catholic, religious high schools might be the least likely. We find some support for this result. Catholic high school students were two percentage points more likely to graduate with a STEM degree than students who had attended public high schools. There is no evidence from this analysis that students from non-Catholic, religious schools are less likely than public high school students to graduate college with a STEM degree. Interestingly, black and Hispanic students were neither more nor less likely than white students to graduate with a STEM degree, but Asian students were 12% more likely. Consistent with previous research, we find that female students were less likely than male students to get a STEM degree (see Ro & Loya, 2015).

The finding that students who attended Catholic high schools are more likely to graduate and more likely to get a degree in a STEM field raises an important question. Do Catholic high schools spark interest in STEM fields and that is why Catholic school alumni are more likely to get a STEM degree, or are students from Catholic high schools just more likely to graduate from college and so that is why they are more likely to graduate with a STEM degree?<sup>11</sup> To examine this question, we estimated the probability of graduating with a STEM degree in four years or ever getting a STEM degree conditional on graduating from the university.<sup>12</sup> When only examining those students who graduated, students who attended Catholic high school are two percentage points more likely to graduate with a STEM degree in four years than students who attended a public high school. This difference is significant at the 0.01 level. When examining ever graduating with a STEM degree conditional on graduating, there is no difference between students who attended Catholic and public high schools. For both outcomes, there are no significant differences between students who attended other types of private high schools and those who went to a public high school. Overall, there is mixed evidence as to how attending a Catholic high school may affect the likelihood of graduating college with a STEM degree.

### **Understanding the Private School Advantage**

We hypothesized that the private school advantage will be prominent for low-income, minority, and urban students, as well as those students with lower ACT scores. Research also indicates that this is particularly likely to be

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11 We thank a reviewer for raising this question and suggesting this analysis.

12 Full results for these models are available from the authors upon request.

true for students who attended Catholic high schools (e.g., Bryk et al., 1993; Neal, 1997). To test this hypothesis, we estimated the full model depicted in equation 1 separately for 1) minority/non-white and white students, 2) low-income and middle-/high-income students, 3) urban and non-urban students, and 4) students with an ACT score below 25 and greater than 27. We present the results of these models in four figures that plot the OLS regression coefficients comparing high school types on each outcome of interest, along with the 90% confidence intervals associated with those coefficients.<sup>13</sup> These coefficient plots compare estimates of each private high school type to public school students, the omitted group. If the confidence interval crosses the vertical line at zero, there is no statistically significant difference at the 0.10 level between that private school type and public school students for that outcome.

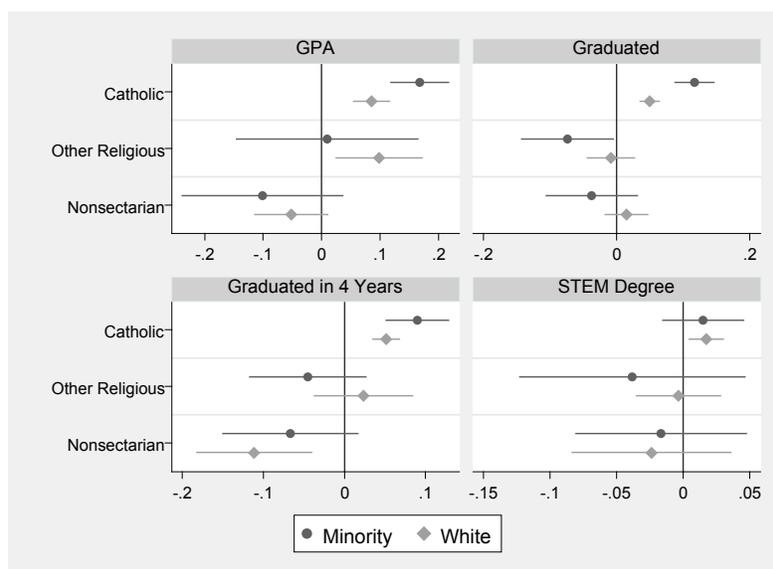


Figure 1. *Regression Coefficient Plots by School Type and Race*

*Note:* The results are from OLS models similar to those in Table 2 but estimated separately for white and minority students. The figure presents the OLS coefficients and 90% confidence intervals for the Catholic variable, other religious high school variable, and the nonsectarian high school variable. Public high school students are the comparison group.

