

School Management and Sexual Behavior of Teenagers

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Abstract: This paper asks whether school based management may help reducing risky sexual behavior of teenagers. For this purpose we use student level data from Bogotá to identify students from Concession School (CS), who are enrolled in public education system with a more school management autonomy at school level, and to compare them with those students at the traditional public education system. We use propensity score matching methods to have a comparable sample between pupils at CS and traditional schools. Our results show that on average the behavior of students from CS do not have a sexual behavior that differs from those in traditional public schools except for boys in CS who have a lower probability of being sexual active. However, there are important differences when heterogeneity is considered. For example we find that CS where girls per boys ratio is higher have lower teenage pregnancy rates than public schools with also high girls per boys ratios. We also find that teachers' human capital, teacher-pupil ratio or whether school offers sexual education are also related to statistically significant differences between CS and traditional public schools.

JEL codes: H51, I28, J13, O15

Keywords: Sexual Behavior, School Management, Concession Schools, Bogota

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1 Introduction

Events and behaviors that happen during adolescence can have long lasting effects on adulthood since many of the outcomes of teenage behavior are irreversible or remediation can be very difficult or costly. During adolescence teenage body and brain are still growing and the events that take place during this period can have effects on the same growth process. Many of these events depend on the adolescents own behavior. It is thus desirable for all adolescents to be immersed in environments where good behaviors are encouraged.

This paper is concerned with behavior in one particular area: sexual behavior. The consequence of risky sexual behavior for young individuals are well known. Besides teenage pregnancy we also have that premature births are more likely in teenage pregnancies and that cervical cancer is more likely when sexual intercourse starts during teenage years. Other problems like sexually transmitted infections are not exclusive of teenagers but the society may still want to protect adolescents from them and they may still have stronger consequences for teenagers than for adults.

Particularly, this paper is concerned with whether school organization can affect sexual behavior. Conventional knowledge and existing research suggests that adolescent sexual behavior depends not only on what happens in school but also on what happens in the household and in the neighborhood. Adolescents are subject to both, role models and peer group effects, which may affect or determine their behavior; role models and peer group effect may be the results of interactions in the household, in the neighborhood or in school. Yet, the education institution has a predominant place when choosing where to implement policies to affect the behavior of adolescents. Not only adolescents spend a large amount of time at school but also the behavior of the different players involved in the school environment may be more easily changed than the behavior of adolescents' parents, siblings or neighbors.

The literature points to several school level interventions that may affect adolescents' sexual behavior. Among them we find giving specific sexual education that is not only concerned with sexual anatomy but also, for example, gender relations; counseling; or helping students understanding long term effects of their own behavior. The literature also points to school level peer group effects which may potentially affect the type of interventions that teachers and principals must perform in school. Many of these interventions are supported by education, psychology and sex research and they seem to be effective. Yet, teenagers continue engaging in risky sexual behavior that leads to sexual related diseases or pregnancy. Moreover, there are important differences in the incidence of problems related to risky sexual behavior across different contexts. For example, in Colombia, Brazil and Chile teenage pregnancy rates are more than five times than those of countries like Italy, France or Spain. Among

Latin American countries Colombia has one of the highest teenage pregnancy rates which is almost four times those of Brazil or Chile.

If one is concerned with the possible contribution of schools to sexual behavior, the questions are then whether schools do actually engage in this type of interventions and which schools do so. The organization of school systems is a very complex issue and in most countries access restrictions and equality considerations have forced countries to adopt systems in which schools have little autonomy. National teacher recruitment systems, curricula that are externally decided, student-school assignment policies, are only some of the restrictions that result in difficulties of schools to adopt appropriate education policies that really protect adolescents from engaging in risky behavior that may have undesirable consequences.

This paper asks whether school-based management may help reducing risky sexual behavior of teenagers. For this purpose we use student level data from Bogotá (Colombia). In Colombia, public education is governed by nation wide rules where schools and teachers are limited in the decisions they can make for their schools. In Bogotá, in 2001 the Concession School (CS) program was launched; this program awarded contracts to non-for-profit organizations to manage public schools. Schools in the program have considerably more autonomy than traditional public schools. Schools in the program are allowed to make all relevant decisions except whether to accept or reject students. Our question is then, whether students attending the CS have different sexual behavior than students attending traditional public schools.

Our paper adds to the literature considering a question that has not been addressed before, i.e., whether school management affects sexual behavior of enrolled teenagers. Our approach is different to that of previous literature because we are not concerned with the effect of particular policies or interventions on sexual behavior. Rather we are concerned with whether schools with more autonomy will engage in establishing policies at the school level that will reduce risky behavior of the students attending those schools. Previous literature has considered questions related to the consequences of sexual behavior and particularly teenage pregnancy (v.g. Fletcher and Wolfe, 2009 and Fletcher, 2012); the effect of different education policies and sexual behavior (v.g. Berthelon and Kruger, 2011 and Duflo et al., 2006); the effects on school sex education on sexual behavior (Oettinger, 1999); and peer group effects in sexual behavior (Richards-Shubik, 2012).

