

Causal Effects of Single-Sex Schooling on Marriage Formation in South Korea

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* Submitted for the presentation at the 2014 Annual Meeting of Population Association of America. Please direct all correspondence to Hyunjoon Park (hypark@sas.upenn.edu), Associate Professor, Department of Sociology, University of Pennsylvania, 3718 Locust Walk, Philadelphia, PA 19104.

CAUSAL EFFECTS OF SINGLE-SEX SCHOOLING ON MARRIAGE FORMATION IN SOUTH KOREA

Using data of high school types and marriage from a nationally representative sample of Korean men and women aged 25 to 35 in 2011, we assess causal effects of attending single-sex high schools (vs. coeducational) on transition to first marriage. Single-sex high schools have educated a considerable proportion of Korean population, suggesting it important to examine single-sex schooling effects on marriage formation. Separating boys and girls into different schools during high school years, single-sex schooling limits the opportunities for students to develop interpersonal relationships and communication skills with students of the opposite gender and to meet their potential spouses in school. However, our discrete-time hazard models show no significant difference in the risk of first marriage between those who graduated from single-sex and coeducational high schools for both men and women. The random assignment of students into single-sex schools in Korean education allows casual inferences for single-sex schooling effects.

INTRODUCTION

Both academic and public discourses of marriage have recognized the role that schools – high schools and colleges – play in marriage formation as institutions where potential spouses can meet, besides the effects of school credentials on marriage. It is not difficult to find movies and novels featuring long-lasting romance of two high school sweethearts. Scholars of educational homogamy have paid attention to the opportunity for colleges to provide in meeting potential spouses, highlighting the contribution of colleges to educational homogamy between spouses with the same level of educational attainment (Mare 1991). These insights into the way in which schools structure the opportunity to meet potential spouses extend our understanding of marriage formation by revealing how an individual's marriage is not only shaped by individual attributes but also by contexts in which the person is located (Lloyd and South 1996).

Reviewing these previous studies of schools and marriage especially in the United States reveals a fundamental assumption that underlies the existing studies: a person is assumed to meet her or his potential spouse in schools where both female and male students attend. In other words, only coeducational settings are considered. However, in various parts of the world single-sex high schools or single-sex colleges educate a considerable portion of students (Wiseman 2008). For instance, in South Korea, which is our study case in the current paper, 7 out of ten men and women aged 25 to 35 in 2011 attended a single-sex high school that lasted three years from 10th to 12th grades. Although in a fairly small size, single-sex high schools and colleges do exist even in the United States, potentially affecting educational and personal experiences of students attending single-sex schools. When men and women are segregated into two separate schools and thus basically do not have any opportunity to meet potential spouses at least in schools, how does it matter for one's probability for transition to first marriage?

Of course, the interest in the impact of gender composition in a local setting on transition to first marriage is not new. Based on the marital search model, several studies have investigated how the relative shortage or abundance of women and men in the local marriage market influences women and men's likelihood of making transition to first marriage. In particular, some evidence suggests that when the pool of women for potential spouses in the marriage market is small, the probability of first marriage decreases (Lloyd and South 1996). The availability of single men is positively associated with the increased probability of women's marriage (Lichter, LeClere, and McLaughlin 1991; Lichter et al. 1992). However, these studies of gender composition in local marriage markets still assume the setting, where basically men and women can meet each other, even though local marriage markets may have imbalanced sex ratios (i.e., not entirely gender segregated places).

Using unique contexts in which the process of students' assignment into high schools has worked as a quasi-experiment using random lottery, in this paper we attempt to assess the causal effect of single-sex high schools on marriage formation in Korea. Given that students attending single-sex schools do not have the opportunity to meet potential spouses in their schools (of course they can meet potential spouses outside of schools), are they more likely to postpone marriage or even to remain permanently unmarried than their counterparts who attended coeducational schools, *ceteris paribus*? Considering that single-sex high schools have long educated a considerable share of Korean population, it is surprising that there is virtually no study so far to assess whether and how attending single-sex schools vs. coeducational schools has an impact on individual's marriage. In Korea students in single-sex high schools spend three years – quite substantial amount of time in students' late adolescence –, sharing their thoughts and experiences only with students of the same gender. Given that meeting students of the

opposite gender outside of schools is not widely available in Korean youth culture, attending coeducational high schools may be of a particularly important opportunity for meeting potential spouses. In short, single-sex schools are likely important institutions that deserve more systematic investigations with respect to their impacts on individual students' marriage chances.

Many studies have examined the effects of single-sex schools on short-term and long-term educational outcomes such as test scores and college transition in both Korea and other countries (Mael et al., 2005; Park, Behrman, and Choi 2013; Riordan 1990). However, as far as we are aware, our study is the first that assesses long-term effects of single-sex high schools on marriage formation beyond educational outcomes. In fact, a systematic review of more than 100 studies of single-sex schooling identified the narrow focus of the field only on students' educational and psychological outcomes, rarely examining long-term effects on occupational attainment and demographic behaviors (marriage, divorce, and fertility among others) which are likely shaped by the opportunity structure for meeting and interacting with peers of the opposite gender (Mael et al., 2005). Among the total 112 studies on single-sex schools by Mael et al., only one study addressed whether there was a difference in the extent to which adults who graduated from single-sex and coeducational high schools remained married to their first spouse.

