

The Effect of College Tuition on High School Graduation: The Impact of College Tuition Changes from 2005 to 2010

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Abstract:

There is a wealth of existing research that examines the determinants of high school graduation and college enrollment, but none that has tested a possible relationship between the two. Tuition is commonly viewed as the main determinant in college enrollment, however, does it also have an impact on high school graduation? Literature suggests that going to college is a strong incentive to graduate from high school. Higher tuition reduces access to college, thus lowering incentives to graduate from high school. I find that there is no relationship between high school graduation and college tuition, but that due to problems in my dataset, further research is required to come to any definitive conclusion.

Introduction

While high school drop out rates have not worsened on the whole, they remain a serious problem in several demographics, where high income, and White students are much more likely to graduate than low income, Black, and Hispanic students (Greene and Winters 2005).

Dropping out of high school significantly impacts a student's chances of success later in life and can raise social costs for society. High school dropouts tend to have lower paying jobs and a higher chance of unemployment, health problems, and dependence on government welfare programs (Martin, Tobin, and Sugai 2003). In addition, dropping out of high school "severely impacts students' chances for subsequent educational and occupational opportunities" (Dalton, Glennie, and Ingels 2009, iii). Many scholars have examined the reasons that students decide to drop out of high school. These reasons include the effects of race, school characteristics, school performance, income, and family structure on high school dropouts, however, the reasons for dropping out are very complex and there remain factors that have yet to be examined.

There has also been extensive research into the determinants of college enrollment. Many studies consider tuition to be the dominant factor in predicting enrollment, however there are several others like race, and unemployment that are also important considerations. Going to college has many benefits for the individual as well as for society as a whole. For individuals, college completion leads to higher earnings, better health, and an overall higher quality of life (Baum and Payea 2005; Cunningham 2006; Oreopoulos and Petronijevic 2013; Wise 1975). Unemployment, poverty and incarceration are also lower among college graduates, which lowers dependence on social welfare programs, and saves the government money (Baum and Payea 2005). While many studies have examined high school graduation and college enrollment independently, none have tested whether there is an effect of one on the other. Some mention

that high school rank is a factor regarding college intentions (Nelson 1972; Meyer 1970), or that success in high school leads to success in college (Wesley 1994). However, none have considered college tuition as the key variable in whether a student decides to graduate from high school.

There is a gap in existing research observing whether there is a link between high school graduation and college tuition. This is the relationship that I am going to test in this paper. From a series of regressions and robustness tests, I find that I cannot reject the null hypothesis that there is no relationship. To come to this conclusion, I will outline some commonly accepted determinants and predictors of high school graduation in existing literature, then summarize some of the major determinants of college enrollment. I will use previous research to build my theory and hypothesis that college tuition has an effect on high school graduation. Next, I will consider some of the systematic differences between states with high and low college tuition and discuss how I plan on controlling for them. These considerations will be part of the controls I use when I run a series of multivariate regressions to observe whether there is a causal link between college tuition and high school graduation rates. In these regressions, I omit different variables to ensure that my findings are not the result of correlations between the independent variables. I also run other regressions to test the validity and robustness of my original results. The main finding from these regressions is that the data does not suggest any link between college tuition and high school graduation. However, I will also discuss several important limitations in this study that could be preventing us from rejecting the null hypothesis. I conclude that there is no relationship in my model, but that due to problems with my data and other confounds that I could not control for, there remains further research to be done to reach any definite conclusions.

Literature Review

Many studies have examined the determinants behind dropping out of high school. One theory in existing research is that there are economic reasons behind the decision to drop out of high school. Some studies found that these students have lower expectations about the rewards from graduation (Eckstein and Wolpin 1999; Dalton, Glennie, and Ingels 2009). Another found that the desire to work has a large effect on the decision to drop out among White, Black and Hispanic males (Rumberger 1987). Another study found that financial responsibilities and home responsibilities have an important impact on the decision to leave high school (Rumberger 1983).

Another determinant discussed in the literature is school related difficulties. Disliking school was a significant determinant in one study, along with poor performance (Rumberger 1983). Other research has concluded that students who drop out have systematically lower school ability and/or motivation than their graduating counterparts (Eckstein and Wolpin 1999; Dalton, Glennie, and Ingels 2009). They also have lower attendance and a higher occurrence of disobedience (Christle, Jolivette, and Nelson 2007). Finally, a student's parent's level of education is of statistical significance in determining their chances of graduating (Haveman, Wolfe, and Spaulding 1991).

Many of these studies have also found significant correlations between high school graduation, race, and family structure. Students of color are more likely to drop out, as well as those who have had more parental separations and live with families with a higher stress factor (Haveman, Wolfe, and Spaulding 1991; Dalton, Glennie, and Ingels 2009; Christle, Jolivette, and Nelson 2007). One study more specifically focuses on the effect of poverty, dependence on welfare and family structure at different times in a child's life. The study found that certain

experiences in adolescence had a strong negative and significant impact on the chances of graduating high school (Haveman, Wolfe, and Spaulding 1991).

Income is also a significant factor in determining whether a student is likely to drop out. Higher dependence on welfare can decrease a child's aspirations and self esteem (Macaulay 1977). In another study, more years spent in poverty led to a higher likelihood of dropping out (Haveman, Wolfe, and Spaulding 1991). This finding is consistent with other reports that show that lower income students are more likely to drop out (Dalton, Glennie, and Ingels 2009; Christle, Jolivette, and Nelson 2007).