In this paper we use propensity score matching methods to study whether students attending schools under a school based managed policy have different sexual behavior than students attending traditional public schools in Bogotá. The database is an original one which was raised in the first quarter of 2010 and contains information of more than 34000 students of the last three secondary school grades with ages between 14 and 19 years. The outcomes that we consider are whether the students are already sexually active (defined as

having already had sexual intercourse), condom use and teenage pregnancy. For all these outcomes we also consider heterogeneous effects according to the human capital of teachers, the teacher-pupil ratio, whether the school offers sexual education and the tightness of the mating market at school.

Our results show that on average the behavior of students from CS do not have a sexual behavior that differs from those in traditional public schools except for boys in CS who have a lower probability of being sexual active. However, there are important differences when heterogeneity is considered. For example we find that CS where the girls per boys ratio is higher have lower teenage pregnancy rates than public schools with also high girls per boys ratios. We also find that teachers' human capital, the teacher-pupil ratio or whether the school offers sexual education are also related to statistically significant differences between CS and traditional public schools.

The rest of this paper is divided as follows. The first section is this introduction; the second section explains details of the CS program; the third section explains the empirical strategy; the fourth section gives details about the data base. The results are presented in the fifth section and the last section concludes.

2 The program of concession schools

The Concession School Program in Bogotá started in 1999. The program was initially designed to last for 15 years after which the continuation should be decided depending on the evaluations of the program. The aim of the Concession School Program was to improve coverage and quality of public education in the city of Bogotá. To do so it awarded contracts to non-for-profit education organizations to manage public schools to attend children from ages 5 to 17 attending the whole cycle of primary and secondary education¹. The program can be describe by five main characteristics which were also reflected in the contracts the city signed with the operators of the schools. First, the concession schools had to operate within the rules of all public schools regarding admission and selection of students; this means that they must provide education to students assigned by the city to them. Second, the schools are free to choose curriculum, pedagogic methods and teaching and administrative staff (within contractual rules subject to the compliance of performance standards). Third, being managed by non-for-profit private organizations, financial management was also responsibility of the organization. Fourth, initially, the city provided the infrastructure for the schools. During the operation of the program it provides fixed per student budget and it must take care of renovating infrastructure; resources allocated to the Concession School were fixed to be very

1. According to Colombian law this consist of one year of preschool, nine years of basic education and two years of high-school education

similar to the per pupil public spending at the time in which the program started. A final important characteristic of the program is that the schools must have a complete school day.

What was seen in practice followed very closely the initial design of the program. Contracts were awarded on the basis of proposals submitted by interested organizations and the institutions that enter to operate the schools are education institutions that are well known in the country for their capacity to manage high quality education institutions. In terms of the population attending Concession Schools if there is any difference it is a result of the location of schools which was chosen by the city administration and of families' behavior when choosing school for the children and not a result of selection strategies of the schools.² Schools were builded by the city administration in locations satisfying two criteria: areas with high levels of poor families and areas with low levels of coverage. This means that students attending this schools come from very low socioeconomic background families. Unfortunately there is no public data to study whether concession schools had high or low demand compared to that of traditional schools nor if applicants to these schools differ from applicants to traditional public schools. In any case, the possible differences between the population attending concession schools justifies the use of a methodology like the one in this paper to compare outcomes of students in both schools.

The main differences between concession schools and traditional public schools can be seen in its management model and in the school day duration; resources allocated to each of the two schools are also different. First regarding school management Concession Schools do have much more flexibility to allocate resources such as financial resources, the time teachers allocate to teaching and to other activities and to do side programs such as the establishment supplemental nutrition, counseling and psychological programs, attention to children with particular learning needs or programs to work with parents and community in general. They are flexible to choose teaching and administrative staff and to establish evaluation systems to give feedback to teachers to improve and eventually to fire bad teachers. In terms of the school day duration, concessions schools have a full day duration (8 hours per day) while traditional public schools have a mid day duration (5:30 hours).

Although the resources allocated to concession schools were not supposed to differ to those allocated to traditional public schools, recent declarations by city officials show that this is not the case and that traditional public schools are more expensive than concession schools.

2. The Bogotá school - student assignment system works very similarly to the Boston. In the first stage of the process families provide a list of three schools, in order of preferences, to which they want their child to attend. With this preferences statement places in schools are awarded giving priority to brothers of children who are already attending the school, children who declare to live near the school, and other criteria like being a displaced family or being a that falls within low resources categories.

The effects of the Program on particular academic margins have already been evaluated by Barrera-Osorio (2007) and Bonilla (2010). Using a propensity score method and administrative data for the years 1999 and 2003, Barrera-Osorio (2007), shows that concession schools have lower dropout rates and higher scores in standardized test than nearby traditional public schools. Using administrative data from 2008 and an instrumental variable approach, Bonilla (2010) shows that students from concession schools have higher results on standardized test than students from traditional public schools.

3 Empirical Strategy

In order to answer how the school management of the concession schools in Bogotá could affect the sexual behavior of teenagers we take advantage of the information for the different types of public schools in the city. In order to have a more comparable set of students, we focus our econometrical exercises on girls and boys that are enrolled in the 205 public schools. Private schools are less comparable because of the differences on the individuals characteristics and the potential large differences on how schools select pupils into the school.