<sup>13</sup> Full results for these models are available from the authors upon request.

The results in Figure 1 suggest both minority students and white students benefit from attending a Catholic high school. Among non-white students, those who attended Catholic high schools had a college GPA 0.17 points higher than non-white students who attended public high schools. White students who attended Catholic high schools had a GPA advantage of 0.09 points over white students in public high schools. Figure 1 illustrates that white students who attended other religious schools had a GPA advantage over their white counterparts who attended public high schools, but that there was no such difference for non-white students (the confidence interval intersects zero). There is a similar result when it comes to the probability of graduation—the benefits of having attended a Catholic high school exist for both non-white students and for white students. However, when examining graduating with a STEM degree, the Catholic school advantage only exists for white students.

Figures 2-4 present similar models comparing the Catholic school effect between low-income and high-income students (Figure 2), urban and non-urban students (Figure 3), and students with low ACT scores and those with high ACT scores (Figure 4).

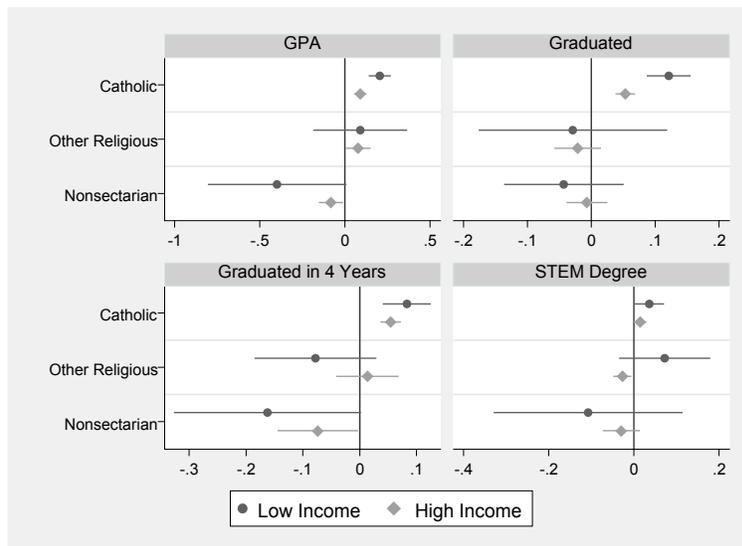


Figure 2: Regression Coefficient Plots by School Type and Income

*Note:* The results are from OLS models similar to those in Table 2 but estimated separately for low-income and high/medium-income students. The figure presents the OLS coefficients and 90% confidence intervals for the Catholic variable, other religious high school variable, and the nonsectarian high school variable. Public high school students are the comparison group.

The results are remarkably similar to those in Figure 1. That is, the positive post-secondary effects of having attended a Catholic high school is quite pronounced for students from low-income and urban areas, and those whose ACT scores are below average. Taken as a whole, the results indicate that positive Catholic school effects are not limited to white, high-income, suburban/rural, or high achieving students. Rather, the benefits of Catholic education pertain to a diverse set of students of different races, income levels, locations, and prior achievement levels.