Several of the factors that influence high school graduation, also play a role in college enrollment. Many found that race is a predictor in college enrollment. One study observed that Black and Hispanic students were five times less likely to enroll in highly selective institutions, even after accounting for income (Reardon, Baker, and Klasik 2012). Another found that among minorities, Black and Hispanic students are the least likely to go to college, while Asians and Pacific Islanders are the most likely (Akerhielm et al. 1998).

Unemployment rates have been found to have an impact on college enrollment. Higher unemployment rates discourage entrance into the workforce, and going to college can be a substitute. As a result, studies have found that higher unemployment rates are correlated with higher college enrollment (Corazzini, Dugan, and Grabowski 1972). However, higher unemployment rates could also be indicative of worsening economic conditions that make it more difficult for students to afford college (Heller 1996). There is therefore some opposing findings in existing literature, however unemployment rates clearly have some effect on college enrollment.

Several studies also find that students from higher income families are more likely to go to college (Kahlenberg 2004; Akerhielm et al. 1998). In addition, the income gap in highly selective institutions seems to be widening. Students from lower income families are becoming less and less likely to enroll at selective institutions (Reardon, Baker, and Klasik 2012).

Because several studies have shown that income is a determinant in college enrollment, it is comes as no surprise that tuition also has a large impact. In existing literature, tuition is one of the most observed factors, and is viewed as one of the most important factors in determining enrollment. The studies that examine the impact of tuition changes on enrollment all find that higher tuition leads to lower enrollment (Corazzini, Dugan, and Grabowski 1972; Heller 1999; Heller 1996). Other studies calculate specific coefficients for student response to tuition changes, all of which are negative. In all of these cases, higher tuition led to lower enrollment (Leslie and Brinkman 1987; Heller 1996). In addition, tuition has a larger effect on enrollment at two-year versus four-year institutions (Ehrenberg 1994; Heller 1997). Another indicator that the price of college is an important factor in college enrollment is the importance of financial aid. Many studies find that more financial aid leads to higher enrollment (Heller 1999; Studenmund, Slobko, and Moore 1991; Van Der Klaauw 2002) and that larger aid packages should be offered to minorities because, all else equal, they have a lower propensity to enroll (Ehrenberg and Sherman 1984). Financial aid also has an important effect on enrollment for low income families (McPherson and Schapiro 1991). Another study concludes that overall, “a \$1,000 increase in the grant aid for which a person is eligible increases ultimate educational attainment by about 0.16 years and the probability of attending college by about four percentage points” (Dynarski 1999, 36). The price of attending college is therefore one of the most important determinants of enrollment rates.

There are several quantifiable reasons that students should want to attend college. While there are many “life experiences” that happen while in college, there are also economic reasons to attend. In general, completing college leads to higher earnings (Kane and Rouse 1995; Oreopoulos and Petronijevic 2013; Wise 1975): “[over] the past 25 years, rising wage differentials by education have increased the economic incentives to graduate from high school” (Heckman and LaFontaine 2010, 244). In addition, completing a degree at an institution of higher quality should increase the returns of going to college (Oreopoulos and Petronijevic 2013). Those with a college degree also have higher starting salaries than those who start work before getting a degree (Wise 1975). Therefore, as the wages of high school dropouts decreases, there is a higher and higher incentive to go to college. Going to college is clearly a strong incentive to graduate from high school.

Theory and Hypothesis

The literature suggests that college tuition could play a role in a student’s decision of whether or not to graduate from high school. College graduates earn more than non-graduates, and have a higher quality of life. Therefore, attending college is one of the incentives to graduate from high school. However, higher college tuition lowers students’ access to college, especially for those who are on the brink between continuing on to higher education or entering the work force. If students have little to no chance of going to college because of price, they will have lower expected payoffs from graduating high school. Consequently, they will have less of a reason to graduate.

Therefore, it seems that college tuition has an impact on high school graduation. I hypothesize that college tuition is negatively correlated with high school graduation rates. In addition, from findings in existing literature, I suspect that the effects of college tuition on high

school graduation rates will be highest among African Americans, Hispanics, and low-income students. Going to college is a strong incentive to graduate from high school, however, if college is unattainable because of cost, this incentive will disappear and some students will decide to drop out.

Data

In this study, I observe high school graduation rates, college tuition, education spending, income, financial aid, unemployment rates, educational attainment, minority population, crime and school ability. For each of these variables, I compiled state level data from a variety of different sources including the Census Bureau, the Iowa Community Indicators Program, the Institute of Education Sciences, the National Association of State Student Grant & Aid Programs, the Department of Education, the College Board, the National Center for Education Statistics, and the Bureau of Labor Statistics. All data is from 2010 (with the exception of education attainment and crime rates where the data is from 2009). All of my variables were measured either in dollars or percentages, with the exception of tuition. I will discuss how I measured tuition later in this section. To better interpret the results, I multiplied percentages by 100 and divided dollar amounts by 100. For example, I converted 15 percent from .15 to 15 and \$10,000 to \$100. I made these changes so that regression results would be easier to analyze. For example, a twenty dollar change in income has a very small effect on a percentage change in graduation. However, a \$2000 increase is more significant and easier to interpret.