We use matching techniques in order to assess the impact of school management (concession school -CS- versus public schools) on five outcomes of sex behavior of teenagers. The outcomes of sex behavior that we will analyze are sexual status (a dummy variable that takes value one if the individual has had a sexual intercourse), age at first sexual intercourse, condom use, use of other modern methods and teenage pregnancy. The idea behind the matching is to minimize model dependence of statistical inference (Ho et al., 2007). The matching techniques allows us to compare similar groups, that ideally should be similar in all dimensions except for the relevant *policy* dimension, whose impact we want to estimate.

These groups are built up artificially based on the characteristics of the units of analysis. The identifying assumption that makes it credible to identify causal effects using matching techniques is the Conditional Independence Assumption (CIA):

$$Y(1), Y(0) \perp T | f(X) \tag{1}$$

that is, potential outcomes of being treated and non treated, $Y(1)$, $Y(0)$, respectively, are independent of treatment T conditional to a balancing function f of individual covariates, X . In our case $T = 1$ for students attending concession schools and $T = 0$ for students attending public schools. With observational data we are able to estimate

$$E[Y(1)|T = 1, X] - E[Y(0)|T = 0, X] = \theta + [E[Y(0)|T = 1, X] - E[Y(0)|T = 0, X]] \tag{2}$$

where θ is the estimator we want to identify. This coefficient estimates the Average Treatment on the Treated (ATT), i.e., $\theta = E[Y(1) - Y(0)|T = 1, X]$. The term in squared brackets in the RHS of Equation (2) measures the selection bias that comes from having differences in confounding factors between the treatment and the control group. Under CIA this term boils down to zero, and we are therefore able to identify the ATT.

We proceed in three steps. First, we perform a propensity score matching using the mahalanobis-metric procedure (Rubin, 1980). We use household variables at this step. The variables included in the matching are age, gender, whether the individual lives with the mother, whether the individual lives with the father, the number of mother's children, the mother's age at first birth and the socioeconomic level of household. By doing this we make individuals in the treatment and control group as similar as possible regarding individuals and household characteristics. Importantly, this allows us to clean up for any sorting of individuals across schools.

Second, we make a regression analysis on the matched sample. The specification is as follows,

$$Y_{is} = \alpha_0 + \theta T_s + X_i' \beta_1 + X_s' \beta_2 + \varepsilon \quad (3)$$

where Y_{is} is a variable that measures sexual behavior of individual i enrolled in school s . T_s is the dummy variable that defines whether school s is treated or not. X_i' is the vector of individual and household variables of individual i that were used in the matching. X_s' is a vector of school variable that help us to further control for differences in schools attended by the treatment and the control group. The school variables included are school quality, the proportion of students at school that claim that their main source of Sexual Education (SE) are their classmates and the proportion of classmates from the opposite gender that are sexually active. The coefficient of interest is θ . Provided that the balancing property of matching holds, the estimation of θ identifies the ATT.

Third, we look at heterogenous effects according to some measures of school management. We look at four variables of school management: the proportion of individuals that reports school as main source of sex education, which is a measure of how school makes emphasis on sex education; the number of pupils per teacher, which is a proxy for (the inverse of) teacher attention; the number of girls per boy at school and the level of teachers' human capital. The specification is as follows,

$$Y_{is} = \alpha_1 + \theta T_s + \theta_1 T_s * M_s + X_i' \beta_1 + X_s' \beta_2 + \varepsilon \quad (4)$$

where M_s is one of the management variables of school s . In these regression our coefficient of interest is θ_1 . Errors are robust in all specifications.

As always, this identification strategy is reliable depending on whether we achieve the balancing property. We report the density function of the propensity score for both the treatment and the control group, for both before and after the matching. Moreover, we look at the bias reduction on averages of covariates X_i comparing the treatment and the control group.

We additionally perform some robustness checks. First, we test whether our main results are robust to different specifications. Second, we test whether our results depend on the specific function $f(X)$ in Equation 1. We basically perform the same matching exercises but using kernel functions instead of Mahalanobis. Third, we perform a falsification test. We randomly divide the control group into two subgroups. One of these subgroups is used as a fake treatment group. Then we build up a counterfactual control group for this fake treatment group using the same matching techniques we use for our main results. We should find no differences in outcomes across the fake treatment and the control group built up in this way.

4 Data and Descriptive Statistics

For this study we use information from the ECSAE Survey, which was implemented and collected by the Universidad del Rosario between February and April 2010. The survey interviewed adolescents between 14 to 19 years old enrolled in the last three years of high school in private and public schools in Bogota (i.e. the years correspond to 9th, 10th and 11th grades at the Colombian education system). The survey is representative for the population size of adolescents enrolled at the last three grades and for each regional level of the city (localidades). The final data contains information for 34397 girls and boys distributed in 205 public schools and 72 private schools. For each adolescent the survey asked about pregnancy, fertility, sexual risk behavior (condom use), received sex education at the school, family and individual background and the type of school they are attending. To capture more information about the type and features of school attended by adolescents we merge the ECSAE with information at the school and the neighborhood level. The school level information includes school facilities, number of teachers and their qualification and school quality measure as the score on the national test SABER 5th grade. All the information on school comes from administrative records of the Colombian government.