The fact that student in single-sex schools do not have the opportunity to meet potential spouses in school seems to suggest the negative relationship between single-sex schooling and marriage formation, holding other factors constant. Moreover, some of theoretical explanations proposed for potentially positive or negative effects of single-sex schools on students' educational outcomes can be extended to help derive potential impacts of single-sex schools on marriage formation. Proponents of single-sex schools, for instance, argue for the impact of single-sex schools to reduce influences of adolescent culture that tend to distract students'

attention from academic learning and instead place emphasis on physical attractiveness and interpersonal relationships (Coleman 1961; Riordan 1985). This argument for reduced adolescent culture in single-sex schools can be extended to claim that there are limited opportunities in single-sex schools for developing interpersonal relationship and communication skills and for casual meetings or dating chances with the opposite sex, which could result in being more likely to remain single at later ages, if not forgoing marriage, than their counterparts who attended coeducational schools. Indeed, those who oppose single-sex schools point out the limited opportunity for female and male students to interact together and to learn and understand different genders under single-sex schools. “Institutionalizing gender-segregated classrooms limits children’s opportunities to develop a broader range of behaviors and attitudes. Positive and cooperative interaction with members of other groups is an effective method for improving intergroup relationships” (Halpern et al. 2011).

A fundamental problem, however, makes it difficult to precisely assess the effect of single-sex schools on marriage (and all other outcomes): attending a single-sex school can be a self-selection. In most countries including the United States, students (and their families) choose single-sex schools over coeducational schools, which likely make the two bodies of students attending single-sex and coeducational schools differ in various observed and unobserved characteristics of students and their families (LePore and Warren 1997; Marsh 1989). In other words, in the context where students select into single-sex schools, the difference, if any, in the likelihood for marriage between adults who graduated from single-sex high schools and their counterparts who graduated from coeducational schools may reflect selection bias rather than the genuine effect of single-sex schools. Although extensive controls for observed characteristics

certainly will help reduce bias in estimation of the single-sex school effect, unobserved characteristics are still of concern.

In this paper, we aim to estimate causal effects of single-sex schools on marriage formation using unusual data from Korea. As Park et al. (2013) describe in detail, Korea has implemented a unique way for assigning middle school graduates to high schools via random lotteries. In their school districts, students cannot choose their schools regardless of whether schools are single-sex (vs. coeducational) or private (vs. public). Although students can move to a different school district after or before the random assignment, Park et al. (2013) highlight that students' noncompliance is not of a substantial degree and thus does not significantly jeopardize the random nature of assignment. Comparing family background measures of students attending single-sex and coeducational schools, moreover, Park et al. (2013) demonstrate balance of family background measures between the two bodies of students.

DATA AND METHODS

For this study, we use data on high school type and marriage of a nationally representative sample of Korean men and women born 1976 through 1986 (Education and Social Mobility Survey). In 2011 when the survey was conducted, respondents were 25-35 years old. Because the high school random assignment is applied to only academic high schools, we drop those who graduated from vocational high schools (about 30% of the original sample). Because we need high school names to identify high school types, we further drop a very small number of respondents who did not report their high school names or who did not obtain a high school diploma, ending up with a total of 1,305 men and women as the final sample for the analysis.¹

¹ Note that due to the small sample size, we include all students who graduated from academic high schools of which a small portion attended schools that were not subject to the random assignment. Given the small share,

In the survey, respondents were asked to write the name of high schools they graduated from. By matching the high school names with school census data compiled by the Korean Educational Development Institute, we identified whether the high schools, which respondents graduated from, were single-sex or coeducational during their high school years. Among the total of 1,305 respondents used for the analysis, 915 graduated from single-sex high schools (485 all-girls schools and 430 all-boys schools) and the remaining 390 graduated from coeducational schools. It is notable that 70 percent of (academic) high school graduates attended single-sex schools in Korea. Respondents also reported whether they were ever married and the age of first marriage for those who were ever married. As mentioned above, respondents for our analysis were 25-35 years old as of 2011. 35 percent of the 25-35-years-old respondents were ever married (total 459: 292 women and 167 men).

In order to assess the effect of single-sex schooling on transition to first marriage, we use a discrete-time hazard model on the basis of person-age records transformed from the cross-sectional data. In other words, each person has observations from the age 19 to the age of first marriage or the age at which she or he was censored as of 2011 (i.e. until the age as of the year 2011). In our dataset, the youngest age of first marriage was 20 and therefore we start each one's person-year data from the age 19. Remember that our sample consists of respondents who at least graduated from academic high schools.