I measured a state's amount spent on education as a percentage of state and local tax revenue going towards higher education funding. This should account for the fact that, for example, a five million dollar increase in education spending would have very different effects across different states, while a 5% increase is more comparable. I measured income as median

household income, unemployment as the percentage of the state that is unemployed, urban population as the percentage of the population living in urban areas, poverty as the percentage of the population living in poverty, state financial aid as the total amount of aid awarded (in millions), and high school completion as the percentage of the population with at least a high school degree. I used the percentage of Asians, Hispanics and African Americans in each state to measure the minority population. I chose to use these demographics not only because they are mentioned in the literature, but also because according to the Census Bureau, they are the three largest racial demographics in the country. I measured crime rates in 2009 as the number of occurrence of violent crime, which includes murder, forcible rape, robbery, and aggravated assault. I measured school ability using NAEP 8th grade math scores. This is measured as the percent of students at or above proficiency on the test in 8th grade. These scores were a better measure of ability than the SAT because students who do not plan on going to college probably do not take the SAT. The decision to use math scores was arbitrary, however it should be a good indication of school ability by state.

Graduation is my dependent variable and it is measured as the percentage of total students that graduated high school with a regular diploma in four years in 2010. In my robustness tests, I also look at the effect of my independent variables on graduation rates for different demographics, which are also measured as the percent of students who graduated in four years.

Finally, to measure state tuition, my key independent variable, I used 2005 and 2010 data from the College Board to calculate the 5-year percentage change in 2013 in-state tuition dollars at two and four-year public institutions. Most public colleges have the majority of students from in state, therefore I suspect that the effect of changes in tuition at these schools will have the

highest effect on graduation rates in that state. Because I did not have enough data to run a fixed effects model, observing tuition as a percentage change helped control for some of unobservable differences between states.

While measuring tuition as a five-year change accounts for some of the unobservable differences between states, it also takes into account the perceptions of high school students on tuition throughout their high school careers. The graduating class of 2010 watched the tuition in their state either rise or fall, and their noticing this change may have had a strong effect on their decision to graduate from high school. Watching college tuition rise while in high school could be a factor in a student's decision to graduate. We know that perceived benefits of graduation are a determinant of dropping out of high school, therefore it is plausible that a perceived change in tuition over one's high school career has an effect on their decision to drop out. Measuring tuition as a five-year change controls for this other important variable.

Table 1. Descriptive Statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
% Graduation	50	82.28	7.02	67.00	95.00
Four year tuition (5 year % change)	50	13.13	10.53	-11.07	47.37
Two year tuition (5 year % change)	50	22.22	14.05	-9.18	72.42
% Urban Population	50	73.59	14.57	38.70	95.00
% Poverty	50	14.15	3.37	6.50	22.50
% State Tax Revenue Towards Education	50	7.28	2.68	2.68	14.89
Median Income	50	528.30	78.75	388.52	693.23
State Financial Aid	50	214.20	268.29	4.13	1076.70
% Unemployed	50	8.73	2.04	3.80	13.80
% High School Completion	50	86.87	3.41	79.90	91.80
% Asian	50	1.93	3.00	0.21	14.97
% Hispanic	50	10.66	10.02	1.22	46.44
% Black	50	10.65	9.64	0.42	37.21
Crime Rate	48	391.76	158.75	119.90	704.60
% NAEP Proficient	50	73.10	7.59	54.00	86.00

Systematic Differences Between High and Low Tuition States

States with high tuition are systematically different from those with low tuition. To account for these differences, I controlled for urban population, the percent of state and local taxes going towards education, educational attainment and crime. To show that high and low tuition states are systematically different, I ran summary statistics for all of my variables for the five highest and lowest tuition states. I ranked each state by tuition and compared the top 10% with the bottom 10%.

At both two and four year institutions, the median income in 2010 for the lowest five tuition states was over \$10,000 lower than highest five tuition states. There is also an 8% difference in poverty rates when ranked by two-year institution tuition, and a 5% difference when ranked by four-year tuition. The five highest two-year tuition states are also 10% more urban and have 10% more high school graduates than the five lowest. The percent of the budget going towards higher education was also twice as high in the lowest tuition states. Crime rates are also very different between the top and bottom five.

By comparing these tables, we can see that states are systematically different in a number of ways. The variables in this table however do not reflect all of the differences between states. I will discuss this issue later in the paper. In addition, with a sample size of only five states, the results could be highly biased by outliers. However, even given these limitations, we can grant that high and low tuition states are systematically different.

Table 2. Summary Statistics for States with Highest and Lowest Two-Year Tuition.

Five lowest tuition states in 2010 at two year institutions					
Variable	Obs	Mean	Std. Dev.	Min	Max
% Graduation	5	75.80	6.76	67.00	84.00
% Urban Population	5	74.52	17.56	49.40	95.00
% Poverty	5	18.58	2.35	16.30	22.50
% State Tax Revenue Towards Education	5	10.98	2.99	7.43	14.89
Median Income	5	480.48	72.13	388.52	585.92
State Financial Aid	5	495.63	454.28	28.03	1076.70
% Unemployed	5	9.96	1.89	7.90	12.40
% High School Completion	5	81.60	1.87	79.90	84.30
% Asian	5	2.98	4.02	0.57	10.13
% Hispanic	5	26.62	19.62	2.76	46.44
% Black	5	16.08	13.89	2.38	37.21
Crime Rate	5	467.66	126.16	306.70	652.80
% NAEP Proficient	5	64.80	10.52	54.00	78.00

Five highest tuition states in 2010 at two year institutions					
Variable	Obs	Mean	Std. Dev.	Min	Max
% Graduation	5	87.00	3.81	82.00	92.00
% Urban Population	5	64.24	19.79	38.90	92.00
% Poverty	5	10.52	2.55	6.50	13.60
% State Tax Revenue Towards Education	5	4.79	2.26	2.68	7.96
Median Income	5	592.09	78.55	482.79	693.23
State Financial Aid	5	95.15	134.96	4.13	318.54
% Unemployed	5	6.66	1.23	5.10	8.30
% High School Completion	5	90.54	1.06	89.00	91.50
% Asian	5	2.26	3.76	0.27	8.94
% Hispanic	5	4.29	3.20	1.51	9.64
% Black	5	3.32	3.04	1.02	7.72
Crime Rate	4	242.80	150.95	135.10	465.60
% NAEP Proficient	5	82.80	1.48	81.00	85.00

Table 3. Summary Statistics for States with Highest and Lowest Four-Year Tuition.