From the total public schools in our sample, 16 schools are classified as concession schools (CS) and 189 are traditional public schools that we called "public". These two types of public schools account for 2158 students and 24657 students, respectively. After cleaning and data management, which includes dropping individuals with missing information on some variables of interest and individuals enrolled on schools with unique gender, we ended with

a total sample of 15225 teenagers with 1280 students enrolled concessions schools and 13945 on public schools. We use this final data set to implement our matching methodology and we ended with a sample of 1138 individuals on public schools as control observations and 1280 students at the concession schools as treatment group.

As it was stated before the first step at the empirical specification was to implement a propensity score matching. At this procedure we use a set of individual and household variables. The set of individual variables includes the age and the gender of the student. The type of household variables that we can use to find a more comparable sample was if the mother and the father live with the teenage, the number of children of the mother, the score of the socioeconomic level (Cortes, Gallego and Maldonado, 2012) and the age of the mother when had her first child.

Table 1 presents some descriptive statistics on the main outcomes on having sexual intercourse, age at the first sexual intercourse, condom use, use of other modern contraceptive methods and teenage pregnancy discriminated by sample (full and matched) and school type. We compare the average characteristics across schools types for the full sample (Panel A of Table 1) and the matched sample (Panel B of Table 1). The first row provides information on the mean, the second row the standard errors and the last row the number of observations for each classification. The descriptive statistics in Panel A shows that the teenagers in concession schools are different from their counterparts in public schools on all outcomes. In particular adolescents in concession seem to be less sexual active 33% comparing with the 42% of the public, they were older at the age they started to be active 14.39 against 14.26 from public schools, once they are sexual active they seems to use more condom at the last sexual intercourse and have less teenage pregnancy incidence 4.7% against 6.9%. The Panel B shows the same figures for the sample after the matching, the differences of the individuals in the two type of schools are reduced for the variable of having sexual intercourse, but for the others the differences even increased making a higher impact of the concession school on the outcome of interest.

Table 1: Descriptive statistics: Outcomes

			Had sexual intercourse	Age first sexual intercourse	Condom use	Modern methods	Teen pregnancy
Full sample	All	Mean	0.4181	14.2723	0.5088	0.1713	0.0675
		Std. Dev.	0.4933	1.4173	0.5000	0.3768	0.2509
		Obs	15225	6207	6207	6207	6207
	Concession	Mean	0.3320	14.3929	0.5286	0.1452	0.0476
		Std. Dev.	0.4711	1.3610	0.4998	0.3528	0.2132
		Obs	1280	420	420	420	420
	Public	Mean	0.4260	14.2635	0.5073	0.1731	0.0689
		Std. Dev.	0.4945	1.4210	0.5000	0.3784	0.2534
		Obs	13945	5787	5787	5787	5787
After matching	All	Mean	0.3461	14.2881	0.5342	0.1693	0.0600
		Std. Dev.	0.4758	1.3793	0.4991	0.3752	0.2377
		Obs	2417	808	808	808	808
	Concession	Mean	0.3323	14.3929	0.5286	0.1452	0.0476
		Std. Dev.	0.4712	1.3610	0.4998	0.3528	0.2132
		Obs	1279	420	420	420	420
	Public	Mean	0.3605	14.1816	0.5400	0.1937	0.0726
		Std. Dev.	0.4804	1.3913	0.4990	0.3957	0.2599
		Obs	1138	388	388	388	388

Panel A and B of Table 2 show the descriptive statistics for the controls for the data before and after the matching and splits those statistics by the whole sample of the empirical exercise and the concession and public schools. The last four columns of Panel A (refereing to the unmatched sample) show the mean and the standard deviation for students at the concession and public school respectively. As the data shows the adolescents in concession schools seems to be in a better socioeconomic and family conditions and they are enrolled at schools with better academic scores. In particular, the age of the teenagers in concession schools (public schools) is 15.33 years old (15.53), the percentage of individuals living with their mother is 94% (90%), the percentage living with their father is 67% (58.9%), the number of children of their mother is 3.02 (3.14), the socioeconomic index is 326.3 (312.14). The Panel B of Table 2 give us evidence that after the matching is implemented the observed characteristics of the teenagers in concession and public schools started to be reduced, in particular, difference on individual and family characteristics are reduced. However the control variables that seem to be less comparable after the matching are related with school variables. We include them on the regression analysis.