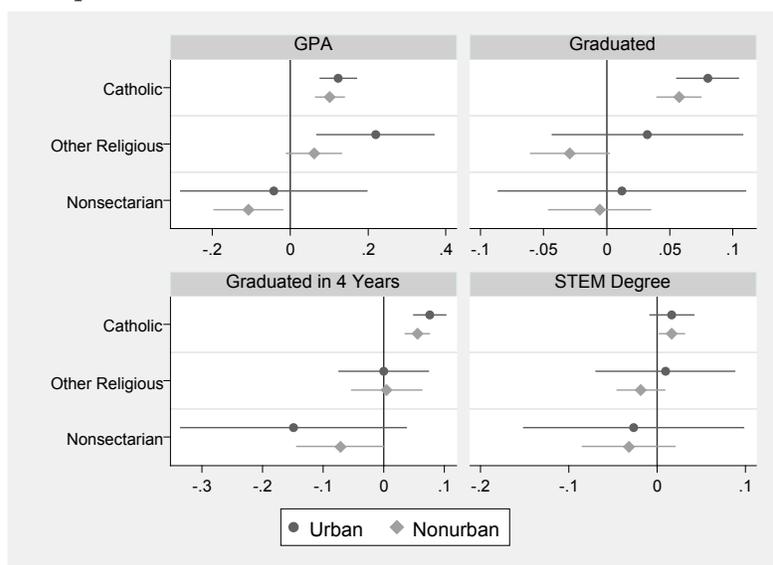


Figure 3: Regression Coefficient Plots by School Type and Urbanicity

*Note:* The results are from OLS models similar to those in Table 2 but estimated separately for urban and nonurban (suburban and town/country students). The figure presents the OLS coefficients and 90% confidence intervals for the Catholic variable, other religious high school variable, and the nonsectarian high school variable. Public high school students are the comparison group.

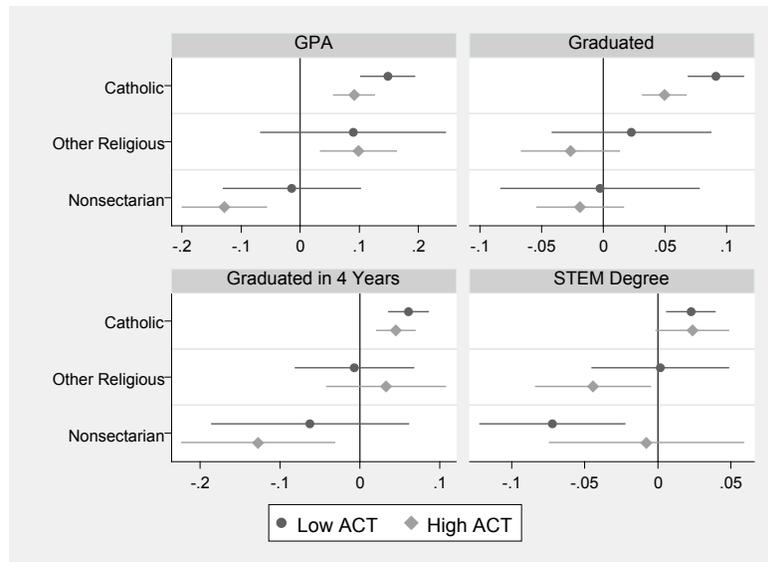


Figure 4: Regression Coefficient Plots by School Type and ACT Score

*Note:* The results are from OLS models similar to those in Table 2 but estimated separately for students with relatively low ACT scores (below 25) and high ACT scores (above 27). The figure presents the OLS coefficients and 90% confidence intervals for the Catholic variable, other religious high school variable, and the nonsectarian high school variable. Public high school students are the comparison group.

### Is the “Private School Advantage” Merely a “Catholic School Advantage”?

Our third hypothesis suggests that students who attended Catholic high schools will have the most positive outcomes when compared to students who attended other types of high schools. The results presented here have consistently demonstrated that Catholic high school students achieved greater college success than otherwise similar public school students. However, it is still uncertain if there are statistically significant differences within the private school sector. Therefore, we restricted our last analysis to students who attended private high schools. This analysis may also dampen, but not eliminate, some concerns about selection bias, as the only students in this analysis are those whose parents possessed the resources and motivation to send their children to a private high school.