BALANCES ON FAMILY BACKGROUND MEASURES BY HIGH SCHOOL TYPE

Before jumping into the result of event history model that predicts marriage timing by high school type, single-sex schools vs. coeducational schools, we assess the extent to which

however, we do not expect inclusion of those students to significantly affect our results as evidenced by the balanced family background measures even with those students included.

graduates from single-sex high schools and coeducational high schools did not differ in major family background measures. When the two groups of respondents are balanced on family background measures, we can increase our credibility that student assignment into high schools was random as we described above. Using a different dataset, Park et al. (2013) already showed balances on major family background measures between students attending single-sex and coeducational high schools. Therefore, if balances between the two types of schools are found even in our dataset, our confidence in the random nature of student assignment in Korean high schools can be substantially increased.

In order to check balances, we select four major family background measures available in our dataset: 1) whether parents helped respondent's homework and school preparation when respondents were 14 years old; 2) whether respondents lived in their own house (not a rental house) at age 14; 3) whether respondents' fathers had a university degree; and 4) whether respondents' mothers had a high school diploma (considering overall lower educational attainment of females for the parent generation). Note that these four measures indicate socioeconomic conditions of families at age 14 when respondents were middle school students, that is before their entrance to high schools. Therefore, these four background measures are useful to test whether respondents who graduated from single-sex high schools and those who graduated from coeducational schools are comparable in their family characteristics, reflecting the random assignment into single-sex vs. coeducational schools.

For each background measure, we run a simple logit model that predicts whether respondents graduated from single-sex or coeducational schools by the background measure. We run the logit models for men and women, separately. Table 1 presents the coefficients and standard errors from each model. Evident from Table 1 is that none of four background

measures is significantly associated with attending single-sex schools compared to coeducational schools. In other words, single-sex high school graduates and coeducational graduates are not significantly different in any of our four background measures. The balances are found for both boys and girls. We also ran multivariate logit model that included all the four background measures simultaneously and found the same result. In short, the result in Table 1 is consistent with our expectation that under the random student assignment, students in the two types of high schools should not show any significant differences in family background measures.

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Table 2 presents the results of discrete-time hazard model for the transition to first marriage for Korean men and women, separately. Although at this point we run the relatively simple model that has only a limited number of covariates (age, age squared, and university degree) besides a single-sex school dummy variable, the result seems to clearly suggest that respondents who graduated from single-sex schools do not differ in their risk of first marriage from their counterparts who graduated from coeducational schools for both men and women. This result is inconsistent with the expectation that the limited opportunity for interactions and dating with students of the opposite gender in single-sex high schools should lead to the delayed marriage.

NEXT STEPS

To check robustness of our findings, we have just acquired data from the same survey for an older cohort born between 1966 and 1975. With additional wave of the different cohort, we are able to check whether our findings are consistent across different cohorts, and also by

increasing a substantial number of samples to our analysis we will be able to produce more precise estimates of the causal effects of single-sex schools on marriage formation. The data are being cleaned up and will be ready fairly soon for analysis.

As we can easily imagine, there can be multiple channels to generate our finding of insignificant impact of single-sex schooling on marriage formation. Even though the long-term effect of single-sex schooling on marriage is not significant, it is still plausible and needs to be investigated that attending a single-sex school may have a short-term impact on communication skills and interpersonal relationships with the opposite sex, gender stereotypes, and perspectives on marriage and gender relationship as well. It is also possible that above mentioned difference can be attenuated over time when adolescents make a transition to adults by accumulating experiences at college, in the labor market, and through military services for boys. We have also acquired data to investigate some of the above mentioned aspects at interim stages, which will provide valuable finding to provide a deeper understanding our findings on marriage formation. We will add some supplementary analysis for the causal effects of single-sex schooling on these interim outcomes.

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Table 1. Attending Single-Sex Schools by Family Background (Logit Model)

	Attending All-Boys vs. Coedu Schools (Men)	Attending All-Girls vs. Coedu Schools (Women)
	b se	b se
1. Parents helped homework and school preparation	-0.072 (0.162)	0.072 (0.187)
2. Family owned a home at age 14	0.082 (0.196)	-0.286 (0.246)
3. Father having a university degree	0.301 (0.216)	-0.236 (0.238)
4. Mother having a high school diploma	0.032 (0.164)	0.038 (0.190)

Note: The beta coefficient in each equation indicates the coefficient of each background measure the logit model predicting whether respondents graduated single-sex or coeducational high schools.

Table 2. Discrete-Time Hazard Model of Transition to First Marriage by Gender

	Men	Women
Single-sex school	0.146 (0.180)	0.055 (0.151)
Age (age-25)	0.760 (0.088) ^{***}	0.475 (0.037) ^{***}
Age ²	-	-
University degree (vs. no)	0.054 (0.010) ^{***}	0.054 (0.007) ^{***}
Intercept	0.084 (0.170)	0.355 (0.125) ^{***}
	-	-
Intercept	4.866 (0.251) ^{***}	2.653 (0.150) ^{***}
Number of person-age observations	7304	6187