Table 2: Unconditional descriptive statistics: Controls

		All		Concession		Public	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Before matching	Age	15.5184	1.1270	15.3391	1.0540	15.5349	1.1320
	Gender	0.3958	0.4890	0.4055	0.4912	0.3949	0.4888
	Mother	0.9097	0.2866	0.9453	0.2275	0.9064	0.2913
	Father	0.5941	0.4911	0.6742	0.4688	0.5867	0.4924
	Mother's children	3.1330	1.2276	3.0297	1.0840	3.1425	1.2396
	Socioeconomic level	22.4315	3.9697	22.7116	3.7649	22.4058	3.9871
	Mothers age at first child	20.4717	4.1562	20.7500	4.0212	20.4462	4.1676
	Average SABER 5th gr language	313.3424	18.4431	326.3961	20.0685	312.1442	17.8145
	Classmates as main source SE	0.2664	0.0591	0.2994	0.0759	0.2634	0.0564
	Proportion active (opposite gender)	0.4209	0.1285	0.3273	0.1011	0.4295	0.1274
	Observations	15225		1280		13945	
After matching	Age	15.3401	1.0526	15.3401	1.0537	15.3401	1.0518
	Gender	0.4112	0.4921	0.4050	0.4911	0.4176	0.4934
	Mother	0.9453	0.2274	0.9453	0.2275	0.9454	0.2274
	Father	0.6731	0.4692	0.6740	0.4689	0.6721	0.4697
	Mother's children	3.0391	1.0814	3.0305	1.0840	3.0481	1.0790
	Socioeconomic level	22.6491	3.6941	22.7058	3.7606	22.5899	3.6240
	Mothers age at first birth	20.6770	3.9327	20.7389	4.0030	20.6126	3.8585
	Average SABER 5th gr language	319.7924	19.5897	326.4034	20.0746	312.8956	16.4552
	Classmates as main source SE	0.2833	0.0684	0.2994	0.0759	0.2664	0.0546
	Proportion active (opposite gender)	0.3752	0.1265	0.3273	0.1011	0.4252	0.1309
	Observations	2417		1279		1138	

Finally, we report descriptive statistics for school management variables. Table 3 presents the descriptive statistics of the sex education at school, pupils per teacher, human capital composition of the teachers at each school, the ratio girls per boys at the school, a dummy if the school has introduced religion education, the percentage of the of sexual active teenagers using modern methods of family planning and the share of teenagers with knowledge of the condom uses. From the mean we observe differences between concession and public schools and we can see that adolescents in concessions schools seems to be affected with better school management decisions and those differences increased between both groups with the matched sample. In particular, concession schools have more sex education at school as main source of information; the number of teachers with college degree are 31.10 at school concessions and 28.75 at public schools. We are going to exploit in our empirical specification those differences on the potential mechanism between concessions and public school as a source of heterogeneous effect on sexual risky behavior.

Table 3: Unconditional descriptive statistics: Heterogenous Effects

		All		Concession		Public	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Before matching	Sex education at school	0.7738	0.4184	0.8299	0.3759	0.7687	0.4217
	Pupils per teacher	28.0340	4.2985	29.0262	2.2876	27.9458	4.4227
	Human capital	29.0649	5.4383	30.3544	4.5507	28.9502	5.4958
	Girls per boy	1.1854	0.3228	1.1882	0.2812	1.1852	0.3264
	Knowledge	0.4936	0.5000	0.4992	0.5002	0.4930	0.5000
After matching	Sex education at school	0.7956	0.4034	0.8298	0.3760	0.7601	0.4272
	Pupils per teacher	28.3652	3.8300	29.0252	2.2883	27.7019	4.8254
	Human capital	29.5554	5.3799	30.3536	4.5526	28.7531	5.9953
	Girls per boy	1.1891	0.3009	1.1883	0.2812	1.1900	0.3201
	Knowledge	0.5046	0.5001	0.4996	0.5002	0.5097	0.5001

5 Results

Table 4 presents naive regressions on five outcomes in sexual behavior, in which we regress each outcome against the explanatory variables for the unmatched sample. Each column is a OLS model for each outcome controlling by individual characteristics, household characteristics and school features with robust standard errors. As a first look, it seems that the concession schools reduce the probability of being sexual active (reduction in 4.1 p.p.) and increase the age of initiation (around 2 months), but it does not seem to have impact on the other three outcomes. As we know for descriptive statistics in Panel A of Table 2 the adolescents in concession and public school are different on observable variables for the unmatched sample. We then need to make the treatment and the control group more comparable.

Table 4: Naive regression: Before matching

	Had sexual intercourse	Age first sexual intercourse	Condom use	Modern methods	Teen pregnancy
Concession	-0.0415*** (0.0138)	0.1438** (0.0672)	-0.0107 (0.0272)	-0.0235 (0.0190)	0.0014 (0.0118)
Individual variables	✓	✓	✓	✓	✓
Household variables	✓	✓	✓	✓	✓
School variables	✓	✓	✓	✓	✓
Observations	15225	6207	6207	6207	6207
R-squared	0.154	0.242	0.018	0.028	0.053

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

5.1 Matching

Matching is performed on individual and household variables. Results on balancing property of the matching are reported in Table A.1. We report there the matching for all individuals regardless of sexual status (see Panel A: Unconditional), and for individuals who has already had a sexual intercourse (see Panel B: Conditional on sexual activity). In all variables, the bias is reduced more than 80%; and in most of them, bias reduction reaches the 100%. This means that the treatment and the control groups are very similar with respect to their individual and household characteristics.

Density functions of propensity scores are depicted in Figure A.1. We can see there that the treated and the unmatched units differ regarding the distribution of the probability of being treated (the propensity score). The matching procedure allow us to build up a control group whose propensity score (PS) distribution mimics almost perfectly the PS distribution of the treatment group. Having this into account we can say that the balancing property is achieved and therefore our estimates identify the Average Treatment on the Treated.