The results we present in Figure 5 are from models restricted to students who attended private high schools—religious or non-sectarian. The estimates in the figure compare outcomes for students who attended “other religious” or “nonsectarian” high schools to those who attended Catholic high schools. The

results provide strong evidence that Catholic high school students outperform those who attended private, nonsectarian high schools. Recall that the descriptive statistics in Table 1 indicate that Catholic high school students had a 0.13 point advantage in GPA, 2.8 percentage point and 6.0 percentage point advantages in total and four-year graduation rates, respectively, and a 1.8 percentage point higher likelihood of graduating with a college degree in a STEM field when compared to students who attended nonsectarian private high schools. After controlling for a host of demographic, locational, and high school achievement (ACT and credit hours) factors, these differences increase: Catholic high school graduates have a 0.25 point higher GPA, eight percentage point higher total graduation rate, 11% advantage in four-year graduation rates, and six percentage point higher likelihood of earning a STEM degree. These differences are all statistically significant at the 0.10 level. The differences between students who attended Catholic and “other religious” high schools are not as pronounced, but there is a statistically significant Catholic school advantage when it comes to the probability of graduation.

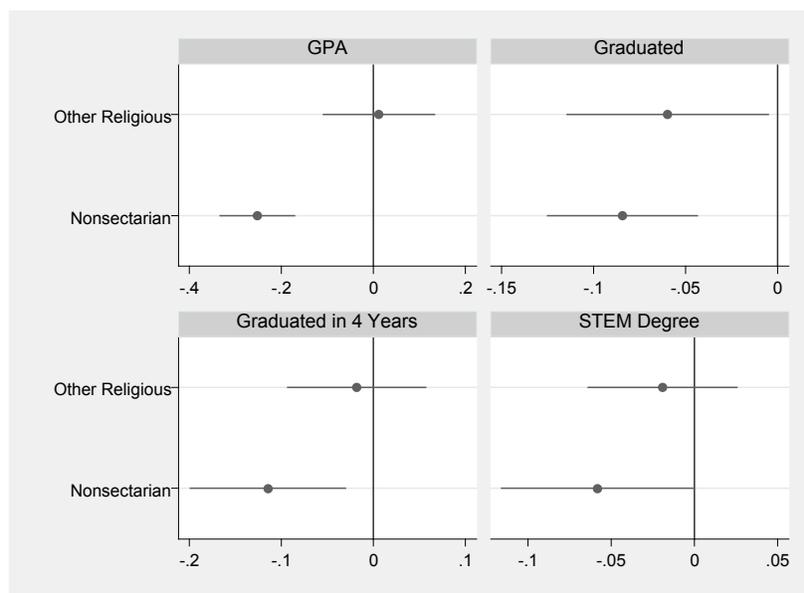


Figure 5: Regression Coefficient Plot Comparison for Private Schools Only

*Note:* The results are from OLS models similar to those in Table 2 but estimated for private high school students only. The figure presents the OLS coefficients and 90% confidence intervals for the other religious high school variable and the nonsectarian high school variable. Catholic high school students are the comparison group.

### Discussion

Despite tuition increases and stagnant wages, the college wage premium is near an all-time high, largely because of the limited economic opportunities for those without a college degree (Abel & Deitz, 2014, p. 8). The growing importance of a college degree—particularly in STEM fields—has compelled policymakers to consider how K-12 reforms might encourage greater college attendance and completion. In this paper, we compared the college achievement and completion rates of students who attended four different types of high schools—public, private-Catholic, private-“other religious,” and private-nonsectarian—as performance by high school type has important implications for an increasingly expanding, yet still controversial reform: private school vouchers. Our results indicate that students who attended Catholic high schools performed better and were more likely to graduate from college (with a STEM or non-STEM degree) than those who attended public high schools, those who attended private-nonsectarian high schools, and, to a lesser extent, those who attended other religious private schools. That Catholic school advantage was particularly noteworthy for students from minority or low-income families, students from urban areas, and students with low ACT scores.