Five lowest tuition states in 2010 at four year institutions					
Variable	Obs	Mean	Std. Dev.	Min	Max
% Graduation	5	73.80	5.40	67.00	80.00
% Urban Population	5	77.90	13.92	64.80	94.20
% Poverty	5	16.22	4.28	9.60	21.50
% State Tax Revenue Towards Education	5	8.48	2.60	5.86	12.12
Median Income	5	495.47	50.47	448.01	554.73
State Financial Aid	5	274.74	281.71	13.79	672.12
% Unemployed	5	10.06	2.85	7.00	13.80
% High School Completion	5	85.50	3.70	82.20	91.80
% Asian	5	1.38	0.82	0.48	2.56
% Hispanic	5	14.18	9.79	4.27	26.62
% Black	5	16.01	12.09	0.90	32.31
Crime Rate	5	515.78	197.47	219.30	704.60
% NAEP Proficient	5	69.40	6.91	62.00	78.00

Five highest tuition states in 2010 at four year institutions					
Variable	Obs	Mean	Std. Dev.	Min	Max
% Graduation	5	89.20	3.90	85.00	95.00
% Urban Population	5	72.22	22.72	38.90	94.70
% Poverty	5	10.94	2.80	6.50	14.10
% State Tax Revenue Towards Education	5	4.12	1.45	2.68	6.40
Median Income	5	600.65	79.56	511.18	693.23
State Financial Aid	5	323.35	306.35	4.13	719.76
% Unemployed	5	8.18	1.90	6.10	10.40
% High School Completion	5	88.80	2.21	86.40	91.30
% Asian	5	0.42	0.15	0.27	0.58
% Hispanic	5	8.73	7.57	1.51	17.77
% Black	5	8.60	6.96	1.02	14.84
Crime Rate	4	251.20	119.34	135.10	388.90
% NAEP Proficient	5	78.80	3.56	73.00	82.00

Research Design and Methods

To test whether college tuition has an effect on graduation rates, I run a series of regressions measuring the effect of two and four-year tuition on statewide high school graduation rates. I control for the determinants of high school graduation, college enrollment, and the systematic differences between states discussed above. I could not randomly assign college tuition rates to different states, therefore these controls are meant to remove significant differences between states and isolate the effect of college tuition on high school graduation

rates. In controlling for these variables, I isolate the effect of college tuition on high school graduation rates. More specifically, I observe the effect of a five-year percentage change in tuition on high school graduation rates in 2010, holding constant a host of other variables in 2010. The results show the effect of a five-year change in college tuition on high school graduation rates in 2010.

Regression Equation

$$GRAD_i = \alpha + \beta_1 PRICE_i + \beta_2 URB_i + \beta_3 POV_i + \beta_4 TAX_i + \beta_5 MEDI_i + \beta_6 AID_i + \beta_7 UN_i + \beta_8 HSC_i + \beta_9 APOP_i + \beta_{10} HPOP_i + \beta_{11} BPOP_i + \beta_{12} CRIM_i + \beta_{13} PROF_i + \varepsilon_i$$

$PRICE_i$: Two/four-year tuition (5-year % change between 2005 and 2010) by state in 2013 dollars

URB_i : % Urban population in 2010 by state

TAX_i : % State and local tax revenue going towards higher education in 2010 by state

$MEDI_i$: Median income in 2010 by state

AID_i : Total amount of state aid in 2010 by state

UN_i : % Unemployed in 2010 by state

HSC_i : % Of population with a high school diploma or higher in 2009 by state

$APOP_i$: % Of the population of Asian descent in 2010 by state

$HPOP_i$: % Of the population of Hispanic descent in 2010 by state

$BPOP_i$: % Of the population of African American descent in 2010 by state

$CRIM_i$: Number of occurrence of violent crime in 2009 by state

$PROF_i$: % Of students who had at least basic proficiency on the NAEP math test in 8th grade in 2010 by state

Results

The results of the regression show that at two-year institutions, a 1% change in tuition over five years corresponds to a decrease in high school graduation rates by .0965%.¹ At four-year institutions, the effect is even smaller with a 100% increase leading to a .0208% decrease. In addition, if two and four-year tuition did not change, we would expect to see a graduation rate of 204.2% and 197.3%. At both two and four-year colleges, poverty is the only variable that is 95% significant. When poverty increases by 1%, I find that graduation rates decrease by nearly 2%. This finding is consistent with the literature that poverty is a strong indicator of high school graduation. While insignificant, most of the other results in columns (1) and (2) are consistent with findings in existing literature. There is a positive relationship between high school graduation and state financial aid, the amount of money going towards higher education, and school ability. On the other hand, there is a negative correlation between high school graduation and poverty, the size of the minority population, and crime rates. However, median income and unemployment are negatively correlated with graduation rates. The regression results show that an increase in income and unemployment leads to an increase in graduation rates. This result is contradicts existing research that finds the opposite relationship.