5.2 Main results

We regress our main specification (see Equation (3)) for the matched sample and we present the main results for the whole matched sample and for girls and boys respectively in the Table 5. As before, all the linear regression model includes individual, family and school controls. The basic results for both girls and boys shows that, on average, concessions schools does not have an impact on the sexual behavior of the adolescents except on the probability to be sexual active, in which it reduces this probability around 4.4% and we can see that this reduction is explained by a reduction around 6.5% on probability to be sexual active on boys, but not on girls.

Table 5: General results: After matching

	Had sexual intercourse	Age first sexual intercourse	Condom use	Modern methods	Teen pregnancy
All	-0.0442** (0.0221)	0.1056 (0.1163)	-0.0352 (0.0448)	-0.0463 (0.0338)	0.0186 (0.0194)
Girls	-0.0122 (0.0292)	0.1425 (0.1444)	-0.0299 (0.0727)	-0.0121 (0.0566)	0.0305 (0.0395)
Boys	-0.0650* (0.0342)	0.0801 (0.1723)	-0.0275 (0.0582)	-0.0611 (0.0403)	0.0032 (0.0174)
Individual variables	✓	✓	✓	✓	✓
Household variables	✓	✓	✓	✓	✓
School variables	✓	✓	✓	✓	✓
Observations	2417	808	808	808	808
R-squared	0.154	0.240	0.029	0.036	0.089

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Although there is no impact of concession schools on the average behavior of adolescents, except for boys in concession schools that reduce their probability to be sexual active, we explore if there are heterogeneous effects of different school characteristics that are more salient on concessions school due to their flexibility on their school management policies. As it was stated before, we implement the same specification for the matched sample with an interaction term of the concession dummy and the variable measuring some dimensions of school management (see Equation (4)). Table 6 reports estimations of θ_1 for the total matched sample and for girls and boys separately. All models use an OLS specification including individual, household and school characteristics.³ In general we can observe some heterogenous effects that are statistically significant and that will have interesting features on how the concession schools will be working through the school management mechanism. At Panel A in Table 6 at the last column we can observe that teenage pregnancy or childbearing is reduced in concessions schools in which the ratio of girls per boy increased (the size of mating market) with girls being the affected population.

3. Besides the results reported in Table 6, we explore differences along with different operators and find no significant differences.

Table 6: Heterogenous Effects

		Had sexual intercourse	Age first sexual intercourse	Condom use	Modern methods	Teen pregnancy
Panel A: Girls per boy	Interaction	-0.0603 (0.0596)	-0.0426 (0.3030)	0.1016 (0.1265)	-0.1048 (0.1045)	-0.1043* (0.0556)
	Interaction for girls	-0.0219 (0.0733)	0.4229 (0.4161)	0.2286 (0.1903)	-0.0645 (0.1336)	-0.2559*** (0.0955)
	Interaction for boys	-0.1066 (0.1023)	-0.4159 (0.4402)	0.0142 (0.1692)	-0.1255 (0.1468)	0.0081 (0.0490)
	R-squared	0.154	0.240	0.032	0.038	0.093
Panel B: Pupils per teacher	Interaction	0.0124* (0.0066)	0.0146 (0.0309)	-0.0055 (0.0137)	0.0111 (0.0097)	0.0101* (0.0054)
	Interaction for girls	0.0068 (0.0084)	0.0026 (0.0324)	-0.0115 (0.0198)	0.0192 (0.0155)	0.0120 (0.0101)
	Interaction for boys	0.0166 (0.0109)	0.0213 (0.0511)	0.0029 (0.0189)	-0.0006 (0.0118)	0.0025 (0.0047)
	R-squared	0.163	0.272	0.033	0.035	0.092
Panel C: Human Capital	Interaction	0.1919** (0.0954)	-0.0389 (0.4178)	-0.4061** (0.1773)	0.2166 (0.1392)	0.0617 (0.0852)
	Interaction for girls	0.0541 (0.1231)	-0.5528 (0.5056)	-0.2171 (0.2644)	0.0274 (0.2411)	0.0630 (0.1443)
	Interaction for boys	0.2984** (0.1498)	0.2793 (0.6943)	-0.5621** (0.2421)	0.3094** (0.1523)	0.0400 (0.0853)
	R-squared	0.164	0.275	0.041	0.040	0.096
Panel D: University or more	Interaction	-0.3402 (0.3177)	-1.5378 (1.2683)	0.1059 (0.5403)	-0.5481 (0.3600)	-0.0881 (0.2632)
	Interaction for girls	-1.0154** (0.4011)	-1.5257 (1.3181)	0.5295 (0.8415)	0.0458 (0.7093)	-0.1690 (0.5626)
	Interaction for boys	0.3262 (0.5056)	-2.1743 (2.2049)	-0.2713 (0.7403)	-1.2865*** (0.4356)	0.1750* (0.1004)
	R-squared	0.154	0.242	0.030	0.038	0.091
Panel E: Sex education at school	Interaction	0.0135 (0.0465)	-0.3310 (0.2282)	-0.2123** (0.0868)	0.0308 (0.0635)	0.0327 (0.0478)
	Interaction for girls	0.0201 (0.0589)	-0.0743 (0.2590)	-0.2506* (0.1305)	0.0447 (0.0984)	0.0155 (0.0898)
	Interaction for boys	0.0025 (0.0754)	-0.5870 (0.3637)	-0.1757 (0.1201)	0.0219 (0.0829)	0.0527 (0.0506)
	R-squared	0.154	0.243	0.037	0.039	0.098
Observations	2417	808	808	808	808	
Individual variables	✓	✓	✓	✓	✓	
Household variables	✓	✓	✓	✓	✓	
School variables	✓	✓	✓	✓	✓	