Twenty-first century changes to the economy have led to an increased emphasis on STEM education. Policymakers, K-12 educators, and university presidents are all concerned with increasing the number of students who can fill jobs in STEM fields. Our analysis is relatively novel in that it sheds light on how high school type might affect students' propensities to earn a STEM degree. These majors require students to have a solid background in math and science, which can vary significantly by the type of high school a student attended. For example, some scholars suggest that some religious high schools might be hostile to modern science or promote more service-orientated careers. However, we find that Catholic high school graduates with a wide variety of characteristics—white, low-income, high-income, non-urban, and low ACT scores—are more likely to earn a STEM degree than similar students who attended a public high school. On the other hand, though we often lack the statistical power to identify the effect conclusively, the results are also consistent with the notion that Christian fundamentalist high schools decrease the likelihood that some of their graduates (i.e., high income students and students with high ACT scores) will eventually graduate college with a STEM degree (Sikkink, 2010, 2014).

What explains the high performance of those who graduated from Catholic high schools? Unfortunately, our data do not allow us to directly answer this question; however, there are many possible explanations. First, Catholic schools may be more academically challenging and require students to take more academic rather than vocational classes (Bryk et al., 1993; Witte, 2000). Aldana (2014) found that some Catholic schools have a “college-going culture,” which can be particularly powerful for urban and minority students. A second possibility is that Catholic schools may promote higher levels of social capital (Coleman & Hoffer, 1987). Third, the positive effects of Catholic schooling may be driven by better teacher quality. Religious and nonreligious schools alike generally have more flexibility than traditional public schools to hire well-qualified teachers and reward effective teaching (Hoxby, 2002).

If the religious nature of the Catholic school system is what is driving these effects, then public schools and private, nonsectarian schools will have a difficult time replicating its success. Jeynes (2002) notes that some have suggested that “Weber’s notion of an ethic of a strong motivation to work hard as a means of showing love to others and fulfilling a heavenly calling” (p. 326) leads to positive Catholic school effects; further, the social justice mission of Catholic schools may explain why minority students may benefit from attending Catholic schools. On the other hand, it is important to note that we generally do not find such effects for non-Catholic religious schools. Thus, if the results are attributable to the religious nature of Catholic schools, it is important to distinguish between religions when making such claims.

Our analysis is unable to explore all of these possible explanations. However, it is important to note the extent to which we sought to address student selection bias—to address the possibility that the perceived benefits of private education are driven by selection effects, as parents that are more involved and those with higher incomes are more likely to put their children in private schools (Lubienski & Lubienski, 2013). We accounted for student demographics, academic aptitude, and socio-economic status; the cities in which high schools reside; the college credit hours students earned while in high school; college major; and cohort effects. It was particularly important to account for students’ high school achievement, as private school students generally outperform public school students on the ACT and are more likely to have completed college-level coursework (Council for American Private Education, 2008). Indeed, to ensure that such differences did not drive the results, we used the most flexible functional form possible (i.e., indicator variables for every ACT score); estimated the models with and without the

controls for high school achievement and academic aptitude; and showed that the results obtain even if we restrict the analysis to students who exercise school choice (i.e., limit the analysis to students who attend private schools). Indeed, we provide estimates that are likely conservative because our concern for selection bias led us to account for some potential benefits of higher quality schools (e.g., higher ACT scores).

Like other evaluations of this type, our analysis has limitations. First, we only examine the college success of students at a single university over a nine-year period. Other evaluations have examined other schools, such as the University of Portland, the University of Winnipeg, and Ball State University, and have reached conflicting conclusions. Perhaps, our conclusions do not apply to smaller or private universities. Second, the relatively small sample sizes for non-Catholic private schools and nonsectarian private schools limit our ability to make strong claims regarding these results, particularly for the subgroup analyses. Further, we are unable to examine the nature of the private, nonsectarian schools that students in our sample attended. Future evaluators should try to examine a longer time period or a more diverse student body in order to have more confidence in the differences between the competing types of private schools. Nevertheless, the results we uncover are strong and offer some information of value for colleges, parents, students, and policymakers.

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