The null hypothesis states that college tuition has no effect on high school graduation rates. Although the regression results illustrate the relationship I hypothesized, I cannot reject the null hypothesis. The coefficients for two and four-year tuition are negative, but highly insignificant. The results show no significant correlation between high school graduation and

¹ Because of the way variables measured in percentages were coded, a one-unit change in the two-year tuition percent change corresponds to a 100% difference. A one-unit decrease in graduation rates also corresponds to a 100% change. Therefore, the table reads that a 100% increase in two-year tuition over five years leads to a 9.65% drop in high school graduation. Hence, when interpreting two percentages in this table, it is more intuitive to divide both unit changes by 100.

college tuition at both two and four-year institutions, even when controlling for a variety of systematic differences between states. The standard error for the effect of two-year tuition is nearly as high as the coefficient, while the error for four-year tuition is more than three times as high as the coefficient. The high standard errors in the coefficients prevent us from rejecting the null hypothesis that college tuition has no effect on high school graduation. From the data I compiled, there is no causal link between the key independent and dependent variables.

Table 4. Regressions.

VARIABLES	(1) Graduation Rate	(2) Graduation Rate	(3) Graduation Rate	(4) Graduation Rate	(5) Graduation Rate	(6) Graduation Rate	(7) Graduation Rate	(8) Graduation Rate
Two-Year Tuition (5 year % change)	-0.0965 (0.0860)		-0.0974 (0.0938)		-0.0775 (0.0805)		-0.102 (0.0859)	
Four-Year Tuition (5 year % change)		-0.0208 (0.0672)		-0.0589 (0.0707)		-0.0173 (0.0622)		-0.0145 (0.0673)
% Urban Population	0.173 (0.104)	0.140 (0.101)	0.113 (0.111)	0.0876 (0.107)	0.100 (0.0862)	0.0911 (0.0869)	0.185* (0.103)	0.151 (0.101)
% Poverty	-1.928*** (0.700)	-1.881** (0.729)			-2.296*** (0.595)	-2.333*** (0.602)	-2.093*** (0.683)	-2.077*** (0.711)
% Tax Revenue Towards Education	0.537 (0.511)	0.588 (0.520)	0.853 (0.542)	0.906 (0.544)	0.196 (0.470)	0.254 (0.472)		
Median Income	-0.0325 (0.0263)	-0.0318 (0.0276)	0.0199 (0.0198)	0.0208 (0.0201)	-0.0506** (0.0224)	-0.0509** (0.0228)	-0.0465** (0.0227)	-0.0479* (0.0238)
State Financial Aid	0.00379 (0.00417)	0.00417 (0.00425)	0.00491 (0.00453)	0.00539 (0.00455)	0.00173 (0.00401)	0.00223 (0.00401)	0.00243 (0.00398)	0.00269 (0.00405)
% Unemployed	-0.398 (0.576)	-0.356 (0.586)	-0.650 (0.620)	-0.568 (0.625)	-0.317 (0.568)	-0.236 (0.571)	-0.627 (0.534)	-0.608 (0.544)
% High School Completion	-1.162* (0.607)	-1.092* (0.615)	-0.504 (0.609)	-0.467 (0.610)	-1.008* (0.539)	-1.051* (0.545)	-1.208* (0.607)	-1.141* (0.616)
% Asian	-0.132 (0.403)	-0.280 (0.394)	-0.651 (0.389)	-0.788** (0.368)			-0.0703 (0.399)	-0.217 (0.392)
% Hispanic	-0.282 (0.168)	-0.238 (0.166)	-0.358* (0.180)	-0.324* (0.175)			-0.221 (0.157)	-0.165 (0.154)
% Black	-0.120 (0.160)	-0.117 (0.174)	-0.293* (0.160)	-0.316* (0.169)			-0.0593 (0.149)	-0.0438 (0.162)
Crime Rate	-0.00758 (0.00793)	-0.00654 (0.00803)	-0.00207 (0.00837)	-0.00125 (0.00837)	-0.0107 (0.00637)	-0.0106 (0.00654)	-0.00958 (0.00772)	-0.00869 (0.00783)
% NAEP Proficient	0.247 (0.188)	0.248 (0.196)	0.338 (0.202)	0.305 (0.210)	0.229 (0.190)	0.232 (0.198)	0.172 (0.174)	0.171 (0.185)
Constant	204.2*** (60.01)	197.3*** (60.88)	91.03* (47.69)	90.22* (48.01)	210.8*** (54.57)	213.8*** (55.12)	228.2*** (55.62)	223.3*** (56.58)
Observations	48	48	48	48	48	48	48	48
R-squared	0.576	0.562	0.482	0.476	0.526	0.515	0.563	0.546