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Panel B of Table 6 shows that sexual activity and teenage pregnancy are larger in concessions schools with more pupils per teacher and both effects are significant at 10%, it implies that when concession schools increase the number of teacher would have an impact on reducing the risky sexual behavior of their pupils (columns 1 and 5). Other important variable that plays a role in the better school management is the human capital composition of teachers. In Panel C of Table 6 we observe that boys in concessions schools with more teachers' human capital use less condom, which seems to be compensated by increasing on the use of modern

methods. As a first result, we think that the reduction on condom use on boys seems to be explained on the fact that better human capital of teacher in concession schools seems to affect the sexual behavior of boys by reducing the probability to be sexual active and to increase the age of sexual initiation. This mechanism of better human capital of teacher is also affecting girls when we implement a more strict measure of human capital qualification of teachers as the percentage of teachers with graduate diploma, in which we found that girls in concession schools with better qualified teachers are less likely to initiate sex activity (see Panel D in Table 6).

The single result that seems to reverse the potential positive impact of concession schools on sexual behavior is the fact that girls that report sex education at school as main source of information use less condom, but this is not substituted with other modern methods as it was documented on boys (see Panel E of Table 6). In order to explore a better understanding of this result we regress the concession school dummy with the share of students that know that condom would prevent sexual infections and pregnancy and we found that this knowledge is important to increase the condom use in concession schools only for boys (see Table 7). The reduction of condom use in girls whose main source of sex education is school might be explained by the fact that those girls do not learn the benefits of using condom.

Table 7: Knowledge about condom use

	Condom use knowledge
Interaction	0.2563**
	0.1162
Interaction for girls	0.1387
	0.1735
Interaction for boys	0.3245*
	0.1723
Observations	808
R-squared	0.037

Includes individual, HH and school controls.
Robust standard errors in parentheses. ***
p<0.01, ** p<0.05, * p<0.1

5.3 Robustness checks

We implement three exercises as robustness check on our results. The first exercise looks at whether our results are robust to different specifications. Table A.2 in the Appendix reports estimations of θ for sexual status. Each column has a different specification. We see there that estimates do not change a lot across different specifications.

The second exercise presents a matched sample using a kernel methodology as an alternative to define our control group. The kernel methodology define a score to measure the distance of each observation with the most similar individual on the treatment group and use this score as a weight on the OLS regression. Table 8, Panel A shows the same results that those specified on the basic regression in Table 5 in which, on average, concession schools reduce the probability to be sexual active and there is not average effect on the other outcomes of interest. Comparing the coefficient of the kernel regression with that on the basic result we observe that the reduction is larger with the kernel specification and around 7.7%, it can be explained by the fact that the kernel methodology uses the whole sample.

Table 8: Robustness checks

		Had sexual intercourse	Age first sexual intercourse	Condom use	Modern methods	Teen pregnancy
Panel A: Kernel matching	Concession	-0.0774*** (0.0153)	0.0963 (0.0819)	0.0025 (0.0316)	-0.0316 (0.0211)	0.0067 (0.0141)
	R-squared	0.154	0.235	0.019	0.035	0.050
	Observations	15182	6124	6124	6124	6124
Panel B: Placebo test	Concession	0.0127 (0.0100)	-0.0180 (0.0425)	0.0153 (0.0167)	-0.0021 (0.0129)	0.0033 (0.0084)
	Observations	11054	4614	4614	4614	4614
	R-squared	0.151	0.228	0.021	0.027	0.054
	Individual variables	✓	✓	✓	✓	✓
	Household variables	✓	✓	✓	✓	✓
	School variables	✓	✓	✓	✓	✓

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The third type of robustness check implements a placebo exercise in which we would like to know if the results we found at the basic specification is driving not for the concession school condition but for any other unobserved heterogeneity. In order to run the exercise we split the sample of students in public schools before the matching (the potential control population) in two groups that we called artificial control and treatment groups. Each observation was assigned randomly to belong to the artificial treatment and control group. Given this random distribution we perform the matching and estimate the basic specification. We find that there is no significant differences on the main outcomes for the fake treatment group (see Table 8, Panel B).

6 Final Remarks

The main concern of this paper was to know whether schools with more autonomy will engage in establishing policies at the school level that will reduce risky behavior of the students attending those schools. The CS implemented in Bogotá is a good case to answer this type of questions because CSs are different from traditional public schools in the sense that the former have more flexibility and might implement better academic and school management decision given their experiences as suppliers in the private sector and their higher decentralization on school decisions. In this paper, we have shown that CS decreases the probability to sexual activity on teenager, particularly on boys, but do not have average effects on the other sexual behavior outcomes. However, when we analyzes potential heterogeneous effects of CS based on variables that account for several components of school management we have found differentiated effects on teenagers sexual behavior by gender. In summary, school congestion measured as the ratio of pupils per teacher is an important predictor not only for the educational outcomes but also for other outcomes like reduction on risky sexual behavior. Other interesting results are the positive impact of a more balanced ratio between girls per boys per school on the reduction of teenage pregnancy and the human capital of teachers on reducing the probability of being sexual active.

In general we are thinking on the type of policies that are already in place on concession schools and that could be scaled to traditional public schools. The first is the investment on human capital of teachers, this policy would have a direct impact on education outcomes of students and an indirect effect on the reduction on risky sexual behavior of boys by reducing their probability to be active and also an impact on girls by decreasing the pregnancy rate. Another policy recommendation that comes out from our results is to increase the number of teachers by pupil. This will increase teachers attention to each pupil that goes beyond education outcomes and allow teachers to put attention to students risky behaviors as well. Another interesting result that we have found from our study is that is key to have a better balance between girls and boys at the school. This will reduce the worse consequences of risky behavior of adolescents, namely, pregnancy and childbearing incidence.

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A Tables

Table A.1: Balancing

		Panel A: Unconditional						Panel B: Conditional on sexual activity					
Variable	Sample	Mean		%reduct		t-test		Mean		%reduct		t-test	
		Treated	Control	%bias	$\ bias\ $	t	$p \geq t $	Treated	Control	%bias	$\ bias\ $	t	$p \geq t $
Age	Unmatched	15.862	15.989	-11.5		-2.23	0.026	15.339	15.528	-17.3		-5.78	0.000
	Matched	15.862	15.855	0.6	94.4	0.10	0.923	15.34	15.335	0.5	97.1	0.13	0.895
Gender	Unmatched	.49762	.46908	5.7		1.13	0.258	.40547	.38479	4.2		1.46	0.145
	Matched	.49762	.49762	0.0	100.0	-0.00	1.000	.405	.405	0.0	100.0	-0.00	1.000
Live with Mother	Unmatched	.92857	.8807	16.3		2.96	0.003	.94531	.90672	14.8		4.62	0.000
	Matched	.92857	.92857	0.0	100.0	-0.00	1.000	.94527	.94527	0.0	100.0	-0.00	1.000
Live with Father	Unmatched	.6119	.549	12.8		2.51	0.012	.67422	.5891	17.7		5.96	0.000
	Matched	.6119	.6119	0.0	100.0	0.00	1.000	.67396	.67396	0.0	100.0	0.00	1.000
Mother's children	Unmatched	3.0571	3.2055	-12.2		-2.33	0.020	3.0297	3.1266	-8.4		-2.72	0.006
	Matched	3.0571	3.0405	1.4	88.8	0.21	0.831	3.0305	3.025	0.5	94.4	0.13	0.898
Mother's age at first birth	Unmatched	20.1	19.982	3.0		0.59	0.556	20.75	20.486	6.4		2.17	0.030
	Matched	20.1	20.09	0.2	91.9	0.04	0.971	20.739	20.694	1.1	82.8	0.29	0.772
Socioeconomic level	Unmatched	22.703	22.324	9.5		1.85	0.065	22.712	22.514	5.1		1.70	0.089
	Matched	22.703	22.73	-0.7	92.9	-0.10	0.919	22.706	22.735	-0.8	85.3	-0.20	0.843

Figure A.1: Density functions before and after matching

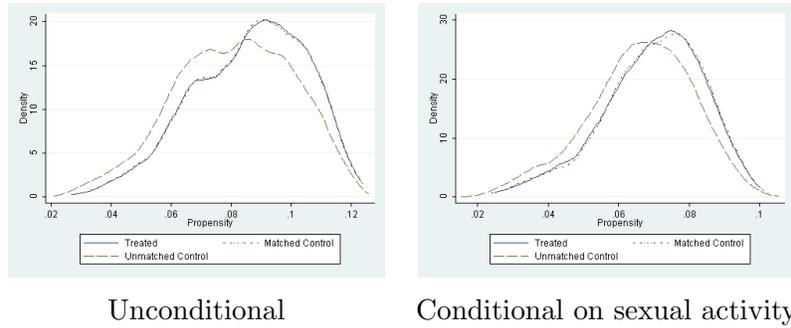


Table A.2: Robustness check: Different specifications for Sex Status

	(1)	(2)	(3)	(4)
Concession Schools	-0.0211 (0.0195)	-0.0219 (0.0181)	-0.0212 (0.0180)	-0.0144 (0.0188)
Age		0.149*** (0.00845)	0.144*** (0.00863)	0.144*** (0.00863)
Gender		0.117*** (0.0188)	0.127*** (0.0188)	0.127*** (0.0188)
Mother			-0.0633 (0.0411)	-0.0622 (0.0410)
Father			-0.0822*** (0.0199)	-0.0820*** (0.0199)
Mother's children			-0.00957 (0.00916)	-0.00961 (0.00914)
Interpolated needs index			0.00485* (0.00255)	0.00564** (0.00264)
Mothers age when had first child			-0.0115*** (0.00230)	-0.0113*** (0.00231)
Average SABER 5th gr language				-0.000571 (0.000473)
Observations	2,466	2,466	2,466	2,466
R-squared	0.000	0.128	0.147	0.148

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1