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Graduation Rate	Graduation Rate	Graduation Rate	Graduation Rate	Graduation Rate	Graduation Rate	Graduation Rate	Graduation Rate
Two-Year Tuition (5 year % change)	-0.108 (0.0805)		-0.0974 (0.0933)		-0.101 (0.0856)		-0.0855 (0.0846)	
Four-Year Tuition (5 year % change)		-0.0278 (0.0611)		-0.0462 (0.0702)		-0.0162 (0.0670)		-0.0310 (0.0650)
% Urban Population	0.0795 (0.0732)	0.0792 (0.0748)	0.160 (0.104)	0.135 (0.100)	0.187* (0.102)	0.154 (0.100)	-0.00696 (0.0757)	-0.0151 (0.0764)
% Poverty	-2.112*** (0.447)	-2.052*** (0.459)			-1.990*** (0.694)	-1.961** (0.724)	-1.435*** (0.480)	-1.466*** (0.484)
% Tax Revenue Towards Education	0.134 (0.394)	0.182 (0.400)	0.443 (0.446)	0.474 (0.448)	0.394 (0.484)	0.430 (0.494)	0.602 (0.457)	0.661 (0.457)
Median Income	-0.0487** (0.0224)	-0.0488** (0.0229)			-0.0358 (0.0260)	-0.0360 (0.0273)		
State Financial Aid							0.00151 (0.00422)	0.00204 (0.00422)
% Unemployed			-0.853 (0.592)	-0.787 (0.596)	-0.420 (0.574)	-0.382 (0.585)	-0.0784 (0.587)	0.0169 (0.588)
% High School Completion			-0.483 (0.522)	-0.455 (0.525)	-1.339** (0.573)	-1.286** (0.583)	-0.892 (0.564)	-0.927 (0.570)
% Asian			-0.657* (0.388)	-0.794** (0.369)	-0.109 (0.401)	-0.259 (0.393)		
% Hispanic			-0.256 (0.165)	-0.212 (0.159)	-0.239 (0.160)	-0.185 (0.157)		
% Black			-0.204 (0.147)	-0.212 (0.154)	-0.0785 (0.153)	-0.0662 (0.166)		
Crime Rate			-0.00550 (0.00799)	-0.00481 (0.00801)	-0.00900 (0.00776)	-0.00808 (0.00787)	-0.00955 (0.00688)	-0.00976 (0.00687)
% NAEP Proficient			0.353* (0.192)	0.336 (0.202)	0.282 (0.183)	0.291 (0.191)	0.332* (0.194)	0.325 (0.203)
Constant	132.5*** (15.23)	130.5*** (15.56)	100.2** (44.55)	99.54** (45.13)	220.3*** (57.19)	214.9*** (58.15)	156.9*** (51.62)	159.8*** (52.06)
Observations	50	50	48	48	48	48	48	48
R-squared	0.406	0.384	0.452	0.443	0.566	0.550	0.461	0.449

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Robustness and Internal Validity

The dataset that I compiled consists of only 50 observations per variable. Therefore, the original regressions runs the risk of controlling for variables that are too closely correlated that could lead me to falsely fail to reject the null hypothesis. The insignificant results in columns (1) and (2) of Table 4 could be the result of the control variables. To ensure that the conclusion is robust and I really cannot reject the null hypothesis, I run a series of regressions omitting certain variables that could be leading me to a false null. In columns (3) and (4), I omit poverty from the analysis. Poverty rates could be highly correlated with several other variables including median income and crime rates. I omit the minority demographic variables in columns (5) and (6). Like poverty, higher minority rates could be tightly correlated with other variables such as urban population and NAEP proficiency scores. In (7) and (8), I omit tax revenue towards education as it may be cancelling out the effect of state financial aid. Columns (9) and (10) show a very

reduced regression model that accounts for unobservable or omitted correlations between variables. Finally, in columns (11) through (16), I leave out groups of variables that could be correlated amongst each other. In all of these tests, the conclusion holds that I cannot reject the null hypothesis. The results I find in the original regression are not the result of correlations between control variables.

In existing research, several articles find that racial demographics and income are a strong predictor of high school graduation (Haveman, Wolfe, and Spaulding 1991; Dalton, Glennie, and Ingels 2009; Christle, Jolivette, and Nelson 2007), and also predictors of college enrollment (Kahlenberg 2004; Akerhielm et al. 1998; Reardon, Baker, and Klasik 2012). This led me to a second hypothesis that racial minorities and low-income students are likely to be more affected by changes in tuition. I test this hypothesis in the robustness section of this paper because should the results fail to reject the null hypothesis, it will strengthen the original results in Table 4. A failure to reject the null hypothesis in this test will strengthen the conclusion that there is no relationship between college tuition and high school graduation.

To test this second hypothesis, I run regressions measuring the effect of two and four-year college tuition on the groups that should be most affected by these changes. I control for the same variables as in Table 4, and replace the dependent variable with more specific groups. While Table 4 observed the effect of college tuition on graduation as a whole, Table 5 examines the effect of college tuition on Black, Hispanic,² migrant, and low-income students.

² I did not observe the effects of college tuition on high school graduation rates among Asians for two reasons. Firstly, they represent the smallest out of the three minorities discussed in this paper, and have the most chance of going to college out of any minority group. Secondly, the data for high school graduation among Asians is much more incomplete than for the other two racial demographics.

The results of the regressions in Table 5 are similar to the original findings in Table 4. Two and four-year tuition rates do not have any significant effect on graduation for any of the more specific dependent variables. Even if the findings were significant, they suggest that in some cases, higher tuition leads to higher graduation rates among these groups. For example, the only significant result I get says that a 1% increase in four-year tuition leads to a .5% increase in high school graduation among migrant students. This result is contrary to all existing literature, and as we will see in the following section, does not take into account all of the systematic differences between states that could bias the results.

Table 5. Regressions for Specific Groups.

VARIABLES	(1) Black Graduation Rate	(2) Black Graduation Rate	(3) Hispanic Graduation Rate	(4) Hispanic Graduation Rate
Two-Year Tuition (5 year % change)	0.0107 (0.132)		0.0431 (0.133)	
Four-Year Tuition (5 year % change)		0.00682 (0.102)		0.0344 (0.103)
% Urban Population	0.100 (0.160)	0.103 (0.153)	-0.0743 (0.161)	-0.0622 (0.154)
% Poverty	-1.898* (1.097)	-1.913* (1.121)	-1.194 (1.104)	-1.270 (1.128)
% Tax Revenue Towards Education	1.126 (0.786)	1.118 (0.787)	0.779 (0.791)	0.740 (0.792)
Median Income	-0.0236 (0.0405)	-0.0242 (0.0419)	-0.0104 (0.0408)	-0.0133 (0.0421)
State Financial Aid	6.08e-05 (0.00652)	2.13e-06 (0.00652)	0.00623 (0.00656)	0.00596 (0.00656)
% Unemployed	-0.203 (0.894)	-0.211 (0.896)	-0.364 (0.900)	-0.399 (0.901)
% High School Completion	-2.002** (0.952)	-2.010** (0.948)	-0.904 (0.958)	-0.941 (0.954)
% Asian	0.269 (0.624)	0.289 (0.601)	-0.528 (0.628)	-0.446 (0.604)
% Hispanic	-0.200 (0.258)	-0.203 (0.252)	-0.138 (0.260)	-0.147 (0.253)
% Black	-0.0238 (0.248)	-0.0197 (0.266)	-0.125 (0.250)	-0.102 (0.267)
Crime Rate	-0.0104 (0.0123)	-0.0105 (0.0123)	0.00275 (0.0124)	0.00221 (0.0123)
% NAEP Proficient	0.534* (0.290)	0.537* (0.298)	0.0701 (0.292)	0.0872 (0.300)
Constant	239.0** (93.66)	239.9** (93.39)	172.5* (94.25)	176.5* (93.97)
Observations	47	47	47	47
R-squared	0.342	0.342	0.229	0.229

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	(5) Low Income Graduation Rate	(6) Low Income Graduation Rate	(7) Migrant Graduation Rate	(8) Migrant Graduation Rate
Two-Year Tuition (5 year % change)	-0.123 (0.145)		0.402 (0.300)	
Four-Year Tuition (5 year % change)		0.00163 (0.114)		0.538** (0.212)
% Urban Population	0.272 (0.176)	0.229 (0.171)	0.0803 (0.331)	-0.0101 (0.310)
% Poverty	-1.045 (1.216)	-1.041 (1.251)	-3.006 (2.243)	-2.876 (2.055)
% Tax Revenue Towards Education	1.199 (0.890)	1.269 (0.898)	1.096 (1.997)	1.156 (1.849)
Median Income	-0.00751 (0.0460)	-0.00847 (0.0475)	-0.0829 (0.0838)	-0.0886 (0.0773)
State Financial Aid	0.00340 (0.00742)	0.00377 (0.00752)	0.0139 (0.0180)	0.0154 (0.0167)
% Unemployed	-0.645 (1.056)	-0.590 (1.066)	1.938 (2.256)	1.278 (2.049)
% High School Completion	-1.648 (1.129)	-1.618 (1.147)	-0.481 (2.485)	-0.331 (2.245)
% Asian	-0.0343 (0.685)	-0.203 (0.667)		
% Hispanic	-0.467 (0.299)	-0.411 (0.297)		
% Black	-0.277 (0.288)	-0.257 (0.305)		
Crime Rate	-0.0119 (0.0138)	-0.0107 (0.0139)	0.0157 (0.0259)	0.0294 (0.0239)
% NAEP Proficient	0.355 (0.333)	0.385 (0.349)	0.172 (0.747)	0.566 (0.715)
Constant	201.1* (104.6)	196.4* (106.0)	137.0 (245.7)	95.88 (222.1)
Observations	44	44	37	37
R-squared	0.298	0.281	0.195	0.310

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

To try to account for systematic, unobservable differences between states, I previously measured tuition as a five-year percentage change. In Table 6, I measure changes in each variable to try to account for even more of these differences. I test the effects of a percentage change in tuition on graduation rates in 2010 and on a five-year change in graduation rates between 2005 and 2010. In addition, I control for the 5-year changes in control variables instead of measuring value in 2010.

Like in the previous tests, the results of the regressions in Table 6 are insignificant. A change in two and four-year tuition does not have any effect on graduation rates or 5-year changes in graduation rates when controlling for changes in the control variables. In addition, 5-year tuition increases are positively correlated with 5-year high school graduation changes. This finding contradicts the theory that tuition negatively impacts high school graduation. However,

these results are highly insignificant and once again, this test further prevents me from rejecting the null hypothesis. The data does not suggest any relationship between college tuition and high school graduation.

Table 6. Regressions for Five-Year Changes in the Variables.

VARIABLES	(1) Graduation Rate	(2) Graduation Rate	(3) Graduation Rate (5 year change)	(4) Graduation Rate (5 year change)
Two-Year Tuition (5 year % change)	-0.00358 (0.111)		0.153 (0.121)	
Four-Year Tuition (5 year % change)		-0.0871 (0.0816)		0.0352 (0.0865)
% Urban Population (5 year change)	0.747 (1.165)	0.795 (1.143)	-0.388 (1.314)	-0.178 (1.336)
% Poverty (5 year change)	-1.862** (0.900)	-1.859** (0.880)	-0.470 (1.042)	-0.423 (1.067)
% Tax Revenue Towards Education (5 year change)	0.143 (0.962)	-0.0400 (0.946)	-0.931 (1.012)	-0.938 (1.043)
Median Income (5 year change)	-0.0685 (0.0572)	-0.0798 (0.0570)	-0.0388 (0.0581)	-0.0434 (0.0599)
State Financial Aid (5 year change)	0.0234* (0.0133)	0.0243* (0.0131)	0.0217 (0.0134)	0.0214 (0.0137)
% Unemployed (5 year change)	0.200 (0.888)	0.504 (0.917)	-0.0762 (1.046)	-0.167 (1.093)
% High School Completion (5 year change)	-0.965 (1.009)	-0.875 (0.992)	-1.649 (1.036)	-1.546 (1.060)
% Asian (5 year change)	13.86 (11.69)	15.91 (11.17)	1.972 (12.23)	-4.368 (11.79)
% Hispanic (5 year change)	-3.716 (2.283)	-3.840* (2.231)	-1.241 (2.426)	-0.791 (2.456)
% Black (5 year change)	4.398 (3.369)	3.592 (3.397)	3.733 (3.694)	3.463 (3.877)
Crime Rate (5 year change)	0.0193 (0.0273)	0.0265 (0.0277)	0.00254 (0.0285)	0.00513 (0.0299)
% NAEP Proficient (5 year change)	0.652 (0.512)	0.745 (0.506)	0.432 (0.532)	0.530 (0.540)
Constant	82.71*** (4.443)	82.83*** (4.323)	-4.860 (4.812)	-3.922 (4.863)
Observations	47	47	44	44
R-squared	0.301	0.325	0.299	0.266
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

Discussion and Limitations

The findings from these tests suggest that there is no causal relationship between college tuition and high school graduation. However there are several limitations that cannot be accounted for given the size of the dataset and the nature of the data. With only 50 states, there are very few observations for each variable and it is difficult to reach any significant conclusions. There is no way around this problem seeing as I cannot increase the number of states. There was also not enough data to run a fixed effects model to try to account for unobservable variables.

Even though I measured tuition as a percentage change to try to account for unobservable differences between states, this method did not capture all of those differences.

The length of time of the percentage change raises another issue. The decision to measure tuition as a five-year percentage change was because five years roughly spans over the amount of time a student is in high school. Therefore, a five-year change accounts for the class of 2010's perception of tuition, which could have an effect on their decision on whether or not to stay in high school. Even so, the five-year change is not long enough. Five years does not take into account long-term effects of any policy that may have occurred during that time. For example, a national policy passed in 2008 could take effect quickly in one state, but not have any observable effect in another until 2011. If that policy is aimed at graduation or tuition, this five-year change does not capture the difference.

Measuring data at the state level raises another issue. The key independent variable is state-level college tuition, therefore the rest of the data must also be at the state level. As a result, there are several important variables that cannot be considered because they are only measurable at the individual level. For example, the number of parental separations is known to have an impact on high school graduation (Haveman, Wolfe, and Spaulding 1991), however this variable is measured at the individual level. I could not control for these types of variables. High schools with high and low graduation rates are also systematically different within a state. However, I could not control for these school level differences at the state level. Therefore, there are many factors that I could not control for due to the unit of analysis.

The data I used for college tuition only applies to public colleges. However, according to data from the National Center for Education Statistics, students at private institutions account for nearly a quarter of all college students. Only observing tuition rates at public institutions ignores

the effect of tuition on a large portion of students who are going to private colleges. However, because tuition is significantly higher at private institutions, it is unlikely that students at risk of dropping out, who are more likely to be from lower income families, would be influenced by private school tuition changes. If a student cannot go to a private school because of cost, it is more likely that they would go to a cheaper public school, rather than drop out altogether. Measuring in-state tuition as my dependent variable might also pose a problem. However, tuition at public universities for out of state students is significantly higher. Therefore, like with private school tuition, it is unlikely that students who are most at risk of dropping out of high school are influenced by college tuition in another state.

Future studies should use a larger dataset measuring variables over a longer time period with more variables. Running a time series cross sectional analysis could be interesting because it would account for changes that the five year change variable misses. In addition, with more data, I could run fixed effects model. Some states' high school graduation rates might be more susceptible to changes in tuition for reasons that I cannot observe or control for. Therefore, the dataset used in this study has important limitations that could be driving the results.

Conclusion

Disparities in high school graduation and college enrollment rates for different income and minority groups continue to be an important problem today. Some studies even suggest that these disparities are becoming worse. Scholars have observed many predictors and determinants of both high school graduation and college enrollment. Those include variables such as income, race, unemployment rates, family structure, and school ability. College tuition is one of the most studied factors in college enrollment and is generally agreed upon to be a strong determinant of enrollment.

In this paper, I observed the relationship between college tuition and high school graduation, and found there to be no causal link between the two. Even among groups that I expected to be the most influenced by college tuition, there was no relationship between the price of college and the decision to drop out. However, the dataset used in this study made it difficult to come to any definitive conclusion. The data did not capture all of the systematic differences between states and was not taken over a long enough period of time. The dataset did not take into account enough variables and was not large enough to run a more sophisticated fixed effects model to capture unobservable differences. Finally, data at the state level could not account for several variables that are known to influence high school graduation because many of these are observed at the individual level.

Future studies need to use a larger dataset over a longer period of time. They need to use a more sophisticated model to capture all of the systematic differences between states. However, even if we could accurately control for all of these differences, the results from this study show that college tuition has little to no impact on high school graduation rates, especially in comparison to variables like poverty and income. There are reasons to graduate from high school, even if college is not immediately obtainable. For example, many people graduate from high school, but do not return to higher education until later (Seftor and Turner 2002). The tests run in this study did not take into account this significant portion of the population. Although this paper does not come to any significant conclusion, the determinants of high school graduation and college enrollment are important, especially as the inequalities between income and race continue to grow. We must continue to study this problem as to reduce these problems for future generations.

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